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ENTERPRISE SYSTEMS & BUSINESS RELATIONSHIPS

**THE UTILIZATION OF IT IN THE BUSINESS WITH CUSTOMERS AND
SUPPLIERS**

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ABSTRACT

This thesis deals with how companies utilize their enterprise systems in their business relationships. The study's starting point is enterprise systems that basically are standardised information systems that the company can acquire from software vendors like SAP, Oracle and Microsoft. Enterprise systems aim to integrate and manage all the company's data and it can also be linked to its business partners.

The thesis contains two case studies of how a focal company utilizes its enterprise system in their business relationships. To accomplish this, an analytical framework based upon the combination of an information systems (IS) and a business relationship perspective is developed and applied. The IS perspective follows an 'ensemble view of technology' approach which describes the use of information systems as embedded in a both technical and social context. The business relationship perspective is founded in empirical studies of industrial companies. Basically, business relationships are unique and based on the companies' exchanges. It also involves behavioural elements as trust, commitment, adaptations and interdependencies between the partners.

The two case studies cover the business relationships between ten companies and the character of the studied business relationships varies. The results show that enterprise systems are mainly focused on the companies' internal activities. The exchanges in the business relationships are either carried out without the enterprise system or are supported by some complementary information system. Enterprise systems are thus mainly seen as production systems. This can be explained by the heritage from former material and resource planning (MRP) systems. An alternative explanation can be that business relationships are unique and require continuous adaptations and a mutual orientation. Enterprise systems require structured data rendering them difficult to use for the activities of a business relationship. The users then develop other, individual, applications that handle what is needed in their ongoing business. The threat is that information can be lost on a company level. The challenge is therefore to investigate the complementary information systems functions to see if it is possible to extend the enterprise system to include them. To be worth its epithet, the enterprise system needs to facilitate all the business activities found in the companies business relationships.

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INTRODUCTION

UTILIZING AN ENTERPRISE SYSTEM IN A BUSINESS SETTING

Kanthal AB is producing heating elements to be used in electrical domestic appliances, electronic heaters, and so forth. The entrepreneur Hans von Kantzow founded Kanthal in 1931 and his business idea was to sell a FeCrAl-alloy who could be used as an electrical heat element. The company have a history of continuous growth and since the 40s and 50s they have bought companies all around the world, following their goal on having a subsidiary in every country that can be considered a market. This philosophy has followed Kanthal to this very day, with continued expansion during the 70s and 80s. The Sandvik Group acquired Kanthal 1997 and during this time there was also a vast overhaul and modernisation of the production plant in Hallstahammar. This year Kanthal also invested in an enterprise system*, Movex, from the software vendor Intentia. Movex replaced a legacy system, but it was also supposed to offer new and improved support for the material and production management. After a couple of years, an up-dated version of Movex offered business-to-business functionality that allowed a tighter integration between Kanthal in Hallstahammar and its subsidiaries. With this new functionality,

* There is a dictionary of the mentioned acronyms and information systems as Appendix A.

many administrative tasks were automated, leading to a radical decreased number of operations and also a significant reduced amount of document handling between the different companies. It also means that a customer can get common product information from several subsidiaries and, when finally buying, receive a single invoice even if the ordered products is produced and shipped from different plants. With this upgrade of Movex, a customer that orders products from different companies within the Kanthal sphere will experience Kanthal as one business actor. But when studying this transformation, changes in the interaction patterns can also be found. The introduction of Movex and its extended enterprise functionality also has lead to organizational changes where the activities that Kanthal's personnel carry out in their business with customers and suppliers are affected.

Kanthal's business with customers is offered as an example: The typical business with a customer has been going on for years, meaning that there have been several business affairs carried out through time and that the partners has learned each others preferences and behaviours. Some of Kanthal's customers' demands specific logistic routines; some have national regulations which mean that they need certain documents; some requires that Kanthal's products are modified; and so forth. There are also differences regarding how the customers purchases Kanthal's products – sometimes there is only one customer representative who negotiates the purchase conditions and that handles the ordering, and sometimes there are both engineers and purchasing personnel involved. Kanthal must be able to handle all these interactions and demands.

The nature of Kanthal's products means that the customer gets a purchase agreement stating a specific quantity over a given period (usually on a yearly basis) to a given price. With the enterprise system Movex Kanthal's salesmen can focus on how much each single customer buys and if their business terms are adequate. This is possible with the business intelligence application Qlik-View that have been integrated with Movex. The salesmen also use product selection applications when creating offers to their customers, applications that display both technical and financial information. Before Kanthal implemented Movex, the salesmen had to handle all their customers' orders, leading to time-consuming order administration. With Movex integrated data handling, the order administration is passed over to the order personnel at Kanthal who can be seen as 'gate keepers' with good knowledge about both customers and internal procedures. Practically, a customer first discusses products, conditions of economic and logistic nature, and so forth with a

salesman. When the terms of business is negotiated and agreed, the customer can, more or less, handle the suborders by themselves. When the customer needs a specific quantity of a product, he or she contacts Kanthal's order personnel and address the agreement. This also means that the order personnel take care of the execution of the order and that the salesmen can focus on other customers. The most frequent contacts are thereby not between the customer and a salesman, but between the customer and Kanthal's order personnel and occasionally with the logistic department regarding practical transport matters.

In 2003, Kanthal also installed a web server that is integrated with Movex. The web server has been used for a web portal that can be used by customers and suppliers to get access to some of Movex data (e.g. order information). This change means that customers can negotiate purchasing conditions with a salesman and thereafter handle their own suborders through the web portal. With this web based service, the customer has a decreased contact with Kanthal's personnel but he or she will be able to keep track on the purchase 24-7. Kanthal and their customers' have thereby reduced spatial and temporal matters and increased accessibility and technological interconnectedness. All these changes made possible by Kanthal's enterprise system Movex.

The description above is extracted from the licentiate thesis (Ekman 2004) that is a forerunner to this study and it is referred to as the Kanthal case or the pilot study in this thesis. As seen in the Kanthal case, an industrial company's business relationships are often based upon repeated exchanges of different kinds. These ongoing exchanges can be arranged so that different individuals handle different tasks. When a company acquires an enterprise system, which is a specific form of computer based information system (Davenport 1998), it may affect how these exchanges are carried out. As seen in the Kanthal case, the enterprise system affected who was performing a certain business activity and how things were done. The case also illustrates how the enterprise system was originally used for material and production focused tasks, but through time its use has expanded to also account for the business activities with customers, suppliers and other counterparts. The enterprise system was also used for business decisions support when interacting with customers through the integrated software QlikView. The functionality of Kanthal's enterprise system was increased over time, leading to a situation where Kanthal's business partners was given access to the enterprise system so

they could carry out some business activities, such as order administration, by themselves.

Given that enterprise systems are a specific type of information system designed for the contemporary company's business (Kumar & Van Hillegersberg 2000), which use also may cross organizational borders, it is an interesting research object. In this thesis there are mainly two theoretical bases that will be used as a perspective to support the study of enterprise systems in such a setting; the field of *information systems* (IS) (Keen 1980, Markus 1999, Avgerou 2000) and theories on *business relationships* (Ford 1980, Håkansson 1982, Johanson 1989). This thesis thereby expands the IS tradition that focuses the organization *per se* (cf. Markus 1984, Walsham 1993, Orlikowski & Barley 2001) and it offers an alternative to the strategy perspective (cf. Ives & Learmonth 1984, McFarlan 1984, Wiseman 1988, Adcock *et al.* 1993, Porter 2001) which has been a frequent approach when studying information systems used in business situations (Walstrom & Leonard 2000, Horton *et al.* 2005). By presenting and applying an alternative perspective, the research on enterprise systems is broadened to include the characteristics of business relationships between industrial companies. By doing so, the repetitive nature of the ongoing exchanges and the complexity of the business relationships are considered. To be able to focus the utilization of enterprise systems in these business relationships, a combined IS and business perspective will be developed.

1.1 Enterprise systems

The central research object *enterprise systems* (also called Enterprise Resource Planning systems, ERP) is a type of managerial information system (Newell *et al.* 2003) that can be acquired from software vendors such as SAP, Oracle and Microsoft. To introduce this research object, Thomas Davenport's description is expressive:

For the first time ever, information will flow seamlessly across diverse business functions, business units, and geographic boundaries. What the Internet is doing for communications between organizations, these systems are doing within companies. For better or worse, no business transaction no customer purchase, no supplier invoice, no product produced will go unnoticed by these systems. Ultimately, every bit of computer-based information used for running a company's operations can be supplied by these systems. This situation sounds utopian, but it's actually available today if companies can master a relatively new type of information system. Lets call such systems enterprise systems (ESs). Also known as enterprise resource planning (ERP) systems, these packages of

computer applications that support many, even most, aspects of a company's [...] information needs.

Davenport (2000 page 1-2)

Enterprise systems are complex information systems that offer companies the ability to support their business activities and integrate all their data transactions, making their business activities more transparent and releasing them from legacy systems (Davenport 1998). Enterprise systems have been described as the most important IT to 'emerge into widespread use' during the 90s together with the Internet (Seddon *et al.* 2003 page 1). Davenport & Prusak (2003 page 52) share this viewpoint and pinpoints that 'big enterprise packages like SAP, Oracle, and PeopleSoft haven't gotten nearly as much public visibility as the Internet, but they're enormously successful within large organizations, and the budgets spent on them surpass e-commerce spending within many companies'. Enterprise systems are, in other words, a form of information system that has become common for industrial companies (Payne 2002, Lykkegaard *et al.* 2003, Sullivan *et al.* 2005).

Enterprise systems have mainly been installed by large companies, and back in year 2000 fully 70% of the *Fortune 1,000* companies had or were in the process of installing an enterprise system (Poston & Grabski 2000), and two years later all *Fortune 500* companies had installed or were installing enterprise systems (Seddon *et al.* 2003). With this extensive interest from the large companies, the enterprise systems' status can be considered a mature market (Poston & Grabski 2000, Lykkegaard *et al.* 2003) and some researchers describe that enterprise systems are 'considered to be the price of entry for running a business, and at least at present, for being connected to other enterprises in a network economy' (Kumar & Van Hillebergersberg 2000 page 24). Research overviews at the beginning of the 21st century emphasized that more research is needed (Esteves & Pastor 2001), and even later research efforts have stressed the need for an increased knowledge on enterprise systems as they are a part of contemporary businesses (cf. Davenport 2000, Poston & Grabski 2000, Hedman 2003). Given that enterprise systems have become a necessity for large companies and that more and more small and medium companies are acquiring them (Kumar & Van Hillebergersberg 2000, Sullivan *et al.* 2005, Wallström 2005) it is a type of information system worth further studies.

When reviewing enterprise systems descriptions it has been depicted as an information system that causes organizational changes, follows the logic of business process reengineering (BPR), disturbs the business, and has caused bankruptcies (Davenport 1995, Davenport 1998, Wheatley 2000, Sandoe *et al.* 2001, Askenäs

2004). Such descriptions are rather radical and later research findings indicate that today's companies select and implement new versions of enterprise systems more well-considered, something that also means that the changes are less revolutionary as new functions are introduced progressively (Kremers & Van Dissel 2000, Davenport *et al.* 2004). The utilization of enterprise systems thereby becomes integrated into the business through step-by-step upgrades, a progress that also could be observed in the pilot study (Ekman 2004 page 65-67).

Even though enterprise systems theoretically can support most parts of a company's business activities, their practical use has been more limited. Enterprise systems have a legacy from MRP systems, i.e. they have a production oriented origin (Davenport 2000, Markus 2000, Payne 2002, Farhoomand 2005, Sumner 2005). The later versions of enterprise systems have incorporated functionalities (at least according to the sales pitches) that are described in terms of: customer relationship management (CRM), supply chain management (SCM), e-commerce, and business intelligence. But even so, the core functioning is focused on the internal and operational tasks (Carlsson & Hedman 2004). The enterprise systems production legacy means that they are focused on efficiency gains (Davenport & Prusak 2003, Newell *et al.* 2003), which is an internal standard of performance (Pfeffer & Salancik 1978) (i.e. 'doing things right') which in turn means that there might be a conflict when it comes to the utilization in business situations with others (which also needs effectiveness, i.e. 'doing right things'). There is also one aspect that is important for a company's future business, the one of innovation (Davenport & Prusak 2003, Newell *et al.* 2003). Even though this thesis does not deepen the discussion about these three concepts (efficiency, effectiveness, and innovation) they are presented to show that a company's business with others holds several aspects that the information systems need to support (cf. Easton & Araujo 2003). All these aspects are also a part of the business relationships a focal company has, something that is further discussed in the next section.

1.2 Business relationships

Håkansson & Snehota (1998) highlighted that industrial companies that act in a business-to-business setting operate under conditions set by a limited number of counterparts in their article 'No business is an island'. They pinpointed that these companies are engaged in different forms of exchanges and that each company's capabilities are formed by the relationships they have with other companies. This means that their business relationships are based upon a complex web of

exchanges. What first comes to mind is the product/service versus financial exchange but other forms of exchanges, such as information and social exchanges, are also needed in the business relationship. (Håkansson 1982) A business relationship is thereby not only based upon purely monetary means, it also involves mutual activities and the two business partners may even have different technical connections to each other. This thesis uses the concept *business relationship* to describe this kind of repeated exchanges, and all the other mutually oriented aspects that exist, between a buyer and a seller. With the concept follows the assumption that a business relationship holds two active partners. Research on industrial markets has shown that both the seller and the buyer are active participants, i.e. it is not a question of a supplier that tries to attract a passive customer in a anonymous 'market' (Håkansson *et al.* 1976, Ford 1980) which is a approach that has been dominant within traditional perspectives on business (Sheth *et al.* 1988). A business relationship can thereby be seen as a dyadic phenomenon – it is not a question of one active partner but of two partners that through their mutual business are more or less coordinated in their actions.

To handle all the forms of exchanges that make up the business relationship, the interaction between two companies is seldom between one buyer and one seller, the ongoing exchanges rather involve a lot of people from both companies holding different functions as salesmen, purchasers, order personnel, logistic personnel, engineers, and so forth (Turnbull 1979, Dwyer *et al.* 1987, Metcalf *et al.* 1992). Such interpersonal interaction puts a demand on coordination and it also requires adequate utilization of the enterprise systems that are used regarding how to capture and handle the data that the exchanges hold (cf. Pan & Lee 2003). The Kanthal case illustrated some of the mechanisms that have been described: the continuous exchanges involved both technical and financial information through the use of product selection applications and there was obviously an exchange of products and money, which required business activities at the order department. The case also showed a business situation that involved several functions such as salesmen, order personnel, and logistic personnel (Ekman 2004 page 77-98).

There are reasons why companies must get involved in these business relationships. Every company is more or less dependent on the input of products and services from other companies to be able to produce their product^{*}, which means that they engage in business relationships with others. But the exchanged resour-

^{*} The term product is used to denote both a product and/or a service in this thesis.

ces are seldom homogeneous, i.e. the product features may have to be explained and there is also often something that has to be done before the product is useful for the buyer. The buyer and seller that are going to do business therefore have to decide whether the offered resource will fulfil the buyer's need, if it is possible to handle the resource logistically (i.e. a transfer uncertainty), if the resource fits with the buyers existing technology, 'know-how', culture, and so forth. (Håkansson *et al.* 1976, Ford *et al.* 2002) All these uncertainties and possible differences between the business partners' means that they need to do *adaptations* to be able to do business. The adaptations are an essential aspect of a business relationship (Hallén *et al.* 1987) and they are needed if there is going to be a fit between the seller's offer and the buyer's need (Hadjikhani & Thilenius 2005). The adaptations can be regarding the product but they can also be technical adaptations in the production process, logistical adaptations regarding how the shipment and packing is arranged, behavioural adaptations affecting how the involved individuals act, administrative adaptations, and so forth (Håkansson & Snehota 1995). Given this study's interest, the adaptations made in a business relationship may also affect how the enterprise system is used (cf. Lamb & Kling 2003). As time passes, the companies become interdependent through the routines that they have formed and on the exchanges that take place between them (Johansson & Mattsson 1988). To summarize the discussion, the business relationship concept can be described as being based upon the continuous exchanges between a buyer and a seller and this process also acquires different adaptations though the exchanged resource is considered heterogeneous, leading to two interdependent business partners.

1.3 Bridging the information systems and business perspective

From a Scandinavian perspective, the IS discipline has been influenced by Börje Langefors who stressed the information rather than the computer system (Ilivari & Lyytinen 1999). His applicable approach to information (amongst others the 'infological equation') also meant that the organizational context could be considered (cf. Langefors 1966, Langefors 1977, Langefors 1995). This study follows this tradition; trying to consider both the studied information systems (i.e. enterprise systems) and the business context. As declared by Allan S. Lee:

An information system and its organisational context each have transformational effects on each other's properties in a chemical compound than the inert elements that retain their respective properties in a chemical mixture.

Lee (1999 page 8)

To recapitulate what has been presented so far, this study not only follows an organization but it broadens the perspective to include the organization's business relationships with customers and suppliers. The suggested business relationship perspective is a theoretical concept. It entails a dyadic approach; it considers both the business partners (a buyer and a seller), it includes the temporal aspects (i.e. that the business relationship develops through time), and it involves multiple interpersonal contacts crossing hierarchical boundaries. It also acknowledges business activities that cannot be directly related to the product versus money exchange but that it is a part of the business relationship. (Håkansson 1982, Ford 1990) To match this perspective on business relationships with an IS perspective, the approach is inspired by Kling & Scacchi's web of computing (Kling & Scacchi 1982) which is a theoretical perspective that urges the researcher to see information systems in their social context. When applying such a perspective the:

[...] information technology is more than just the tools deployed on the desktop or on the factory floor. It is the ensemble or 'web' of equipment, techniques, applications, and people that define a social context, including the history of commitments in making up that web, the infrastructure that supports its development and use, and the social relations and processes that make up the terrain in which people use it.

Orlikowski & Iacono (2001 page 122)

The applied approach on information systems, labelled *the ensemble view of technology* by Orlikowski & Iacono (2001), stresses the utilization of the enterprise system as embedded in a social context. Another way of describing this thesis and the pilot study (Ekman 2004) is as following an enacted view (Orlikowski & Iacono 2000, Boudreau & Robey 2005), i.e. the enterprise system utilization is shaped by the users' everyday situations.

To be able to link the utilization of the enterprise systems with the context (with an emphasis on a focal company and its business relationships), a concept that is a result of the pilot study is useful. The practical manifestation of an enterprise system's utilizations in business relationships can be found in what can be described as the enterprise system's activity influence (Ekman 2004 page 114-118). By searching for the activities that are affected by the enterprise system, e.g. how orders are handled, how the business partners reach a deal, how the product is produced, and so forth, the enterprise system's role in the focal company's business relationships can be understood.

When recapturing the Kanthal case, the activity influence was manifested as a change in who was handling an order and how the ongoing exchanges with customers was carried out. As a result of the enterprise system, the order personnel became responsible for more of the business activities with customers (i.e. related to the exchange of the ordered products) whilst the salesmen could focus on business activities that could result in new customers and new orders. When the business intelligence application QlikView was integrated with the enterprise system Movex, Kanthal's salesmen could get information that supported them in their negotiation with customers. When the web server and Kanthal's web portal was implemented, some business activities were even transferred to the customers who then performed their own order administration. (Ekman 2004 page 72-88) Given that enterprise systems are described as production focused (Davenport 2000, Markus 2000, Payne 2002, Farhoomand 2005, Sumner 2005), their activity influence can be expected to be stronger within the internal activities (what we can refer to as production) than those that take place in the business relationship activities (i.e. the exchanges) carried out with customers and suppliers (cf. Dubois 1998 regarding the activity concepts).

1.4 This study's aim, questions and purpose

A business relationship perspective embraces both the buyer and the seller, and by applying such a perspective on enterprise systems' utilization, new insights can be gained. When adding information systems (such as enterprise systems) into companies business relationships, they become 'sophisticated information and relationship networks' (Anyfoti *et al.* 2004). Given Lee's description, the result may be a new 'compound' worth studying (Lee 1999). As described in the previous sections, business relationships are a part of the setting where enterprise systems are used. This study therefore *applies a business relationship perspective on a focal company's enterprise system utilization with the aim of expanding the knowledge on how enterprise systems are used.* The underlying presumption is that business relationships and enterprise systems are best understood as an 'ongoing' phenomenon: they are aspects of contemporary business that develop through time, hold continuous exchanges, and thereby become a part of the involved partners business. Supported by these descriptions, three research questions have been formulated.

The first research question is based upon the enterprise systems' characteristics, i.e. that they are rather in a state of continuous improvement rather than fully implemented (Davenport *et al.* 2004). It is also a form of information system with a

production focused legacy (Payne 2002) and even if it is described as a solution that handles all of a company's transaction needs (Davenport 1998) we can expect to find information that is not handled by the enterprise system, something that the pilot study also illustrated (Ekman 2004 page 70-71). Given that the company has to make adaptations in its business relationships with others, we can also expect that the enterprise systems' functionality is partly a result of the existing business relationships. This leads to the first research question: *What ongoing business activities does the enterprise system support and what business activities are excluded?* The question puts the enterprise system into a context of use, non-use or even misuse and it also puts forth the business relationship aspects of the use. The business activities involve those activities that are related to the exchange of products with a specific business partner, i.e. those activities that Håkansson & Snehota (1995 page 26) describe as: '[the] technical, administrative, commercial and other activities of a company that can be connected in different ways to those of another company as a relationship develops'. The business activities thereby involve those activities that are needed for producing the offer including purchases and sales, but also those activities that are related to the development and production of the offer as well as those needed for handling the transfer between the focal company and its business partners.

The other research question is connected to the interpersonal contacts in business relationships, i.e. how the involved companies' employees interact in the business relationship. The pilot study showed examples of altered contact patterns where the customers could handle their order administration by themselves through the implementation of a web shop (Ekman 2004 page 117). Findings that have described changed interaction have also been addressed by others (Walsham 2001, Melin 2002, Schultze & Orlikowski 2004). This leads to the second research question: *How is the enterprise system used seen from a business relationship perspective?* This question is in line with the first one, but it highlights the ongoing exchanges as a central aspect of business relationships (cf. Ford 1980, Johanson & Mattsson 1987, Ford *et al.* 2003). What exchanges are supported, or handled, by the enterprise system and what exchanges are not? It is also interesting to see if any other computer based information systems are used for this exchange, or if it is not suitable or possible to handle the task with an information system.

The third research question is a follow up question on the prior one: *Why is the enterprise system used, or not used, seen from a business relationship perspective?* To be able to understand the use or non-use, it is necessary to examine the reasons for how the enterprise system is utilized in the business activities. When addressing this aspect

it is also important to mention that this question also needs to consider the context of use, which in this study especially means the ongoing exchanges with customers and suppliers.

The study's aim can be fulfilled by answering the questions above. By applying a business relationship perspective, lessons transcending the single company can be found. This leads to this study's purpose: *to develop a theoretical framework and explore a focal company's enterprise system utilization in their business relationship activities* with customers and supplier. By doing so, the prevailing organization/strategy focusing knowledge on an enterprise system is expanded and the business relationship research is enriched with an IS perspective. The product and financial exchange are thereby not given a central role; the business relationship may also involve social and information exchanges. Given the enterprise systems' characteristics, it also means that it needs to be studied both within and outside the focal company.

1.5 Continuing a research effort

As has been declared, this thesis presents a continued research effort where the first results from a pilot study was presented as a licentiate thesis (Ekman 2004). The pilot study highlighted the need to consider the enterprise systems' scope, its influence on the business activities that were carried out, and the role it takes in the business interaction with others. The approach also differs from what can be considered the traditional approach within IS research. The relationship between IS theory and organization theory have a well established tradition within the IS discipline (Lee 1999, Orlikowski & Barley 2001) and also the issue of technology and change (Klein & Hirschheim 1983, Eason 1988, Orlikowski & Gash 1994, Markus 2004). But the effects on an interorganizational level have not been explored as extensively, even though there are efforts made with organizational approaches (involving aspects as identity and social embeddedness) (Walsham 2001, Schultze & Orlikowski 2004), following interorganizational information systems (Kaufman 1966, Barrett & Konsynski 1982, Easton & Araujo 2003) and strategy approaches (e.g. work within the e-commerce field). But changes that are derived at an organizational level can also be expected to affect how the organization acts with other organizations, i.e. in a company's business. And we can also assume that the opposite relationship is true. This means that *both intraorganizational and interorganizational aspects need to be considered when studying information systems in a business context* (Esbjerg 1999, Birkinshaw & Hagström 2000), a stance that has coloured this study.

1.5.1 Theory refinement

In this thesis the lessons from the pilot study (Ekman 2004) are taken one step further, influencing the theory and empirical selection as well as the analysis. The combination of theories on business and information systems have been refined since the pilot study and further developed in this thesis. The synthesis of the applied theories is used as an analytical framework. The construction of this framework is inspired by Walsham's (1995) metaphorical description of theoretical support in research as the use of 'scaffolds'. According to his description, theories may work 'as an initial guide to design and data collection' (Walsham 1995 page 76). With such an approach, this thesis represents research where the results are supposed to be added to an existing body of knowledge within the fields of IS and on business relationships. The IS field is enriched with a perspective that includes the companies environment and the research on business relationships is enhanced with a study that highlights the IT use. The findings are also expected to complement the knowledge on enterprise systems.

1.5.2 Information systems as embedded in ongoing business

The applied perspective on information systems follows a tradition where the system is seen as an entity, which use cannot be known in advance, and thereby it is impossible to describe its effects according to an *a priori* set of laws or with a deterministic approach. Following an ensemble view of technology (Orlikowski & Iacono 2001), all users are seen as unique individuals where their use depends on contextual aspects (this view is in line with the proposals of Kling & Scacchi 1982, Markus 1983, Walsham 1993, Markus & Lee 2000, Orlikowski & Iacono 2000). This somewhat holistic approach, used and described in the pilot study (Ekman 2004), will be further developed in this thesis. Orlikowski & Iacono (2001) pinpoint how IS research has been poor to perform, or at least publicise, research where information systems are integrated in the context of use. With the applied approach, the use of an enterprise system in a business situation is not only considered and studied regarding a single business transaction. Instead it considers the repeated exchanges that the focal company, and its customers and suppliers, have with each other.

1.6 Thesis structure

After this introduction where the area of interest, the research questions, and the purpose have been declared, it is time to describe and discuss the theories that have supported this quest. To get an overview of how the study is presented, fig-

ure 1 shows this thesis structure in parallel with that each chapter is briefed described. It is also worth mentioning that the structure has considered the dual audience of this thesis – the theories are presented stepwise to introduce those from the IS discipline to the business relationship theories and those from the business discipline to the enterprise system phenomena.

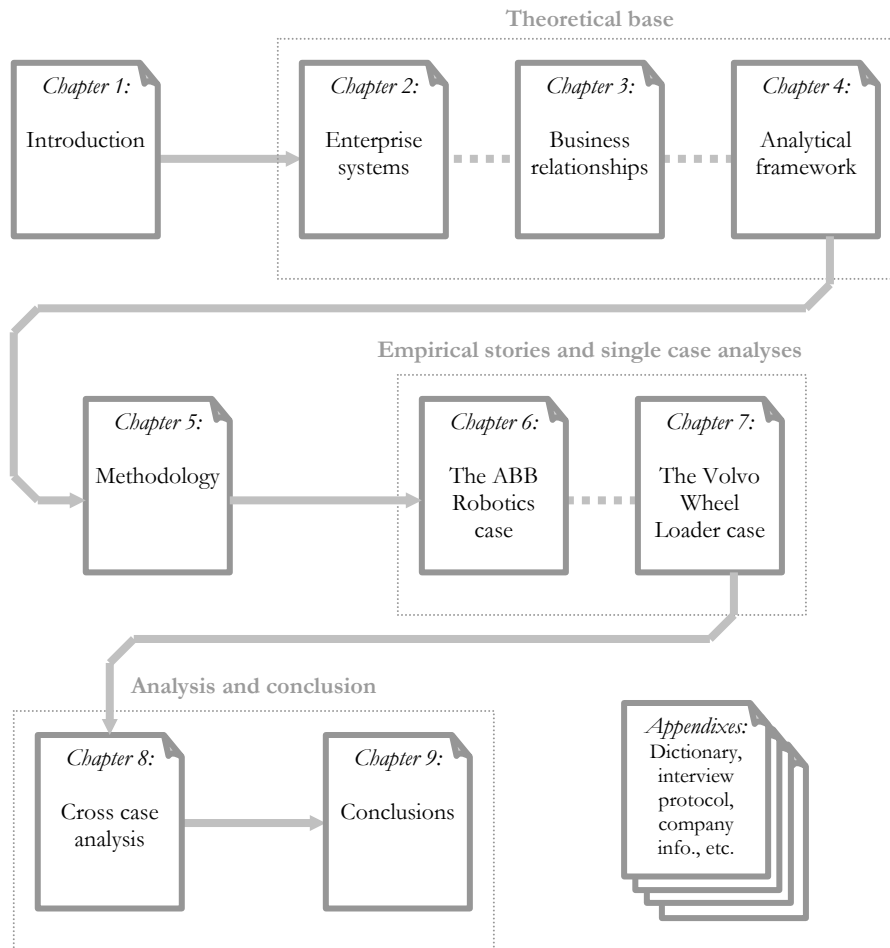


Figure 1 ► This thesis' structure

The upcoming *chapter 2* presents the research object enterprise systems and how such an information system can be studied in context. Initially, there will be a discussion about what characterizes enterprise systems from other information systems. Thereafter follows a basic description of the enterprise systems' technology, its legacy and what organizational effects it used to be associated with. The chap-

ter ends with a presentation on how enterprise systems can be captured in a way that considers the phase they are in followed by a presentation of the ensemble view of technology, following Kling & Scacchi's (1982) web of computing.

Chapter 3, which introduces the business relationship theories with a focus on industrial companies, presents some central concepts such as exchanges, business activities, and adaptations. The chapter begins with a clarification on how this perspective differs from other, traditional, marketing perspectives and then moves on to some theoretical concepts that later will be a part of the analytical framework.

The theories that are presented in chapters 2 and 3 are then further discussed in *chapter 4* in parallel with that they are synthesised to an analytical framework. Both the two applied perspectives, an ensemble view of technology and business relationships, give attention to contextual factors that can affect the enterprise system utilization. The chapter ends with a retrospective discussion on the theories that have been presented throughout the thesis so far, ending with an analytical framework.

Chapter 5 presents the chosen methodological approach and how the empirical setting was selected: what has been done, why, and how? The chapter also presents the used data collection techniques and how the empirical material was handled when creating the 'case stories' and during analysis.

When the methodological considerations have been discussed the first case study, descended from the focal company ABB Robotics, is presented as a case story in *chapter 6*. The chapter introduces the focal company, their enterprise system and products, whereafter the text moves over to their business partners' descriptions (that is: of the business relationships with customers and suppliers). The chapter ends with a single case analysis where the empirical data is analysed with support of the analytical framework, penetrating the empirical material. During this single case analysis the case story is scrutinized to find those aspects that show the business relationship characteristics and the enterprise systems' utilization, business relation by business relation.

The second case study named 'Volvo Wheel Loaders' is presented in *chapter 7*. The structure and logic of this chapter is the same as for the previous chapter.

When the empirical material has been presented and analysed, one by one, *chapter 8* presents the cross-case analysis. In this chapter, the two cases are compared and analysed together in a search for common patterns and asymmetries. By now, the synthesis of this study takes form.

Finally, *chapter 9* presents the conclusions from this study, followed by a discussion about managerial challenges and future research.

ENTERPRISE SYSTEMS

THIS CHAPTER DISCUSSES WHAT KIND OF information system enterprise systems are and it touches upon the effect they can have on companies. Enterprise systems have been described as having a great impact on a company's organizational structure and fundamental operations (Davenport 1998). But even though the enterprise system may put its own logic on an organization, the company and its employees choose to what degree they use the enterprise system functionalities. As presented by Davenport *et al.* (2004) companies do not change all their operations according to the enterprise system but they implement some functions when it is acquired, while others are incorporated through time. But before dealing with the enterprise system technology there is a brief discussion about how enterprise systems differ from the traditional interests within the information system (IS) discipline. Thereafter, the enterprise systems' construction is described, followed by a discussion about their process orientation. This is followed by the ensemble view of technology that has been applied in this study. This approach allows the researcher to capture the enterprise system in its setting which in this thesis includes the focal company's business relationships. Finally, two concepts that help us understand the enterprise system utilization (labelled system features and enacted use) are presented.

*It's a way
of doing
business*

2.1 The IS discipline and enterprise systems

The IS discipline has gone from being a rather data and information processing focused research area to incorporate concepts from business strategy, marketing, organizational development, and political science and thereby it has become a multidisciplinary area (Keen 1980, Wiseman 1988). The researched setting, and the analytical level, has usually been the *organization* (Keen 1980, Markus 1984, Walsham 1993, Orlikowski & Barley 2001) and when reviewing frequently cited books, researchers that theorize on the structures and dynamics of organizations, such as Thompson (1967), Weick (1979), Cyert & March (1963), and Simon (1947), can be found (Walstrom & Leonard 2000). The IS discipline's focus of interest within the organization is both the design and the use of information systems (Keen 1980). But the IS field has also incorporated the possibilities of sharing information between organizations (Barrett & Konsynski 1982), often discussed as interorganizational information systems (IOS) (cf. Cash & Kosynski 1985, Kavan & Van Over 1990). The development within the IS field has also put forth contextual factors surrounding the information system (Ives *et al.* 1980, Walsham 1993, Checkland & Holwell 1998) but it used to be either an internal or external focus:

[U]ntil quite recently the focus of the AIS* field has been on organisations' *internal* operations and data. Increasingly important to organisations are external data sources and electronic links to suppliers, customers, and end consumers. This suggests a growing need for an *inter-organisational*, as well as an *intra-organisational*, focus in the field of AIS.

Markus (1999 page 179)

This thesis, and the prior pilot study (Ekman 2004), shares Markus' (1999) viewpoint. The functionalities that an enterprise system can have means that its use can be beyond the single company, i.e. to capture its use it needs to be studied from inside the company and outside it.

Another movement within the IS field – closely related to enterprise systems – is that contemporary organizations do not need to develop their own information systems, which has been one cornerstone through different information systems development (ISD) methodologies (Avison & Fitzgerald 1995). Today's companies can instead acquire their information systems 'off-the-shelf' (Davenport 1998),

* Markus (1999) discusses the *Academic Information Systems* (AIS) field.

i.e. the information systems are developed by other vendors. Even though descriptions of enterprise systems have included in-house developed information systems (Brandt *et al.* 1998), the enterprise systems developed by other vendors seem to be the most common (Nilsson 2000) and the *de facto* use of that concept is based upon 'off-the-shelf' solutions offered by vendors as SAP, Oracle, Sage Group, and Microsoft* (cf. Magnusson & Olsson 2005). This means that an enterprise system is a generic solution (Hedman 2003), something that may affect the reception and use of the focal company. Instead of following the development and the implementation problems, which are a common research interest within the IS field, this thesis focuses on the utilization of these standardized information systems when they are up and running. Additionally, the analytical level in this thesis is not the single organization. Inspired by approaches within the IS field that have incorporated the interorganizational aspects (Markus 1999), based upon lessons from recent studies (Walsham 2001, Lamb & Kling 2003, Schultze & Orlikowski 2004), this study emphasises the interorganizational level.

Even though enterprise systems are developed to handle all the transactions within companies, their functionality is also a fundament for e-commerce and interorganizational information exchanges (Davenport 2000). The enterprise systems' characteristics also means that some of their major effects can be found within the organization, but that others cross organizational boundaries, something which could be seen in the Kanthal case (Ekman 2004 page 104-107). To understand the enterprise system in its context, thereby, means that its use must be traced both within and beyond the focal company. To sum it up, this thesis puts forth the interorganizational aspect (which is done by focusing on business relationships, see chapter 3) rather than the single organization. Enterprise systems are also a form of information system that is standard 'off-the-shelf' rather than developed in-house. The following section will continue the description of the enterprise system's construction and its described impact.

2.2 Some key characteristics of enterprise systems

Following Markus' (1999) critical reflection regarding the changes and challenges in the academic field of information systems, more and more organizations leave in-house ISD projects and move toward standardized software offered by software vendors. As the introduction illustrated, an enterprise system can cause

* The four largest enterprise system vendors according to Computer Sweden 31 August 2005.

effects on how a company's business activities are carried out. Hedman (2003) offers an exposition of some key characteristics that describe enterprise systems: the industry coverage that has no comparison with other kinds of information systems. Enterprise systems have been widely implemented, and some branches can even be considered fully covered (as with the oil industry, cf. Davenport 2000). The enterprise systems' scope and functionality cover most of a company's information processing needs. It is also a generic solution made up of reference models, organizational models, and data models that are supposed to be configured to fit the company's business. Finally, it is based upon master data that allows effective data handling by standardizing the data formats. Beside these key characteristics, an enterprise system can be considered an integrated system that has a process orientation. (Hedman 2003 page 54-55) Some of the characteristics that Hedman describes are further discussed in the following sections.

2.2.1 Selection instead of development

Though enterprise systems are bought 'off-the-shelf' the traditional cycle covered by the traditional ISD phases (cf. Avison & Fitzgerald 1995) is not applicable. Instead, the company has to select and implement the standardized system so it fits its needs (Nilsson 1991). A labelling of information systems that others have developed for generic purposes is commercially off-the-shelf (COTS) systems. These COTS systems can be stand alone applications such as Microsoft Word or a single financial application, but they can also be integrated and allow multiple individuals to share data and work together via a single application suite as with enterprise systems. A difference between traditional descriptions of information systems as something that have to be developed in-house, with support of consultants and programming teams, is that COTS systems are already developed when the company is exposed to them. (Nilsson 1991, Maiden & Ncube 1998, Hedman 2003) Whilst the traditional ISD life cycle contains steps like feasibility study, system investigation, systems analysis, systems design, implementation, and review and maintenance (Avison & Fitzgerald 1995), the selection of an enterprise system follows another procedure. Hedman (2003) proposes four stages that fit standardized software: selection phase; configuration phase; implementation phase and; use and operations phase. Initiatives to structure the selection and adjustment of the standardized information system has resulted in methodologies like SIV (Nilsson 1991, Nilsson 2000) and VFS (Brandt *et al.* 1998). No matter the methodologies; when implementing an enterprise system it is rather a matter of selection and adjustments than one of developing the system that fits the company

perfectly. There are, thereby, some tradeoffs to choosing such a standardized generic information system in the form of how the company handles their business activities and how the exchanges takes place (cf. Ekman 2004).

2.2.2 The technical construction

An enterprise system is a computer based information system that is built around a (logically) common database. This means that all the data that are registered by a user can be used by others that have access to the enterprise system immediately (Davenport 1998, O'Leary 2000, Magnusson & Olsson 2005). The advantage with enterprise systems is that there is no redundant data; everybody shares the same data and the information only needs to be registered once. To access the common database, different software applications called modules are used. These modules can be designed for production planning, materials management, financial accounting, sales and distribution, human resource management, plant maintenance, and so forth. The figure below shows conceptually the 'anatomy' of an enterprise system.

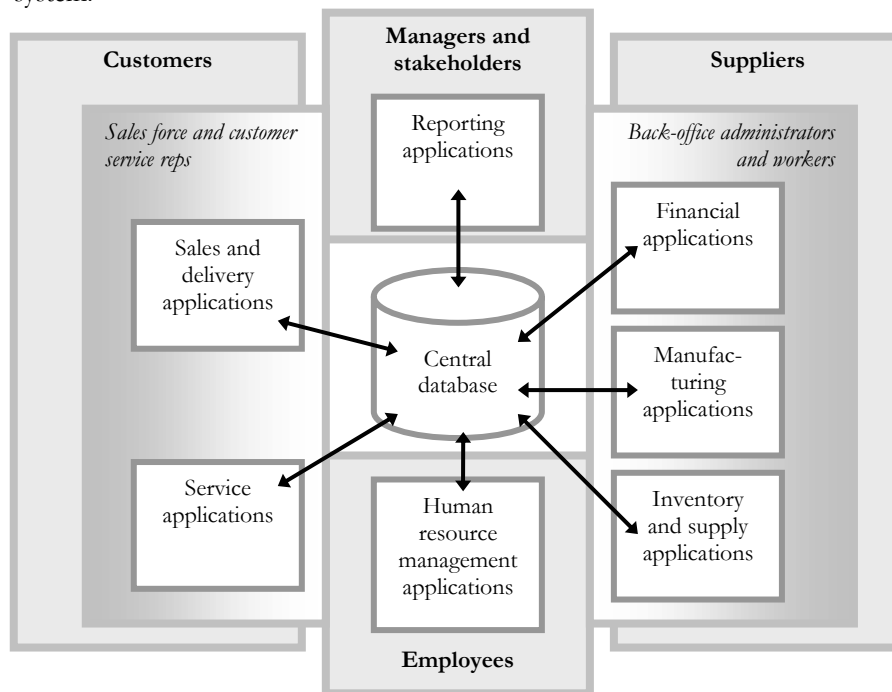


Figure 2 ► The anatomy of an enterprise system (Davenport 1998 page 124)

The modules are selected according to the company's needs and they are designed so that there will be no conflict if more than one module (and hence user) wants to use the same data simultaneously. The enterprise system modules have different names (see some examples in table 1) depending on vendor, but their functioning covers a company's fundamental processes.

Table 1 ► Enterprise systems' modules supported by vendors (Sumner 2005 page 8)

Function	SAP	Oracle	PeopleSoft ^(a)
Sales order processing	Sales & Distribution (SD)	Marketing Sales Supply Chain	Supply Chain Management
Purchasing	Materials Management (MM)	Procurement	Supplier Relationship Management
Production Planning	Production Planning (PP)	Manufacturing	
Financial Accounting	Financial Accounting (FA)	Financials	Financial Management Systems
Management Accounting	Controlling (CO)		
Human Resources	Human Resources (HR)	Human Resources	Human Capital Management

^(a) PeopleSoft was bought by Oracle during this study.

Modules can be seen as software applications with a specific focus and they can communicate with each other through the common database (Davenport 2000). The company selects the data (i.e. the master data) that shall be common for all modules (Sumner 2005). The downside with this is that the company must have a consensus on which terms and which units the enterprise system shall have. Davenport (2000 page 160) exemplifies by mentioning that the 'term customer may have to be defined as anyone who buys or might buy anything from the firm, which includes customers, prospects, distributors, retailers, customers, competitors, and sometimes even salespeople (if they are forced to buy inventory before selling it). A company that collapses all of these different types of customers into one category will not be able to learn much about any of them'. To overcome this problem, the company can let different units of the organization use their own instances of the enterprise system or alternatively introduce different terms on different types of customers, which on the other hand can give problems regarding how to consolidate the customer data.

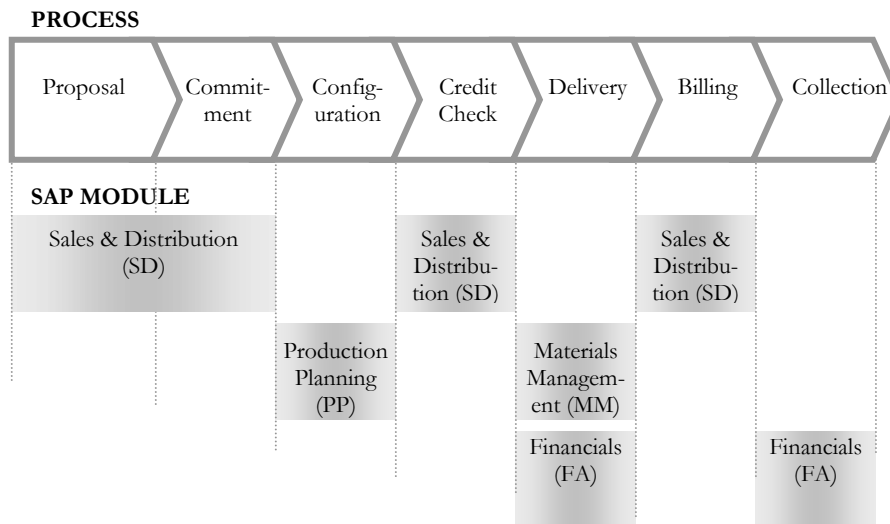


Figure 3 ► Example of used SAP R/3 modules in a order management process (modified from O'Leary 2000 page 36)

The selection of modules has an impact on what parts of the organization are affected by the enterprise system. The enterprise system vendors are usually offering industry-specific modules that may fit, or not fit, the focal company's business. And even within each module, the company can decide to implement only a part of its functionalities. This is also one of the problems or disadvantages with enterprise systems, they come with a lot of functions that are not needed (Kalderén 1995). The modules can also be used for different business processes. O'Leary (2000) exemplifies this by showing how different SAP R/3 modules can be used for a company's order management process, see the figure above. Each module in figure 3 uses the same data, e.g. data about the customer, and they can also add new data to an order as e.g. the sold product (SD), which production batch it belongs to (PP), used parts (MM), and so forth.

2.2.2.1 Adjusting the system

An enterprise system can follow the vendor's recommended setting or it can be adjusted according to the customer's prevailing processes through configuration tables. The most sold enterprise system SAP R/3 has, for example, more than 8.000 configuration tables that allow a company to adjust the enterprise system to fit their business activities. A company that uses the basic configuration and one vendor's recommended modules are following a 'vanilla implementation' (Sumner 2005) which seems to be the best path when considering future upgrades, avoid-

ing errors, etc. (Davis 1998, Höij 2002). The pilot study provides an example of this lesson; the IT manager described that the problems they have had were often caused by the adjustment that they had made within their enterprise system (Ekman 2004 page 65). It is, thereby, simpler to select one enterprise system and stick with that. At the other end are the companies that modify most of the configuration tables or even alter the enterprise system's basic code (i.e. 'customization'). Another approach is to go with a 'best of breed' solution which means that the company selects the modules that seems to fit their business best from different vendors. With such an approach, the sales and order module can be Intenia's Movex whilst the CRM module is from Microsoft's Axapta and the financial module is from SAP. The benefits with a best of breed approach is an enterprise system that is designed exactly for the company's business, the downsides are that it is more expensive, that it requires integration that can be problematic, and that the different modules are experienced as disparate systems by the users. (O'Leary 2000) Early studies of how enterprise systems were modified indicated that the majority of companies went with the vendor's standard adjustments and that they avoided modifications. Davis (1998) mentions a study on *Fortune 1,000* companies, indicating that just 5% had customized their enterprise system. Davis quotes Corning Inc.'s director Steve Cooper: 'If you modify the software, then there will be a cost. The cost comes when you make the modification initially, when you do an upgrade, and when you support the software over time' (Davis 1998 page 57).

The concept 'best practice' is used when discussing enterprise systems and the business activities that they support (Davenport 2000, O'Leary 2000). Best practice is defined as 'the best way to perform a process' (Sumner 2005 page 2), which means that the enterprise system supports some business activities by offering different structured ways of carrying out these activities. Each enterprise system vendor is usually regarded as 'better' for some industries (i.e. having the best practices that fit them well) than others, meaning that a company needs to investigate which vendor has the best software package for them (Kalderén 1995, Brandt *et al.* 1998). The interesting aspect with this concept is that the best practice is the vendor's one, i.e. there is no *de facto* or legislated standard for best practices. A best practice is thereby basically what the vendor considers to be a best practice. (Magnusson & Olsson 2005) The vendors are developing numerous of such best practices which they let their customers select from and, as an example, SAP R/3 has more than 1,100 best practices available (O'Leary 2000). The idea with best practice is also a generic one. Soh *et al.* (2000 page 48) mentions, for example, that the underlying business model, i.e. the best practices, in most enterprise systems is

based upon European and U.S. industry practices which leads to 'misfits' in the Asian industries. The generic solution enterprise system thereby has many problematic dimensions even if they, to a certain degree, can be adjusted to fit the company that acquires them.

2.2.2.2 Accessing the system

Once the enterprise system is in place, the users can access the enterprise system with either a text-based interface or via a graphical user interface. The enterprise systems have moved from being mainframe applications via client-server solutions and today the vendors offers web based systems (Carlsson & Hedman 2004). The principle for a client-server is that a client, i.e. the users terminal or PC, gather remote access to the server (something else, usually a database with some functionality) (Connolly *et al.* 1999, O'Leary 2000, Sandoe *et al.* 2001). The later development within the enterprise field has also been towards enterprise portals, i.e. the user is offered a single gateway in the form of a web portal that offers access to both structured and unstructured data. The vendor SAP has labelled such a solution 'my SAP workplace' and depending on what privileges the user is given, something that is arranged in SAP's more than 400 role templates, both internal and external applications, can be accessed by a user. (Carlsson & Hedman 2004)

Finally, it is worth mentioning that even if the enterprise system is regarded as a total integrated information system making the stored data visible for everybody (Davenport 1998), in practice each user use to have restrictions for what information he or she might get. As has been mentioned, the enterprise system may have different role templates or user profiles that the system administrator sets (Sandoe *et al.* 2001). As an example, that follows this thesis' interest in business, the purchasers may not be able to see the same data as the salesmen and vice versa, i.e. the enterprise system has individual interfaces where one user's interface can differ from another's. We might also believe that this causes an effect in how a company interacts with its customers and suppliers; some business activities can be seen as originating from the company's organizational structure where some employees are granted access to the enterprise system and others not.

2.2.2.3 Getting it all together

Even if enterprise systems take care of many of the problems caused by legacy and obsolete systems (O'Leary 2000, Sumner 2005), some of the old information systems may be untouched if their functioning cannot be handled by the new enterprise system. As within the pilot study (Ekman 2004 page 92-94), some legacy

systems were used in parallel with the new enterprise system. Such a solution limits the scope of the enterprise system and it can also cause problems. Axelsson & Goldkuhl (1998 page 12, translated) discuss this situation:

[...] when in-house developed systems shall coexist with bought systems. Some vendors design complex and highly integrated system packages [as enterprise systems] with many cooperating modules. Then it can be difficult to change one of these modules with an own developed, or another bought, application. The purchase of such complex system packages may demand adjustments of the systems structure. You do not only buy an information system, but at larger installations, also a systems architecture.

An enterprise system and other integrated information systems can thereby be seen as a company's information handling backbone. But the coexisting information systems must not only be legacy systems, they can also be purchased after the enterprise system to complement its functionality. A description of information systems that complement the enterprise system is 'add-ons' or 'bolt-ons' (Davenport 2000, Sandoe *et al.* 2001). The basic description of these complementary applications is that they are created by other vendors (Davenport 2000) as with the pilot study where a business intelligence system (QlikView) was getting its data from the enterprise system's database (Ekman 2004 page 84). The use of such complementary software offers enhanced functionality but it can also lead to data that is not fully integrated with the enterprise system. The problem that is caused by disparate information systems use to be called 'information silos' or 'islands of automation' (Sandoe *et al.* 2001, Luftman 2004), i.e. the data is not available for others but locally stored, meaning that the information system is addressing a certain function, but that the 'integration at the enterprise level' is missed (Luftman 2004 page 8). A company needs to consider to which degree complementary software shall be used; by using the enterprise system as much as possible the company can get more benefits out of it.

The problem with a new and legacy system living side by side has lead to concepts such as Enterprise Application Integration (EAI) which basically is the process of integrating the enterprise system, or other information systems, with other applications (such as procurement or shopping sites). An EAI solution can handle different formats, such as EDI and XML messages, and also integrate different applications within and outside the organization. This is usually made with middleware or web based interfaces. (Sandoe *et al.* 2001, Seddon *et al.* 2003, Sumner 2005) Companies that go for a 'best of breed' solution may also see the

EAI solution as the most important technology since it is the resource that allows the different modules to work together in a sufficient way. Another concept that addresses the problem with multiple information systems is Service Oriented Architecture (SOA) which is a recent concept (Magnusson & Olsson 2005, Lamont 2006). Harney (2006 page 24) mentions that 'there has probably not been an IT term more widely used but more vaguely defined'. Even so, the SOA philosophy prescribes solutions that allow the user to get a unified application based upon what is needed for his or her business activities, following the logic of a more flexible information systems infrastructure.

2.2.3 A production focused legacy

Enterprise systems have predecessors like MRP (Material and Resource Planning; in the 50s), MRP II (with extended functionality of MRP; in the 70s), and CIM (Computer Integrated Manufacturing; in the 80s) (Davenport 2000, Markus 2000, Farhoomand 2005). All the predecessors had functionalities that allowed companies to optimise their production with an increasing number of other functions for each acronym shift. Simplified, it is 'the concept of one (logical) integrated database with a common user interface' (Farhoomand 2005 page 260) that has led to the emergence of enterprise systems. With an inherited functionality from production and manufacturing, enterprise systems are sometimes described as insufficient as the central business engine.

Based upon their production focus, enterprise systems may lack functionality when it comes to interorganizational utilization leading to problems in the interaction with customers and suppliers because its 'limitations [...] from the fact that the first generation of ERP products has been designed to integrate the various operations of *an individual firm*' (Akkermans *et al.* 2003 page 284, own emphasis). Following the delimitations of enterprise systems, there might be a risk that enterprise systems are one of all the 'fads' within the IS discipline (Newell *et al.* 2003). Even so, these standardized information systems have been around for quite some time and the companies have implemented them aiming for organizational changes, even though there are also warnings for quite huge problems and obstacles that these systems can cause. (O'Leary 2000, Scheer & Habermann 2000, Koch 2002) In practice, it seems like the back-office functions are used to a high degree, whilst the front-office functions are less developed to fit the need of the users (Ekman & Révay 2004). This can be a result of the traditional organizational need of internal stability that allows rational and planned decisions versus the external contingencies that may require flexibility and adaptability (Thompson 1967,

Pfeffer & Salancik 1978). The shortcomings of the enterprise systems have led to concepts such as second-wave ERP systems (Shanks *et al.* 2003) and ERP2 (Rombel 2002), concepts that are supposed to indicate an increased interorganizational functionality. Despite the interorganizational possibilities, companies seldom acquire all the enterprise system's modules, but the financial and production focused applications seem to be the most frequently selected ones (Markus *et al.* 2000b). Even though it also has flaws based upon its transactional functioning where its decision support functioning can be weak (Holsapple & Sena 2003), the enterprise system supports many of a company's business activities.

2.2.4 Process-ware

Enterprise systems have a process orientated logic (Davenport 2000, O'Leary 2000, Sumner 2005), which means that the implementing company's business will be affected somehow. Davenport & Prusak (2003) review how the development of enterprise systems has gone so far:

[Enterprise systems] were, in a sense, the reengineer's dream; they had many positive attributes from the standpoint of reengineered business processes, including the following: They worked – that is, they were reliable, secure systems that churned out information the way they supposed to. They were cross-functional, as the newly reengineered business processes were supposed to be. They were based upon best-practice process designs. They supplied a relatively easy way (compared to companies building applications themselves) to automate a broad range of business processes in an integrated fashion. Not surprisingly, the managers of processes and reengineering projects flocked to the [enterprise system] vendors SAP, Oracle, PeopleSoft and so on.

Davenport & Prusak (2003 page 172)

Depending on the enterprise system's best practices, if it is standard or customized and depending on how many modules that are selected, the company has to adjust its business activities. There is also a trade-off between implementing the enterprise system as it is and adjusting it according to the prevailing business processes (Davis 1998, Sumner 2005). O'Leary (2000) uses the concepts 'technology enabled reengineering' and 'clean slate reengineering' where the first uses the enterprise system to drive the reengineering effort and the other adjusts the enterprise system to support the business activities that the company needs.

An enterprise system may affect how employees can act when performing their ongoing business activities, which in turn can lead to both intended and uninten-

ded use (Walsham 2001), and the magnitude of the enterprise systems' impact can affect more than they first reveal (Davenport 1998, Markus 2004). Hedman & Kalling (2002 page 191) address the impacts on business practices and mention that they 'will remain as an enduring part of IT for a long time to come and will affect nearly all aspects of organization'. The embeddedness of enterprise systems in business activities, which they may affect and reengineer, thereby means that their impact can be comprehensive and complex. The next section will address some aspects that can differ and that need to be considered when studying and analysing enterprise systems utilization.

2.3 The impact of enterprise systems

Due to the enterprise system's characteristics its impact can vary. Firstly, the enterprise system has different life cycle phases that in turn affect how deep its impact is expected to be. Secondly, companies implement the offered modules to different degrees, i.e. the implementations have different scopes. Finally, each enterprise system is more or less adjusted according to the company's needs, i.e. an issue of modifications and bolt-ons. Each of these factors will be described in the following sections.

2.3.1 The life cycle phases

As has been described by Davenport *et al.* (2004), an enterprise system never seems to be fully implemented but it is in an ongoing state of change. Markus *et al.* (2000a) address the differences between newly implemented enterprise systems and enterprise systems that have been used for a long time by different phases. They label the phases project phase, shakedown phase, and onward and upward phase. Whilst the (i) *project phase* is focused on closing the project in time, on budget, it can also hold a lot of conflicts, unwillingness to participate in the first use of the system and in the training activities that are offered. In this phase it can be difficult to follow any use – success metrics is instead measured based upon gained functionality, project success, and so forth. Once the enterprise system is running it enters the (ii) *shakedown phase* where the first impacts can be traced. During this phase, the users can adjust to the processes supported by the enterprise system alternatively creating their own 'workarounds'. Initially, the system can need adjustment and the users need to get experience of using the system, which can lead to data input errors, and short-term negative impacts on the company's customers and suppliers. During this phase, the company is highly dependent on its IT support organization and the so called 'super users' (Davenport 2000), i.e.

operational personnel that have been involved in the enterprise system implementation and that have extra training in its functioning. After being in operation for a longer time, the enterprise system settles and enters the (iii) *onward and upward phase*. During this phase, the company has learned the enterprise system's functions and they now start to evaluate upgrades and migrations to later versions of the enterprise system. During this phase, the users are becoming more and more skilled, and the organization starts to appreciate the decision support offered by the system. By now, the company are also more at ease with complementing the enterprise system and accepting other technologies. (Markus *et al.* 2000a)

Following the description of the enterprise systems phases, we might expect to see more of the enterprise systems impacts in the later phases whilst the project phase probably does not reveal much. This means that the life cycle phase can be used as an indicator on what to expect and what the studied enterprise system utilization means – is it initial disturbances or is it fully developed use?

2.3.2 The scope

The second aspect that differs between enterprise system implementations is the enterprise system's *scope*.

Scope is important for several reasons. First, it defines the extent and type of benefits that can be derived from an ERP system. Implementation of only the financial modules of an ERP package in one business unit has the potential for quite different benefits than implementation of all ERP modules in every unit.

Markus et al. (2000c page 43)

The scope has similarities with what was described as the 'enterprise systems boundary' in the pilot study (Ekman 2004 page 112-114). The module-based construction of enterprise systems means that a company can select one or more modules depending on the needed functionality. An important aspect that also affects the selection of modules is the economic one. Sullivan *et al.* (2005) studied ten major enterprise system implementations (spanning between 1,000-10,000 users) and found that the cost could reach up to \$100 million and that the enterprise system upgrades could cost as much. They also found that the cost for maintaining the studied enterprise systems was 20-30% of the initial purchase sum on a yearly basis. A reason for just implementing some modules can therefore be the cost that follows an enterprise system. Another aspect to consider is which business activities that are affected by the enterprise system. Davenport (2000) mentions process

and business unit phasing as a way to be able to control the implementation and evaluate its effects. Whilst the process phasing means that a certain process is supported by the enterprise system (such as production or accounting) the business unit phasing means that a certain plant or office is used as a pilot project to evaluate the enterprise system. As an example; the company's most technologically mature business unit can implement an enterprise system first. Afterwards, they can work as a role model for other business units. The enterprise systems' scope thereby helps us to capture where the impact of the enterprise system, if any, is found (Markus *et al.* 2000c).

2.3.3 The modifications

Finally, even though the enterprise systems used to be described as 'standard', one is not equivalent to another though there usually are some *modifications* made. As has been mentioned, the so-called best practices an enterprise system offers can surpass 1,000 and each company can also adjust the configuration tables differently leading to that no enterprise system is identical. Beside this, the use of add-ons and bolt-ons adds functionalities that are hard to imitate. There is also the aspect of the enterprise system as the business engine or information backbone in parallel with other more or less integrated information systems (Ford 2000, Farhoomand 2005). To capture the enterprise system in its context and to scrutinize its modifications is thereby also a factor that can indicate the impact of an enterprise system (Ekman & Thilenius 2005).

2.4 An ensemble view of technology

When studying technologies such as an enterprise system in use, the approach must consider its wide application area. Some traditional approaches within the IS field have been rather deterministic pointing to 'failure' or 'success'. The shortcomings of such studies are the absence of contextual factors, i.e. they have taken an atomistic stance. As an alternative to these approaches, reactions that reject atomistic viewpoints have resulted in more holistic approaches that consider several aspects and contingencies. With such an approach, the use of information systems is both 'enacted' and 'embedded' into everyday life, but the information system *per se* is seldom the central aspect. The following discussion highlights the difference between atomistic and holistic approaches and puts forth how enterprise systems can be studied.

2.4.1 Discrete-entity approaches and computational views

Kling & Scacchi (1982) address research that applies *discrete-entity analysis*, i.e. studies of information systems that ignore the social context and the history of the participating organizations. They pinpoint that approaches on information systems that do not consider the setting may miss the benefits or problems of the studied information system. With a discrete-entity analysis the information system is seen as a tool, equipment or technology that is socially neutral and that offers specific processing capabilities. Even if Kling & Scacchi's (1982) argumentation is more than two decades old, it still seems to be an actual topic. As an example, Orlikowski & Iacono (2001) studied and conceptualised articles in the high ranked journal *Information Systems Research* (see classifications made by Avgerou *et al.* 1999, Whitman *et al.* 1999, Avgerou 2000) between the years 1990-1999, and they found that the technology's appearance was absent in the majority of articles. They also found that the second largest group of articles was constituted of what they labelled *the computational view*^{*}. Their reflection upon this perspective was:

Not all research in the field of IS is interested in the interaction of people with technology in various social contexts. Some research concentrates expressly on the computational power of information technology. Articles embracing this view are interested primarily in the capabilities of the technology to represent, manipulate, store, retrieve, and transmit information, thereby supporting, processing, modeling or simulating aspects of the world.

Orlikowski & Iacono (2001 page 127)

By approaching information systems with a computational view (which holds similarities with what Kling & Scacchi describe as discrete-entity analysis) means that the study will implicitly bring a number of assumptions that make the situation easier to capture. The assumptions is that: (i) the information system is best described as 'equipment' and this equipment is supported by an adequate infrastructure, (ii) the organization manages the resources needed to handle this infrastructure, (iii) the focal information system can be analyzed isolated from other computing resources and other organizational arrangements, and (iv) the formal goals describe what the organization, and hence the information system, do (Kling & Scacchi 1982 page 6-7). With such approach, each information system is easily

^{*} The largest group, the nominal (absent) view and the computational view of IT, stood for approximately 50% of all the articles (i.e. more than 90 articles [N=188] of the publications in *Information Systems Research* during the years 1990-1999).

identified and it is thereby possible to address costs, benefits, skills, and so forth directly. Studies that follow an atomistic approach suggested by discrete-entity models (Kling & Scacchi 1982) or the computational view (Orlikowski & Iacono 2001) will be coloured by these assumptions. Kling & Scacchi (1982 page 2) describe how ‘the social context in which the technology is developed and used, and the history of participating organizations, are ignored’ within the IS tradition. But to take things for granted, or to make conclusions too hastily, is risky (Markus 2000). Any impact, whether technological or otherwise, on an organization holds multilevel aspects as the individuals’ behaviours and attitudes, group norms and interactions, organizational structures, and strategies; aspects that must be treated simultaneously (Schneider & Klein 1994).

2.4.2 Information systems as embedded in economic and social action

Later approaches that consider information systems, and their infrastructure, as embedded in a social context offer other results than the discrete-entity models. Researchers that try to capture information systems in their context acknowledge that information system use is dependent on several variables that will not be captured by too narrow descriptions (Markus 1983, Walsham 1993, Orlikowski & Iacono 2001). Even though enterprise systems may dictate how things shall be carried out once implemented, the use is dependent on how the users perceive it and choose to use it (Boudreau & Robey 2005). To understand the use of a specific information system, the context of use is central. Even if it is possible to use an information system in a specific way, as described by its technical design, it may not be used in that way. Following this reasoning, the functions of an information system are not the sole guide to understanding its use. It is, instead, both the technology *plus* the individual and organizational aspects that affect the use and that need to be examined (Markus 1983). The enterprise system utilization is thereby influenced by the situation where and when the use takes place (cf. Orlikowski & Iacono 2000). An information system is used based upon the user’s needs and the users approach it, and use it, as it seems ‘meaningful in context’ (Checkland 1999 page 54). In this study this means that the users use the enterprise system’s functions they think support them in their business activities.

2.4.3 The web of computing

Orlikowski & Iacono (2001) describe approaches that see technology as a ‘package’ integrated in ‘socio-economic activity’ as an *ensemble view of technology* (Ibid. page 125). Such an approach also allows the inclusion of other perspectives (such as business relationships). One theory that Orlikowski & Iacono (2001) present as

an ensemble view of technology is the 'web of computing' by Kling & Scacchi (1982), an approach that considers 'the social processes surrounding the introduction, creation, use/misuse/disuse of information technology' (Orlikowski & Baroudi 2002 page 57). By analysing information systems as embedded in a setting that involves more than the system itself, its use is captured in its context. When applying the web model of computing approach the researcher 'must examine the social and political context in which the technology is developed and used, the ongoing concerns of the organization using it, and the extent to which financial, technical, and staff resources support it' (Kling & Scacchi 1982 page 5). A recent example of a case study that applied an ensemble view of technology could present why ERP implementations failed in China. The result indicated that the outcome did not only depend on technological factors, but also on cultural and environmental factors. (Xue *et al.* 2005) Basically, with an approach inspired by the web of computing the social relations between the individuals, the infrastructure where the information system is used, and the history of the setting must be examined (Walsham 1993). As quoted in the introduction, the enterprise system must be seen as more than a tool 'deployed on the desktop' (2001 page 122). Markus (2000) advocates such a view on technology by pinpointing that the use of information systems are affected by the historical setting. This means that a company that has a long experience of computer based information systems is probably more open to accept or use new software than a company that has not utilized the possibilities of information systems. It is also difficult to draw a line between the technology and its social setting, i.e. the borderline between what is technology and what is social is vague (cf. Kling & Lamb 2000).

Kling & Scacchi's (1982 page 7-8) web of computing theory is based upon five basic assumptions regarding the nature of computing^{*}: (i) An information system 'is best conceptualized as an ensemble of equipment, applications, and techniques' that is only partly identifiable. The information system is also, besides being technical artefact, a social object 'highly charged with meaning'. (ii) The infrastructure that supports the focal information system (in this study an enterprise system) and its organizational procedures are critical elements. The structure of support, coupled to this information system resource, and the information system itself and its setting cannot be seen as a neutral entity. There is also no 'human factor' separable from the information system and both the system's development

^{*} Kling & Scacchi (1982) uses the term 'computer system' in their description, and this labeling is used as synonymous with 'information system' in this thesis.

and use are carried out within a social setting. (iii) The organization has limited resources to put on the information system and its infrastructure, which means that the organization does not have complete control over the information system. This is because all the resources that are needed can never be kept within a narrow organizational setting. Some resources are acquired through other organizations (for example, via an enterprise system vendor such as SAP). Other factors are practical issues that the organization has arranged, as a distributed network that is designed to handle different traffic loads from different departments, i.e. a technological resource can be shared between several information systems. (iv) The information processing capability of the focal information system is dependent on contingencies descended from other information systems and the social and organizational arrangements where the information system is developed and used. (v) The formal goals of the organization are a poor guide to what the information system does, so are the formal feature descriptions of the system.

The description by Kling & Scacchi (1982) is opened to political and institutional aspects and different contingencies that are found in the wider setting. To be able to capture the utilization of an information system five key concepts help the researcher to pay attention to aspects that can be considered as the information systems technical and social context. The concepts, called *structural concepts of computing*, are: the (i) line of work, (ii) going concerns, (iii) infrastructure, (iv) production lattices, and (v) macrostructure (Kling & Scacchi 1982 page 17-23). These five factors will be discussed, considering this study's research object enterprise systems, in the next section.

2.4.3.1 The structural concepts of computing

The first concept that helps the researcher to understand what is taking place is to study the *line of work* (Kling & Scacchi 1982 page 17). When studying a focal company's personnel in their business activities, they will hardly depict themselves as 'users' (Lamb & Kling 2003) but rather as a salesman, purchaser, engineer and so forth (Ekman & Thilenius 2005). The situations that a user enacts involves interpersonal contacts but also the use of artefacts (i.e. not only the focal information system). There can also be spatial and temporal aspects involved, i.e. the frequency between the exchanges, the distance between the user and the business partner, and so forth, that affects the use. (Kling 1987) By searching for the line of work, which is made by asking 'what do people do and value here?' (Kling & Scacchi 1982 page 18), the organizational life that the enterprise system is embedded and can be captured and understood.

Closely related to the line of work is *the going concerns* (Kling & Scacchi 1982) which, in this study, is interpreted as the phenomenon's momentum. The utilization of an information system is based upon the users' prior experiences (Markus 2000), i.e. the history and the technological maturity of the organization must be considered when studying information systems. Even if all *Fortune 500* companies have, or implement, enterprise systems more technologies can be expected to come:

In anticipating the effects that computers will have upon organizations, or already having, we must keep firmly in mind that we are dealing with *a moving target*: the capabilities of computers have changed with a great rapidity during the whole period during which they have been entering into our organizations. Today they are performing functions (for example, determining customer creditworthiness) that would have been unthinkable a few years ago. Tomorrow they will be performing functions that most of us would think wholly infeasible today.

Simon (2001 page 406, own emphasis)

The use of these forthcoming technologies will be dependent on past experiences. A company that has been using EDI should, for example, be more open to web technologies than a company that has no experience of interorganizational information systems (Markus 2000). The going concerns also signal 'the multiplicity of overlapping and sometimes conflicting activities' that are present in the company (Kling & Scacchi 1982 page 17). This concept thereby gives a hint of what is on the agenda.

The *infrastructure* refers to the resources that support 'the provision of a given service or product' (Kling & Scacchi 1982 page 18), and in this study the resources surrounding the enterprise system are especially interesting. The infrastructure is, though, more than the local technical network. 'In practice, a 'supporting infrastructure' involves a much wider range of 'systems' and 'networks' that includes organizational practices, key support staff, and access to technical and social skill sets' (Kling & Lamb 2000 page 311) The infrastructure thereby holds both organizational and technological arrangements that the user has access to. One aspect of the infrastructure is the enterprise system's organizational arrangement. The company's IT personnel has an important role once an enterprise system is implemented as well as the 'super users', i.e. operational personnel with a deeper knowledge of the enterprise system. The managerial support is also important, so are

the training and support available, including the organization's social network. (Kling & Scacchi 1982, Walsham 1993, Davenport 2000)

The fourth 'structural concept of computing' is the *production lattices* that signal the division of labour. Kling and Scacchi (1982 page 20) describe the production lattices as: 'Different organizational locations provide different elements which contribute to some final product. These contributing elements constitute a production lattice'.

The last 'structural concept of computing' is the *macrostructure*, which is a concept that holds the focal organizations 'market', prevailing technical standards, the availability of critical resources needed for upholding the information systems and other aspects that affect the utilization of the studied information system (Kling & Scacchi 1982).

2.4.3.2 Some clarifications about the ensemble view on technology

Even if Kling & Scacchi do not express the focal level in their web of computing, they mention that the lines of work and the going concerns 'helps [us] to know what people actually do and care most about when they act *in organizations*' (Kling & Scacchi 1982 page 71, own emphasis). The web of computing approach is thereby taking a traditional starting point within an organization. Though this thesis is a focal company (with an enterprise system) and its business relationships with customers and suppliers, the web of computing has a different analytical level. Despite this, it is used as a base when putting together the analytical framework in chapter 4.

2.5 Understanding enterprise system utilization

By now, the enterprise system technology and an ensemble view of technology (represented by the web of computing) have been presented. As has been evident in this thesis so far, companies use enterprise systems for their business. Given that the ensemble view of technology approach opens up for the incorporation of other theoretical perspectives (Orlikowski & Iacono 2001), as a business relationship perspective, the following sections will put forth some concepts that can be related to the activities that companies carry out in their business. Given that they are concepts that later will be a part of this study's analytical framework, they are described as framework components (cf. Walsham 1993). The first framework component is described as *system features*. When checking the description of 'feature' in the Longman Dictionary (2003 page 579) it is described as 'a part of some-

thing that you notice because it seems important, interesting, or typical'. Markus (1984) mentions that the word feature is often used to refer to a distinguished beneficial character. In this thesis it is a quite 'open' concept that aims at understanding what kind of functionality comes to hand when companies are engaged in business relationships. The second component is labelled *enacted use*. No matter the enterprise system features, it is the actual use that takes place in the individual's work situation that is of interest (cf. Boudreau & Robey 2005). By seeing the use as enacted, the setting is considered.

2.5.1 System features

There have been several attempts to address what kind of impact information systems may have. In this thesis, some concepts that may help us understand the enterprise systems roles have been gathered under the concept *system features*. As described, a feature is something that distinguishes the object of interest. When focusing on the technology itself, the design of an artefact as an enterprise system may facilitate or hinder use. Norman (1988 page 9) describes how an artefact signals how it can be used through its affordance which is 'the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used'. The enterprise system use is thereby affected by its design, whether it signals its functionality in a proper way or not, and how it affects the users work situation.

Markus (1984) describes information system features as *operational* (structuring work), *monitoring and control* (evaluate performance and motivate personnel), *planning and decision* (support intellectual processes), *communication* (support interaction) and *interorganizational* (to support transaction between companies). Markus mentions that the features are not dependent on a specific type technology and they also do not assume a specific type of user. We can, thereby, believe that they are applicable to the enterprise system as well as on both operational and managerial personnel. Other descriptions of the role of information systems are as having features that *automate* and *informate* (Zuboff 1988). Whilst the first concepts have a controlling dimension, a functionality that has also been addressed by Markus (1984), the latter signals an empowering dimension. Taking a business relationship perspective, an information system can inform about the ongoing business but it can also automate some business activities and support exchanges. Others describe information systems as having *facilitating* (i.e. resource employment and development) and *representing* roles (Baraldi & Waluszewski 2005). Within the consulting literature, information systems are also described as *enablers* (Hammer

& Champer 1993). There are, in other words, many ways to address the features of an enterprise system and depending on the situation the experienced functions can hinder or facilitate the task.

Another way to address enterprise systems' features would be to see what kind of data they handle. Following the vendors' descriptions, the later generations of enterprise systems shall be able to handle both *structured data* (e.g. transactional data) as well as *unstructured data* (e.g. from knowledge management systems) (Carlsson & Hedman 2004). Whilst structured data is organized in a regular way, often in the forms of tables and relations, unstructured data does not contain any structuring information (Losee 2006). Examples of unstructured data can be letters, spreadsheets, images, audio, email, and MS Word documents (Jaques 2004). As well as the design and functions of the enterprise system being able to affect the use, the form of data that it handles can also do so. The pilot study indicated that the information that was needed to carry out Kanthal's ongoing exchanges with customers had to fit the enterprise system's fixed data structure if it should be included in the enterprise system utilization. When the information that was exchanged was customer specific (such as shipping declarations) these were not handled by the enterprise system. Instead, they were written and handled in ordinary office applications. (Ekman 2004 page 77-98) The example from the pilot study can work as an indicator that the unstructured data may be easier to handle in separate information systems (including basic office applications) than in an enterprise system.

Given the interest in business relationships, there are also information systems that replace human contact, i.e. the exchanges take place without human intervention. In such cases, the *interorganizational connection* (as for example EDI) becomes a part of the business relationship. But as well as being a part of the business relationship, it can also change how the business relationship develops based upon the reduced interpersonal contacts.

Because network relations are enacted through the work practices and interactions of customers and providers, the use of the self-serve technology by customers led to arm's-length relations at the company level. For a company relying on embedded relationships and social capital to generate revenue, such an enactment raised serious challenges for the viability of its business model.

Schulze & Orlikowski (2004 page 105)

Even though the information exchange can be enhanced or replaced by information systems, we can still expect the users to have some interpersonal contacts (as

seen in the Kanthal case). As an example, Laage-Hellman & Gadde (1996) mention both technical and organizational barriers as obstacles that slow down the adaptation of EDI between business partners. The use of EDI between companies involves an overhead cost based upon the mutual adjustments that have to be made in the business partners respective information systems (Medjahed *et al.* 2003). When such an information system is 'up and running' it also binds the partners to each other though the 'implementation of interorganizational information systems means an increase of the interdependence between partners' (Lapiedra *et al.* 2004 page 227). Data sharing through EDI may thereby facilitate the business relationship (Fredholm 2002), but there still needs to be human contact to facilitate the exchanges and certainly also once the interorganizational connection is up and running. Such interorganizational connections may make the business relationship more efficient, but with the risk that the effectiveness (i.e. a question of flexibility) may suffer (Easton & Araujo 2003).

There are also applications with open standards that allow interorganizational communication between companies (Medjahed *et al.* 2003) and the companies can even choose to use different communication means, such as email or web based EDI, that do not require any specific arrangement from each partner. The introduction of Internet has also allowed the companies to display company information, product catalogues, on-line manuals, or even offer order history to their partners – information that is accessible via web browsers (Fredholm 2002, Oz 2002, Turban *et al.* 2004). Depending on the standards that are used and the complexity of the communication patterns in a business relationship, the interorganizational integration is a result of the business exchanges and the adaptations between the two business partners (cf. Leek *et al.* 2003). This means that the existence or absence of interorganizational connections becomes extra interesting given this study's interest in business relationships.

2.5.2 Enacted use

In this study, the focal company's utilization of an enterprise system is seen as the aggregated use. This means that, to understand the utilization of an enterprise system, the *use* (i.e. an individual entity) of the enterprise system must be examined. The presented web of computing supports such interest, though 'Kling and Scacchi theorize about how new technologies come to be *used*' (Orlikowski & Iacono 2001 page 126). When studying the use of information systems, it cannot be taken for granted but it must be evaluated by the circumstances. As an example: the involved people (i.e. the users) may use or resist using an enterprise sys-

tem. Markus (1983) describes that the outcome (use or non-use) can be described differently depending on if the approach follows a people-determined, system-determined or 'interaction theory'^{*} perspective. With the people-determined perspective we can assume the use is a result of the individuals; whether they resist change, are hostile against technology, want another technology, and so forth. With a system-determined perspective it is a matter of the information system *per se*. Is it cumbersome to use, is it poorly designed, is the infrastructure inadequate or has the user not received enough training? With the 'interaction theory' perspective, issues of culture and politics become central. Following this reasoning, resistance leading to use or non-use, is dependent on the 'interaction between the design features of the system and features of its organization and social context of use' (Ibid., page 436). With a 'interaction theory' view changed power balances and other influencing aspects can explain the use – whether the information system supports a user to act as he or she wants.

Markus' (1983) 'interaction theory' has similarities with the presented ensemble view of technology (Orlikowski & Iacono 2001); an enterprise system needs to support the given task or activity, it must fit the prevailing culture (i.e. 'way of doing things'), and the outcome needs to be connected to the prevailing rewarding system if its going to be used (cf. Markus 2004). When seeing information systems as enacted in the users every-day situation, the social context, the dynamic character, and the multiple instantiations that an information system can have are considered (Orlikowski & Iacono 2000). Following this reasoning, a focal information system:

[...] is neither an independent, external force completely outside our influence, nor a malleable resource that can be thoroughly controlled and bent to our will. Rather, the organizational changes associated with the use of technologies are shaped by human actions and choices, while at the same time having consequences that we cannot fully anticipate or plan. This approach we term an *enacted view*.

Orlikowski & Iacono (2000 page 357)

The enacted view follows the same ideas as the ensemble view of technology (Orlikowski & Iacono 2001). In this study, this means that each individual is simultaneously seen a user and a business actor (i.e. each individual have parallel roles

^{*} Note! This 'interaction-theory' is not the same as the interaction approach presented by Håkansson (1982).

in business situations, cf. Halinen & Törnroos 1998). With such an approach the enterprise system is considered to have dynamic properties: The user evaluates the enterprise system features according to the prevailing circumstances and it is used according to what the user considers suitable in that specific situation. (Orlikowski & Iacono 2000) And as well as organizational incentives affects use, so do the ongoing exchanges. The exchange that takes place between two business partners is also a part of the context that affects how the enterprise system is used:

Client relationships, interorganizational networks, and information infrastructures both constrain and enable organization members. Clearly, client demands exert a major influence on data gathering practices and the ways that people uses ICTs.

Lamb & Kling (2003 page 207)

If the features of an information system fail to meet the user's needs, he or she may create *workarounds* (i.e. creating manual or computer based systems that are used instead of some of the focal information system's features) or perform *augmented use*, even described as *tweaks* (i.e. using the information system as it is not supposed to be used but in a way that the user has discovered works well), as a result. (Markus 1984, Boudreau & Robey 2005) This means that the borderline between resistance and acceptance is difficult to capture; the users can use the information system, but not according to the designers or implementing organizations' intention, but to his or her individual needs and wants. Though an enterprise system affects a user's situation by imposing control or increased abilities (Markus 1984, Askenäs & Westelius 2000, Eliason 2003) it restricts or enhances the users possibility to act.

The use of an enterprise system is believed to be a result of the user's situation – does the enterprise system allow the individual to act as he or she needs to when performing the business activities that are the foundation for the exchanges with the company's business partners or does it hinder some activities? This discussion will be further developed, including the information systems features, when presenting the analytical framework in chapter 4.

2.6 Summary

By now, the novel reader has been introduced to this study's central research object *enterprise systems*. It is a specific form of information system that uses standardized, but modifiable, modules as building blocks to create a system that can sup-

port most of a company's business activities. Through a central database, all data transaction is handled and instantly (in real-time) available for others. With a legacy from the MRP system, the handled data was originally focused on handling material and production, but later versions support both sales and purchase processes. Following this study's interest, we can assume that the enterprise system is more used for the focal company's internal activities and to a lesser degree used in the exchanges.

As a side-effect of the enterprise systems' 'standard philosophy' come organizational, and even interorganizational, effects. Enterprise systems are process oriented; offering generic solutions described as best practices that are created for different industries and branches. The production focused legacy may also mean that there is a trade-off in its functioning for the business relationship activities and the continuous exchanges with business partners. But to get the functioning needed, the company can choose to customize the enterprise system, create an enterprise system based upon modules from different vendors (i.e. a best of breed solution), or use add-ons and bolt-ons and thereby get a system that fits their needs. When implemented, the enterprise system is also entering an environment of other information systems leading to integration problems. To sum up, even if enterprise systems are considered standard solutions, their modifiable characteristics and role in the prevailing information system architecture means that each installation becomes unique.

The factors described above means that there are differences between companies' enterprise systems, even if they may have the same installation from e.g. SAP. Three factors that may reveal these differences have been presented. The use may differ depending on which *phase* the enterprise system is in (for example, during its earlier phases a well developed use may be hard to find). The second aspect that has to be considered is the enterprise system's *scope* – i.e. how large a part of the company is affected by the enterprise system – with a wider coverage its functioning may be more influential on the company's business than with a narrow coverage. Finally, the organizational impact and the users' acceptance or resistance may differ depending on the enterprise system's *modification*. Has it been arranged according to the organizational structure and the prevailing business activities or has it rearranged how things are done?

To deal with the spectrum of factors that can affect the utilization of an enterprise system, the applied approach needs to cover more aspects than the technology *per se*. This chapter has discussed an atomistic view on information system use and

argued that such an approach may miss important aspects of how and why a system is used. As an alternative, an approach that considers the context of use has been proposed. With an *ensemble view of technology* the enterprise system is seen as embedded in social and economic action (Orlikowski & Iacono 2001). Kling & Schacchi (1982) offer such an approach with their *web of computing*. When considering the web of computing the researcher has to study the: (i) line of work, (ii) going concerns, (iii) infrastructure, (iv) production lattices, and (v) macrostructure. The five factors presented are described as ‘structural concepts of computing’. The line of work involves what people do and value and the going concerns means that the situation’s momentum has to be considered. The infrastructure involves the resources, both technical and organizational, that support the user. The production lattice indicates the division of labour and the macrostructure involves the wider setting. Even though these concepts are originally created for the study of an organization, they will be further elaborated upon and adjusted to also count for business relationships in chapter 4. The basic purpose of addressing the web of computing for this study is to highlight aspects besides the technology itself and to give attention to contextual factors that affect the use of an enterprise system, something that lies well in line with this study’s aim.

To understand the enterprise system utilization, two different concepts that later will be components of the analytical framework were put forward. The first concept was described as *system features*, an ‘open’ concept that urges the researcher to search for distinguishing characteristics of the enterprise system. Examples that can indicate such characteristics were describing enterprise systems in terms of: operational, monitoring and control, planning and decision, communication, interorganizational, automating or information, facilitating or representing, and as an enabler. There was also a discussion about how the type of data (structured or unstructured) could affect the utilization. Finally, the possibility of interorganizational connections between two business partners’ information systems was discussed. Such use, often discussed as interorganizational information systems (IOS), must also be evaluated with regard to its effect on the focal business relationship. The second concept *enacted use* describes the use based upon the users’ situation. Depending on if the enterprise system’s functionality seems suitable for the situation that the user faces, it may be used or not. There is also the possibility that the user uses the enterprise system in an unintended way, something that can be described as augmented use or tweaks.

A BUSINESS RELATIONSHIP PERSPECTIVE

AS STATED IN THIS THESIS INTRODUCTION, the study presented focuses on companies' utilization of enterprise systems and their business relationships with customers and suppliers. The theoretical perspective applied stipulates how business relationships can be understood and what role enterprise systems take in such a setting. The theories that are presented in this chapter are the foundation for the business relationship perspective that is a part of the analytical framework. Before presenting the theoretical perspective on business relationships a brief discussion about how this body of knowledge has evolved. Thereafter, industrial companies and their business relationships are addressed, presenting how business relationships and exchanges relate. The business relationship as a ground for adaptations is also touched upon, as well as how this leads to interdependence between the business partners. There is also a brief presentation of the research stream that focuses on business relationships in networks. The aim with the chapter is to introduce the reader to the business relationship perspective before scrutinizing it together with the ensemble view of technology approach in chapter 4.

*The process is
not one of action
and reaction; it
is one of
interaction*

3.1 Research on business-to-business marketing

Even though this study is carried out in an industrial setting, focusing on the business relationships between companies, a short introduction stating how this interest (which can be described as ‘industrial marketing’) is related to traditional perspectives on marketing. A dominant perspective within marketing has been marketing management, a normative approach that is closely related to the ‘marketing mix’ (for an overview, see e.g. Sheth *et al.* 1988, Kotler 2003, Shaw & Jones 2005). In the 60s, one of the contributors behind the marketing mix, Jerome McCarthy, declared: ‘bearing in mind the paramount importance of the customer and the fact that the target market must be selected first, we can reduce the number of variables in the marketing mix to four: Product. Place. Promotion. Price. It may help to think of the four major ingredients of a marketing mix as the Four P’s.’ (McCarthy 1964 page 38) Companies can employ these 4Ps when trying to attract customers and gain market shares, and the underlying logic is that each company has to choose how to act when it comes to selling its products or services. As described by Walker *et al.* (2003, page 12): ‘companies seek competitive advantage and synergy through a well-integrated program of marketing mix elements (primarily the 4Ps of product, price, place, promotion) tailored to the needs and wants of potential customers in that target area.’ The marketing mix is a major marketing concept (Kotler & Armstrong 2001) and during the last decade more Ps, such as personnel and politics, have been added (Magnusson & Forssblad 2000, Kotler 2003). But even though this theory has opened up for further enhancement, its construction is too simplistic to capture the complexity of business-to-business markets (Håkansson & Waluszewski 2004). The marketing mix lacks the time perspective and the complexity that prevails in the business between suppliers and customers in an industrial setting (cf. Johanson 1989, Easton 1992, Snehota 2004).

When taking an interest in business conducted by companies the researcher must consider that the purchase conditions differ from those in a consumer market. During the 60s there was an increased interest regarding the interpersonal bonds within sell and buy processes which has lead to ‘interactive’ marketing perspectives (Sheth *et al.* 1988). With an interactive approach, both the selling and buying partner is considered to be an active part in carrying out the business, something that leads to the relationship between the two becoming central. From a Scandinavian perspective the interest in the interactive characteristics of business has manifested itself in two different approaches, described as relationship marketing (RM) and market-as-networks (MAN) (Grönroos 1994, Mattsson 1997). *Relationship marketing*, with its roots within the service marketing area, stresses that it is much

more expensive to attract a new customer than keeping an existing one, which is why the company should put efforts in keeping the existing customers and developing the relationship with these. A key concept is, thereby, customer loyalty. (Grönroos 2002, Gummesson 2002). The *market-as-networks* approach put forth that the study of relationships is important for the understanding of companies and it is a theoretical base that has its origin in studies of industrial companies (Axelsson & Easton 1992, Johanson 1994, Håkansson & Snehota 1995). When comparing the two approaches, the relationship marketing approach puts the seller as the active participant whilst the market-as-networks has a more balanced view of activity levels of sellers and buyers (Mattsson 1997). Given that enterprise systems have a legacy that was focused on production rather than services (Hedman 2003), the ideas from the market-as-networks approach has been used in this study. As seen in the Kanthal case (Ekman 2004), the enterprise system can also be used beyond the single company. This means that the business partners (i.e. customers and suppliers) also need to be incorporated in the study.

When reviewing current research topics following a market-as-networks approach they have focused on different aspects of business such as technologies, knowledge management, internationalisation and resource management (Johanson 2001, Wedin 2001, Andersson 2003, Baraldi 2003, Bengtsson 2003). Others have combined a relational perspective with a traditional strategy perspective (Jönsson 2006). There has also been a shift from seeing one business relationship (Ford 1980, Håkansson 1982) to seeing relationships in networks (Axelsson & Easton 1992, Håkansson & Snehota 1995, Ford *et al.* 2002). The research on industrial markets can thereby not be seen as one theory – it is several theories that have different application areas.

The following sections describe the theoretical base that has been used in this study, highlighting concepts that are later presented as a part of this study's analytical framework.

3.2 Theories on business relationships

As has been evident in the introduction, industrial companies are not involved in single isolated transactions. Instead, it is a question of repeated exchanges that are the foundation for their business relationship. To facilitate all the exchanges that take place between companies, behavioural elements are needed to facilitate the exchange processes (Johanson & Mattsson 1987). These behaviours involve adaptations that the companies do to the exchanged product or the process of exchan-

ge and the routines that are a result of the continuous exchanges. The adaptations and institutionalized behaviour can also be seen as facilitating the upcoming exchanges as well as being a base for further development of the business relationship, i.e. the concepts are interrelated. (Ford 1980, Hallen *et al.* 1991, Brennan & Turnbull 1999) Basically, the companies' need to carry out business activities to be able to have their exchanges, and to facilitate these exchanges companies are engaged in adaptations. Through time, some of the involved behaviours also become institutionalized (Håkansson 1982, Johanson & Mattsson 1987), i.e. the involved people act as expected of them in that business relationship and routines are developed.

The industrial markets are also made up of a limited number of actors, which means that the companies are aware of each other (Håkansson 1982). When studying how business relationships develop between these companies it often starts with a situation where the partners evaluate each other. This procedure may be initiated by different reasons, but a common denominator is that the situation involves social, cultural, technological, temporal, or geographical distance between the partners. To overcome these uncertainties, the partners get involved in negotiations, which often lead to sample deliveries. As time goes, the number of deliveries adds up, something that enhances the partners' experience of each other. Through time, the business partners may show a great commitment to the relationship and the interpersonal relations can also be so strong that it can be difficult to draw the line between what is the business relationship and what are personal relationships. As described, a business relationship goes from an initial stage characterized by inertia and uncertainties and then follows stages holding frequent exchanges that lead to adaptations, institutionalized behaviour, routines, and mutually oriented activities. (Ford 1980, Dwyer *et al.* 1987, Ford *et al.* 2003) It is also worth mentioning that not every business relationship may lead to a stable state; some business relationships are ended instead (Havila & Wilkinson 2002).

The theories that describe this kind of business between industrial companies has been labelled *the interaction approach* (Håkansson 1982), *the network approach*, *markets-as-networks* (MAN), (Mattsson 1997), *the International Marketing and Purchasing* (IMP) *Group* (Ford 2004) and *the industrial network paradigm* (McLoughlin & Horan 2002). In this thesis, the concept business relationship has inherent concepts from the mentioned theories. The following discussion will take its starting point in the early findings on the business between a buyer and a seller, and it ends with a description of the later findings on business networks (Axelsson & Easton 1992, Håkansson & Snehota 1995, Ford *et al.* 2002).

3.2.1 A dyadic phenomenon

When having a business-to-business perspective, selling and purchasing are seldom an isolated event but rather a repeated act that needs to be considered in its context (Ford 1980, Håkansson 1982, Johanson & Mattsson 1987). Companies' business with each other is not based upon single discrete transactions: instead they perform several exchanges with the same business partner at more or less frequent intervals.

In business markets, we are not just dealing with active sellers who try to attract the attention of a passive market. It is not a case of action and reaction, but one of *interaction*. Sellers do seek out buyers and try to influence them to buy. However, buyers also have to search for suppliers that can and are prepared to meet their requirements, which may often be complex or idiosyncratic.

Ford et al. (1998 page 5)

Whilst traditional marketing research has focused the exchange of commodities on the consumer market, business-to-business markets are made up of product exchanges that must be modified to fit the buyer's need and at the same time be manageable for the seller, something that is sometimes discussed as heterogeneous resources (cf. Alderson 1965, Penrose 1995). The heterogeneity 'signifies that the supplier exhibits differences with respect to combinations of features of the goods and services which they sell' (Forsgren *et al.* 1995 page 26). The business between companies thereby involves uncertainties whether the product can solve the customer's problem and if it is possible to transfer the solution to the customer (i.e. regarding technology, logistics, know-how, administration, and so forth). The exchanges that takes place between a buyer and a seller are needed to utilize this heterogeneous resource (Håkansson & Snehota 1995). There is, in other words, a question of problem-solving abilities and transfer abilities when business partners interact (Håkansson *et al.* 1976, Ford *et al.* 2002). The supplier's and customer's mutual processes can be described as a 'double search' (Alderson 1965 page 37), i.e. the supplier searches for customers that need their product and the customer searches for a product that solves their problem. By getting involved in business relationships, the companies are engaged in a process that limits the addressed problem.

When studying how a dyadic setting with a customer and a supplier may look, Håkansson's (1982) interaction model may be used as inspiration. The figure below is a reduced and modified version (the full version of the interaction model was presented in Ekman 2004 page 35) made to fit this study's purpose and it

shows the setting for a business relationship. The setting is made up of a supplier and customer, two organizations with their own technology, structure and strategy. The companies are also surrounded by an environment that holds the prevailing market structure, the partners place in the manufacturing channel, the degree of internationalisation and so forth. The companies' size, their technology, and their strategic strivings can be seen as the fundament for how they can act. (Håkansson 1982, Campbell 1985) The companies are made up of their employees (i.e. people) and it is the employees who perform practically the business activities needed for all the exchanges between the two companies (Håkansson & Snehota 1995). In this study, these employees are also seen as information systems users that access different information systems (including the enterprise system) as a support for the business activities that they carry out (a approach that also was used in Ekman 2004).

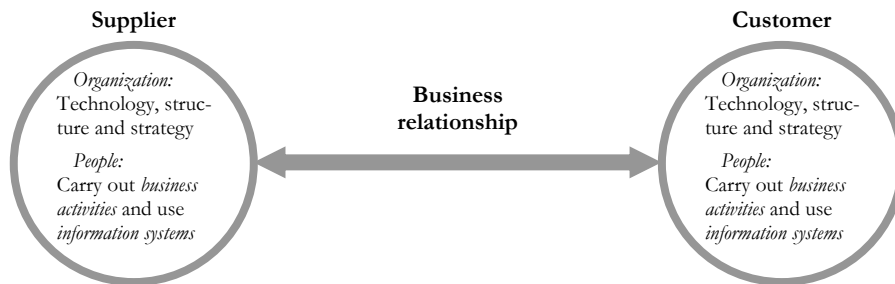


Figure 4 ► The business relationship setting as it is perceived in this study (inspired by Håkansson 1982)

Many of the ideas presented in the interaction model have been further developed and incorporated in later findings on business relationships (IMP Group 2005). The following sections will present concepts that deal with business relationships and that are used in the analytical framework.

3.2.2 Exchanges

The *exchange* between organizations has a central role within marketing (Enis 1973, Bagozzi 1974). The exchange is the business relationship's short-term entity and the interaction approach describes the traditional exchanges products and/or services versus financial means, but it also addresses information and social exchanges (Håkansson 1982). The different types of exchanges are carried out through time, and whilst one episode is added to each other, the business relationship develops (Holmlund 1997).

A later description of business exchanges has categorized them into three types: business, information, and social exchanges (Johanson 1989). The (i) *business exchange* can be seen as the fundamental reason for the business relationship to exist. This exchange is concerned with the exchange of resources that practically can involve the exchange of products and money, 'know-how', and so forth. As illustrated in the Kanthal case (Ekman 2004), the customers got electrical heating elements in return for money. The (ii) *information exchange* is needed to make the business exchange possible (following the logic of heterogeneous resources). Some of the information that is exchanged between two business partners can be general, e.g. as standard purchase conditions or the basic product specifications. Other information exchanges can be more complex or idiosyncratic, e.g. involve specific economic incitements or technical customized modifications. As an example, in the Kanthal case information was given based upon the salesmen's production selection applications, but there was also information offered by the application QlikView regarding earlier purchase volumes (Ekman 2004 page 84). Finally, the (iii) *social exchange* is a result of that the previous exchanges are carried out by people. The social exchange 'functions as glue that binds actors to each other, and at the same time, facilitate the business relationship' (Hadjikhani & Thilenius 2005 page 25). An important aspect of business relationships is the interpersonal contacts – i.e. the foundation for the social exchange (cf. Håkansson 1982, Johanson & Mattsson 1987, Hallén *et al.* 1991) – something that will be discussed later in this chapter.

When focusing on the exchanges that are carried out in a business relationship, they will also result in that behaviours develop in the business relationship. Initially, there will be uncertainties involved in the exchanges that the business partners carry out (Ford 1980) and this will lead to a situation where the partners try to facilitate the situation, something that is discussed next.

3.2.3 Behaviours

When two companies engage themselves in a business relationship they need to show a mutual interest in the upcoming exchanges. As has been mentioned, the exchanges can be complex for the parties to evaluate. To ease this situation, the business partners need to behave in certain ways to facilitate the business between them. The behavioural aspects that are presented in this thesis can be seen as the business relationship's long-term entity (Håkansson 1982) and, depending on the characteristics of the business relationship, they can be expected to exist to various degrees.

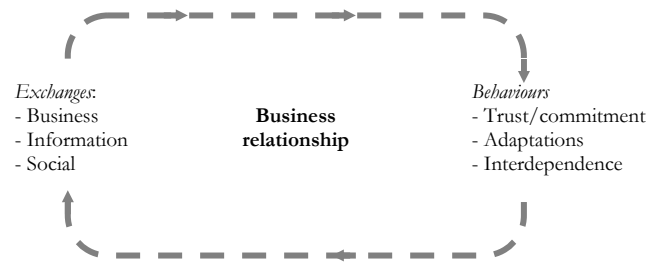


Figure 5 ► A conceptual description of the business relationship

The previous figure presents how the exchange and behavioural aspects of business are related and how together they form the business relationship.

3.2.3.1 *Trust and commitment*

To be able to do business, the business partners need to *trust* each other. By selecting a business partner that has similar values and where the mutual communication works well, it might develop into a situation where there is ‘a willingness to rely on an exchange partner in whom one has confidence’ (Morgan & Hunt 1994 page 23). Basically, to be able to have a business relationship the partners need to believe that the other partner will act as expected and not take other actions (Anderson & Narus 1990). One of the most important aspects to gain trust is the past performance (Dwyer *et al.* 1987, Tuominen 1999), i.e. that each company has (so far) done what is expected of them.

If there is trust in the business relationship, the partners may also show *commitment* to the business relationship. Morgan & Hunt (1994 page 23) define commitment as ‘an exchange partner believing that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it; that is, the commitment partly believes the relationship is worth working on to ensure that it endures indefinitely’. Anderson & Weitz (1992) describe a different form of business relationship investments and adaptations as one way to signal commitment. Two-way communication, i.e. a frequent exchange of information, also has a positive effect on the business partners’ commitment. From the distributor side, the manufacturer’s reputation may also have a positive impact. It is also interesting that formal contracts play a less important role to the parties’ commitment as the business relationships become long-term and more complex. The partners may also grant each other ‘exclusiveness’, but this is also an action that does have a weak effect on the other partner’s commitment. (Ibid.)

3.2.3.2 Adaptations

As exchanges are made the business relationships grow and the partners start to rely on each other; something that leads to business partners making *adaptations* to facilitate the ongoing exchanges (Hallén *et al.* 1991, Metcalf *et al.* 1992, Brennan *et al.* 2003). Within a business relationship, both the seller and buyer have to adapt both the offering and the processes related to it (Johanson & Mattsson 1987). This process can be offensive or active; some adaptations are made to satisfy the business partner, others are made as a foundation for future business opportunities. (Hagberg-Andersson 2006) Following the logic that the resources exchanged are heterogeneous, it implies that the business partners have to do some adjustment and fitting, as well as bridging the knowledge gap between each other:

In business markets, where suppliers and customers often establish and develop lasting relationships with each other, and where the business in such relationships may account for considerable shares of the supplier's sales and/or the customer's needs, there is reason to expect that significant counterpart-specific, or symbiotic, adaption occurs. Hence, one can expect that suppliers adapt to the needs of specific important customers as well as that customers adapt to the capabilities of specific suppliers. This adaptation is considered a central feature of working business relationships.

Hallén et al. (1991 page 30)

Through the repeated exchanges, the business partners learn how to act and what benefits they can get from each other, knowledge that leads to the prevailing partner being preferred to an unknown one; 'better the devil you know' (Ford *et al.* 2002 page 7). Besides the adaptations of the products and production, the business relationship can also require adaptations regarding skills (Lorenzoni & Lipparini 1999). Through time, the behaviour becomes institutionalized, which means that the business partners act as is 'expected' of them and that routines are developed (Ford 1978, Håkansson 1982). These routines bind the partners together and they facilitate the mutual coordination needed for the exchanges and they may also hinder conflicts and indicate that there is 'space' for further development in the business relationship (Johanson & Mattsson 1987, Håkansson & Snehota 1995).

One example of an adaptation that the pilot study's focal company made to be able to do business with some international customers was to complement their enterprise system with other applications to handle the specific documents that were needed for each customer's national laws (Ekman 2004 page 97-98). Such

adaptation cost and it can be difficult to calculate a 'business relationship cost'; but without these adaptations it can be difficult to get the benefits of the business relationship, which is why the partners initially have to evaluate the potential of each business relationship and consider whether to take the risks and make the relationship investments. (Ford *et al.* 2003) The adaptations made for a company's business relationships can also lead to investments. These investments can be of a general character, as for example a subcontractor that puts resources on an ISO 14000 certification to appease some major customers. But other investments are focused on a single business relationship, which then becomes *idiosyncratic investments*. These investments cannot be used in other business relationships and they are costs that must be related to a specific customer or supplier. (Anderson & Weitz 1992) One example of an idiosyncratic investment is the acquisition of a production facility that is specially designed for one customer and which produces products that cannot be sold to others.

Given this study's interest – the adaptations and the routines that are developed can also be expected to affect the use of an enterprise system. The users that are involved in a company's business exchanges with customers and suppliers are thereby influenced by the business relationships that their company is engaged in.

3.2.3.3 Interdependencies

The adaptations made and the developed routines in a business relationship lead to a situation of *interdependency*, i.e. it is difficult for them to move from one business partner to another. One example is a supplier that, through time, has gained power in the business relationship with a customer who has based all their production technology on the supplier's products. (Ford *et al.* 2002) Whilst a 'perfect market' would mean independencies between the business partners, the 'imperfect' (real) market can hold one dependent partner (i.e. a buyer's or seller's market) or the business partners can be interdependent, i.e. the business relationship has grown to something that they both need (Campbell 1985). When both partners have created a situation where they are mutually dependent on each other it is a question of interdependency (cf. Cunningham & Homse 1986). The sources of interdependency can have different origins. It can be technology; knowledge; social relations; administrative routines and systems; and legal ties that lead to a situation where the partners become interdependent. (Håkansson & Snehota 1995). All these factors can more or less exist in a specific business relationship and together they all lead to a situation where the actors will have difficulties in changing partners. The technical dependencies can involve a specific product or process.

The partners can also have knowledge dependencies, i.e. the training and use of the supplied products has lead to a situation where the partners have gained 'know-how' and where it is hard to change business partners. The involved social interaction can also lead to social dependencies, i.e. the web of interpersonal contacts and the mutually oriented values and norms hinder the termination of the business relationship. Finally, there can be logistic or administrative dependencies as a result of the business partners' mutual adaptations and the routines that have been developed in the business relationship. (Håkansson 1987) To sum it up, there is a advantage to getting involved in a business relationship as it facilitates the on-going exchanges, but at the same time it restricts the partners from becoming engaged in other business relationships that may be more beneficial (Ford *et al.* 2003, Beverland 2005).

3.3 The activity dimension of business relationships

Many of the concepts presented so far are theoretical ones, and they may be hard to capture in a real life setting. This study sees *business activities* as a bridging entity between what is theoretical and what is empirical in a business relationship. A business activity can be writing a quotation, negotiating prices, handling an order, assembling a product, and so forth. The business activity can be seen as what actually is done and is the entity closely related to the involved companies' business (cf. Håkansson & Snehota 1995). Some of the activities performed are, though, related to a specific business relationship whilst others are 'general' or internal (Dubois 1998). To carry out the activities, there is also a need for human intervention, something that is described as interpersonal contacts in this thesis. Given this study's interest in enterprise systems, the people involved may also be affected by the information systems that are utilized in this business (cf. Ekman 2004). The following sections will address these aspects.

3.3.1 Internal and exchange activities

As has been described, the business activities that are carried out in and for a business relationship involve both internal and exchange activities. The activities that companies carry out are the 'lowest level' of an industrial system (Dubois 1998 page 21) and they are the foundation for the coordinated and mutually oriented efforts taken at two business partners' companies. Whilst the business relationship and exchange concepts are theoretical ones, we might empirically see activities – 'something is done'. The pilot study (Ekman 2004 page 77-98) revealed business activities related to the sales of electrical heaters (such as negotiations, writing

quotations, receiving orders, and so forth) and also activities that were needed to handle the orders received such as fetching the products, packaging, and logistic administration leading to that the product being sent to the customer. Whilst some of these activities were carried out in direct relation to a specific customer others were general activities.

In this study, there is a distinction made between *internal activities* that a company carries out (even described as the production or transformation) and the *exchange activities* carried out in the business relationships (even described as the transaction) (cf. Dubois 1998). Following the logic that each company acts in an environment that requires its offerings, both internal and exchange activities are needed, i.e. they are two mutually dependent entities. The mutually oriented activities that are carried out by a buyer and a seller can be described in terms of activity dependencies (Johanson 1989). When carrying out an exchange activity in a business relationship, this may thereby be influenced by how the other business partner carries out his or her activities. By following the activities performed, clues regarding the business relationships characteristics can be found.

Later approaches that have taken an interest in business networks have labelled the activities within a company as the 'activity structure', between the companies as 'activity links', and between several companies in a network setting 'activity patterns' (Håkansson & Snehota 1995). The business activities that are carried out by a company are thereby seen as a part of a wider web of interrelated activities and this also means that they are dependent on how and when the other activities are carried out (Dubois 1998).

3.3.2 Interpersonal contacts

Given that the exchanged resources on industrial markets are considered heterogeneous (cf. Håkansson *et al.* 1976), i.e. the offered product is complex (Metcalf *et al.* 1992), the activities performed require different personnel and competencies from both companies (Turnbull 1979, Cunningham & Homse 1986). The involved people bring knowledge, experiences, personal aims, and expectations into the business relationship. The important 'social' factor is sometimes described as social embeddedness in economic action (cf. Granovetter 1985), i.e. the social and economic bonds in business are interlaced. The social aspects are described as social exchange in the interaction model (Håkansson 1982) and are a fundamental aspect of later theorizing about business relationships (cf. Johanson 1989). The *interpersonal contacts* that are a part of a business relationship are thereby close to an ordinary relationship between two partners well-known to each other (Thilenius

1997). The interaction model address the ‘atmosphere’, i.e. power and dependence; cooperation and conflict; closeness and distance; and expectations (Håkansson 1982), all entities that have origins as human attributes (Medlin 2004). The social dimension of business relationships is also related to the trust and commitment that evolves in the relationship (Morgan & Hunt 1994) and the interpersonal contacts can fill different roles. Whilst some individuals are given more formalized roles such as carrying out the negotiations, offer information, or do assessments, others are more informal such as the purely social or the ego-enhancement role. (Turnbull 1979) The importance of interpersonal contacts can also vary depending on the business relationship’s stage; in the earlier stages the social bonds hold important governing mechanisms reducing the distances between the companies (Ford *et al.* 2003).

The interpersonal dimension of business relationships is a foundation for business and information exchanges. To be able to evaluate a supplier’s offer, there can be more or less complex organizing in a business relationship to deal with all the issues that the business interaction holds. Later theories have described these interpersonal contacts in terms of ‘actor bonds’ (cf. Håkansson & Johanson 1992, Håkansson & Snehota 1995). The interpersonal contacts cross organizational hierarchies and they hold all the communication needed to facilitate the exchanges (Håkansson 1982, Ford *et al.* 2003). The interpersonal contacts in a business relationship are also needed as an information handling function and there may be a lot of people involved in e.g. a purchase decision (Cunningham & Homse 1986). Depending on the exchange frequencies and importance of a business relationship, we might expect different degrees of interpersonal contacts and these may even live on as purely social relationships once the business relationship is terminated (Havila & Wilkinson 2002).

When approaching business relationships empirically, the interpersonal contacts may give hints about the strength and complexity of the business relationship. (cf. Hadjikhani & Thilenius 2005) The business activities will also have a human origin, i.e. practically there are people involved in the activities that are carried out. When adding this study’s interest in the utilization of enterprise systems, we might even expect that the user’s interpersonal contacts (or what Lamb & Kling 2003 describe as the user’s ‘affiliations’) affect how the enterprise system is used. The interpersonal contacts are thereby an entity that is related to the business activities and information system used in this study.

3.3.3 Information system's activity influence

The people involved at a company may use an enterprise system in their business activities and the same goes for the other business actor involved in the exchange. When viewing the enterprise system in this way it is indirectly affecting the business relationship, i.e. it may facilitate or hinder the production and the business exchanges. During the pilot study (Ekman 2004) the interdependencies of activities, as they are presented by Johanson (1989), was developed further to also account for the enterprise system's (or other information system's) role in the business activities. Given this study's approach, when an enterprise system is seen as a central aspect of the business relationship, the possibility to act is considered affected, something that may also have repercussions on the business partner. Given the descriptions in the Kanthal case, some activities may even be transferred to the partner (i.e. some customers handled their own orders) (Ekman 2004 page 75-76).

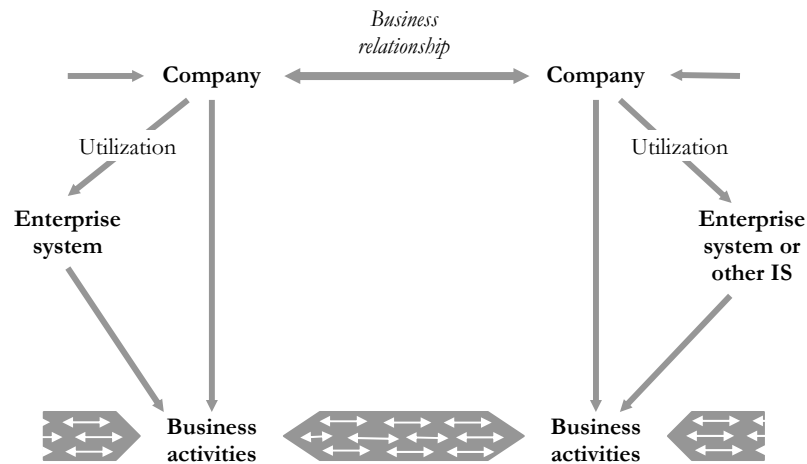


Figure 6 ► The relations between the concepts business relationship, enterprise system utilization, and business activities (inspired by Johanson 1989 page 73 and Ekman 2004 page 121).

The figure above shows some of this study's core concepts. The business relationship is made up of all the exchanges that take place. To be able to carry out these exchanges, the companies perform business activities. To facilitate these activities, the company utilizes their enterprise systems (or other information systems). The activities are thereby an empirically available level that bridges this study's business relationship and enterprise system interest.

3.4 The business relationship setting – networks

The final aspect that needs to be attended when studying business relationships is its context. Even if a business relationship is a dyadic phenomenon, it is surrounded by other business relationships. Each company is embedded in several business relationships through which it lives and acts. All these business relationships are the focal company's portfolio of relationships (Ford *et al.* 2003). The interest for connected business relationships has led to a theory on *business networks* where 'Rather than being concerned with single relationships between companies or the portfolios of relationships of a single company, the network approach suggests that a company and its relationships can only be understood as part of a complex and dynamic network of interconnected relationships' (Ritter & Ford 2004 page 104). Whilst the network approach has gained great interest in trying to understand the dynamics in these interconnected business relationships (Axelsson & Easton 1992, Håkansson & Snehota 1995, Ford *et al.* 2002), the network view can also be applicable on a specific business relationship. This thesis does not aim at capturing the enterprise system in a business network; instead it puts forth the focal business relationship as the analytical level. But when aiming for an understanding of the enterprise system in its setting, the focal business relationship's context must unavoidably be touched upon as it has an impact on the focal relationship (Anderson *et al.* 1994). This means that this study acknowledges that a business relationship is manifested in a business network setting and that it is affected by the surrounding business relationships.

Alajoutsijärvi *et al.* (1999) use the term *focal net* to describe how each business relationship is surrounded by other business relationships. Each company is involved in a number of business relationships and they are able to describe their network up to their network horizon (i.e. the network that the focal company manages to overview) (Thilenius 1997). When viewing a business relationship as a phenomenon best captured in its network of other business relationships, effects caused by this network may be traced on the company, on the business relationship, or on other actors in the network (Håkansson & Snehota 1995). By addressing more than the focal business relationship, the surrounding influencing factors are considered. The focal company's possibility to act is based upon its network position (Forsgren *et al.* 1995) which means that some business relationships should be more beneficial than others. Each business relationship also affects the others, something that can be discussed in terms of *connectedness* (Blankenburg & Johanson 1992). When seeing business relationships as connected, what happens in one business relationship affects what happens in others. In fact, getting invol-

ved in one business relationship may hinder actions in other business relationships (Ford *et al.* 2003). By seeing business relationships as connected entities in a network setting, the characteristics of a focal business relationship can be a result of the surrounding connected business relationships that can be found in the focal net.

3.5 Summary

This chapter has introduced the business relationship perspective by presenting concepts that are later a part of the analytical framework. Given that this study's research object is enterprise systems, there has also been a discussion on how information systems can be seen, and partly integrated, in the business relationship perspective. By now it should be clear that a *business relationship* is based upon the *repeated exchanges* that companies, a customer and a supplier, have with each other. The exchanges can be in the form of products in return for financial means, but they can also be information or social exchanges that are needed to facilitate the business relationship.

All the exchanges that take place affect the involved business partners' *behaviours*. By getting involved in the mutual business activities, the level of *trust* between the business partners may be increased and there will be different degrees of *commitment* to their business relationship. To facilitate the future exchanges the partners also make *adaptations* to the products or to the procedures involved, a form of investment that must be related to that specific business relationship. Some of these investments are general in nature, i.e. they can also be an asset in other business relationships, whilst others are idiosyncratic (i.e. they are only related and useful for a specific business relationship). As time passes, the business partners' behaviours and actions become institutionalized, which leads to a situation where the partners' act as the other business partner expects them to do. The adaptation and the routines that are developed in these dual business activities are also expected to be seen in the utilization of the enterprise system. Depending on how a business relationship has been developed, it leads to a situation where the enterprise system is used (or not).

The products that are exchanged in industrial markets are considered heterogeneous, i.e. they are complex, and this means that a need arises for the seller and buyer to negotiate and communicate each other's possibilities and needs. This is a process that may require several skills which involve different functions (e.g. salesmen, purchasers and engineers), i.e. a complex web of *interpersonal contacts*. The

mentioned aspects, as adaptations and the interpersonal contacts, are indicators of business relationships' complexity; where more developed business relationships may involve more interpersonal contacts and adaptations.

When two business partners are involved in a business relationship characterised by continuous exchanges they become mutually oriented. When the business partners make adaptations for the business relationship, dependencies are developed. In some cases these dependencies are twofold, i.e. both business partners become dependent on each other, a situation described as *interdependencies*. Once again, even these concepts are valid for this study's research object enterprise systems. As well as a company investing in the offered product, in the production, or in the administration of the product, they can also invest in their enterprise system's functionality. When such adaptations are made by both business partners it might lead to a situation where interdependence arises due to that they have developed an information system infrastructure that is made for their specific business relationship.

The involved business partners are also respectively carrying out *business activities* with respect to the other. Business activities can be a rather generic concept and in this thesis the business activities that are carried out within each company are described as *internal activities* and the activities that are carried out between the companies as *exchange activities*. Another way of addressing the activities that the companies studied carry out is as activity structures (within a company), activity links (between two companies) and activity patterns (within a network of companies). Information systems, as enterprise systems, have an impact on these activities as an information system can facilitate the user that performs the activities. The activities carried out for, and in, a business relationship are thereby an entity that is related to the utilization of the company's enterprise system.

Finally, the focal business relationship does not exist in vacuum. Instead, it is embedded in a *business network*. The focal business relationship's adjacent business relationships can be described as its *focal net*. By accepting that each business relationship exists in a network of relationships, the effects of other connected business relationships can be discussed as a form of *connectedness*.

THE ANALYTICAL FRAMEWORK

THIS CHAPTER SYNTHESIZES THE information systems (IS) and business relationship theories that have been presented and discussed in the previous chapters. Basically, enterprise systems are seen as important business entities that companies utilize to support their business. The use of these enterprise systems is enacted, i.e. they are used for a purpose that seems significant for the user at that time. This means that the utilization is based upon the users' situation: if the enterprise system fits with the business activities, if it supports the ongoing exchanges, if the functions are considered useful, and so forth. Due to this study's dual belonging (IS and business), the applied theories are combined to support the understanding of the enterprise system's utilization in a business relationship setting. The web of computing (Kling & Scacchi 1982) is used as a base when scrutinizing the business relationship and IS theories leading to an analytical framework that is inspired (not in content but in structure) by the work by Walsham (1993, 1995, 2001). The framework lifts both business relationship and enterprise system aspects. It also considers contextual aspects in the wider setting. The business activities that the people involved carry out are regarded as a bridging entity between the business relationship and enterprise system interest.

*Technology is
social, dynamic,
and multiple*

4.1 Combining IS and business relationship perspectives

As has been argued in the previous chapters, the research object enterprise system needs an approach that can handle its complex and widespread use and the effects that follow. The ensemble view of technology (Orlikowski & Iacono 2001), as it is represented by the web of computing (Kling & Scacchi 1982), has been introduced as a way to approach this phenomenon. The web of computing has its starting point within an organization, whilst theories on business relationships focus on the exchanges that take place between organizations (Ford 1980, Håkansson 1982, Johanson & Mattsson 1987). To understand the effects of enterprise systems, the approach needs to consider both intra- and interorganizational aspects simultaneously (Esbjerg 1999, Birkinshaw & Hagström 2000). This was achieved in the pilot study (Ekman 2004) by applying the two perspectives in parallel. The intraorganizational perspective, offered by the IS theories, was described as: ‘Companies have *enterprise systems* to support the production and the business processes. The enterprise system supports [the company’s] people in the *activities* they perform to be able to have *exchanges* with others [companies]’. This was combined with an interorganizational perspective supported by the business relationship approach, where the business relationship was illustrated by declaring that: ‘Companies have *business relationships* with each other which include interaction that in its smallest parts is made up of different sorts of *exchanges*’. (Ekman 2004 page 42, translated) These declarations are also well in line with this second part of the study.

When trying to grasp the use of enterprise systems in a business relationship setting the approach must address the analytical levels of business relationships (involving several companies), organizations (companies), and people (as information system users). Whilst the applied theories were put side-by-side in the pilot study (Ekman 2004 page 47) they are combined into a analytical framework in this thesis. To achieve a framework that allows this combination of theories, some concepts need to be linked. By following an ensemble view of the technology approach, and see *people’s business activities and information system use* as taking place simultaneously, the business relationship and IS perspective is combined. The business activities that take place are thereby the integrating entity. This is further elaborated when putting together the analytical framework later in this chapter.

4.1.1 Comparing the perspectives

When recapturing Kling & Scacchi’s (1982) structural components of computing in parallel with the business relationship perspective presented we find both simi-

larities and differences. Seen from a business relationship perspective the first structural concept of computing, *the line of work*, which basically means ‘what people actually do in a job’ (Lamb & Kling 2003 page 72), can be interpreted as more or less related to the business activities that the employees carry out. Here, both the organizational structure (cf. Markus 1984, Orlikowski 1993, Walsham 1993) and the interorganizational interaction (Lamb & Kling 2003) affect how the enterprise system is used. The line of work can thereby be seen as the business activities performed both within and outside the focal company.

The *going concern* (Kling & Scacchi 1982) holds the situation’s momentum. To gain an understanding of the prevailing situation, both organizational and technological factors need to be considered, but there may also be aspects that originate from the focal company’s business situation. The going concerns can therefore be seen as a contextual factor and given the interest in business relationships we might also include the business relationship’s history as well as its anticipated future (Ford 1980, Dwyer *et al.* 1987, Ford *et al.* 2003).

The third structural concept of computing is the *infrastructure* (Kling & Scacchi 1982) which, from a business relationship perspective, can be seen as the resources that support the ongoing exchanges. The infrastructure is both the technical and the organizational arrangements (Kling & Lamb 2000) that set the boundaries for how the business partners can act within a business relationship. When recapturing the business relationship perspective, we also find infrastructural components described as technology, structure and strategy (Håkansson 1982, Campbell 1985) as illustrated in figure 4. Both information system and other resources must thereby be accounted for when studying how the business partners carry out their business. As an example, the integration of two business partners’ enterprise systems with EDI may be a part of the existing infrastructure and also a result of the business relationship. The infrastructural element thereby involves both IS and business relationship aspects. But the exchanges do not only have to be handled by the enterprise system (cf. Ekman 2004 page 75-76), they can also be supported by other technologies, a fact that needs to be considered if the company wants to manage their interaction channels:

[M]ost companies are confronted with an increasingly sophisticated customer base that demands a higher level of immediate service across multiple access channels. To satisfy customer needs, companies have to maintain consistency across all interaction channels (such as the Internet, email, telephone, Web, fax,

and so on) and across all areas of a company a customer interacts with (including sales, service, marketing, and other fields).

Pan & Lee (2003 page 95)

All the information systems that are used, and their potential need for mutual adjustments and operations, are thereby seen as a part of the infrastructure that supports the exchanges between two business partners. As are other technologies as well as the organizational arrangements.

The *production lattice* (Kling & Scacchi 1982) describes the division of labour and with this study's interest this can also be seen within the performed business activities and manifested in the interpersonal contact patterns. Following the reasoning that the exchanged resources between the focal company and its business partners are heterogeneous (Alderson 1965, Penrose 1995), the interpersonal contacts around the internal activities and the exchange activities need to be coordinated within and between organizational boundaries. Another way to address the production lattice is as the 'production chain' (Kling & Scacchi 1982), i.e. how the business activities are carried out (and how the enterprise system is used in that context).

Kling & Scacchi (1982) label the last structural concept of computing the *macro-structure* which 'denotes the set of union of broader organizational arrangements, and extraorganizational arrangements which influence the production lattice' (Ibid. page 79). With a business relationship perspective this concept would be addressed in another way. Each organization's surroundings, which can be addressed as its macrostructure or environment, differ depending on the products and technologies that the focal companies produce and utilize. As an example, the Swedish electricity producer Vattenfall's (cf. Wedin 2001) industrial setting differs from the one of the office furniture producer Edsbyn (cf. Baraldi 2003) or that companies within the wood- and building industry (cf. Melin 2002, Bengtsson 2003) are active in. Within systems theory the entities that lie outside the system's boundary is called the 'environment'. The environment is fixed and it cannot be affected by the system, but the environment affects the system (Churchman 1968). Another way to describe it is as: 'the environment can exert a degree of control over the system but cannot be controlled by the system' (Skyttner 2001 page 59). The business relationship perspective describes its environment differently. As mentioned in chapter 3, one way of viewing a focal company is to incorporate its *business network* (Håkansson & Snehota 1995), another is to consider its *focal net* (Alajoutsijärvi *et al.* 1999), i.e. a selection of business relationships that are

related to a focal one. When studying the focal business relationship it will also be influenced by other *connected* relationships (Blankenburg & Johanson 1992). No matter the perspective, the macrostructure can be seen as an element that the focal company has limited control over; it is somewhat an exogenous factor that affects the company, its business relationship, and the enterprise system utilization. In this thesis, the concept macrostructure is seen as a part of the general setting holding both inertia and possibilities.

4.1.2 What is business relationship or enterprise system specific and what are contextual aspects?

Having discussed the ensemble view of the technology perspective (Orlikowski & Iacono 2001) as it is presented by Kling & Scacchi (1982), and compared it with the business relationship theories presented in chapter 3, it is time to put the concepts together into an analytical framework. By now, the labelling of Kling & Scacchi's (1982) five structural concepts of computing are abandoned. This is done though the analytical framework application is focused on capturing the enterprise system's utilization with an emphasis on business relationships, not on a single organization.

The construction of the framework is inspired by the metaphor 'scaffold' that Walsham (1995) uses when discussing the applications of theories in case studies. Theories can be used in case studies to expand, modify, validate or abandon a theoretical base. Both the strength *and* weakness with such an approach is that a house that is constructed with scaffolds will not expand beyond the scaffolds. This means that when research follows a given theoretical perspective the results will be close, but at the same time delimited, to the applied theoretical base. (Ibid.) Whilst traditional theories would support findings regarding the enterprise systems possibility to reduce operating costs, optimise supply chains, segment customers, reengineer the business processes, and so forth (cf. Oliver & Romm 1999, Davenport 2000, Sandoe *et al.* 2001, Sumner 2005) this analytical framework is supposed to offer a better understanding of the enterprise system's role in a focal company's business relationships.

4.2 The analytical framework

The applied analytical framework is based upon three 'components' reflecting aspects that have been presented so far. The first of the components focuses on the business relationship at hand, the second concept the utilization of the enterprise system, and the last is a general concept. The analytical framework's compo-

nents are labelled: (i) the business relationship characteristics, (ii) the enterprise system utilization and (iii) the contextual aspects. As shown in the following figure, these concepts are bridged with the business activities as a unifying entity.

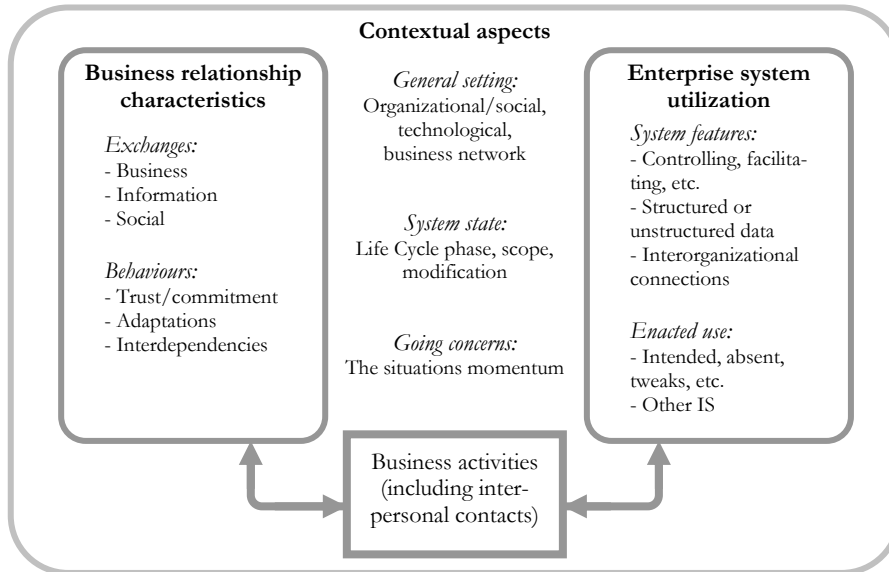


Figure 7 ► The analytical framework's components

The following text presents each component's inherent conceptual elements, their origin and their functioning in this study. The analytical framework is created to consider the web of computing components (Kling & Scacchi 1982), the described characteristics of the research object enterprise systems (cf. Davenport 1998, O'Leary 2000, Shanks *et al.* 2003), and the dynamics of business relationships (cf. Håkansson 1982, Johanson 1989, Ford 1990).

4.2.1 Business relationship characteristics

The first analytical component is labelled the *business relationship characteristics* which is supposed to capture aspects of a business relationship that can signal its perceived importance and complexity (cf. Håkansson & Walsuzzewski 2002, Hadjikhani & Thilenius 2005). The fundamentals of this study's business relationship perspective were presented in chapter 3 and two fundamental aspects of a business relationship, described as exchange and behaviours, are put forth as conceptual elements that depict the business relationship characteristics. The first element *exchange* can be *business exchanges* but also *information exchanges* or *social exchanges* (Håkansson 1982, Johanson 1989, Hadjikhani & Thilenius 2005). The second ele-

ment is described as the *behaviours* that signify the business relationship. The business interaction between two companies is the fundament for a business relationship and the exchanges are its smallest entity (Håkansson 1982). But to carry out these exchanges, the business partners have to *trust* each other and they also need to be *committed* to the business relationship (Anderson & Narus 1990, Anderson & Weitz 1992, Morgan & Hunt 1994). As the exchanges take place, the business relationship will involve *adaptations* that facilitate these exchanges (Håkansson & Snehota 1995, Brennan *et al.* 2003). Through time, the business partners also get to know each other's preferences, which may lead to institutionalized behaviour and routines (Håkansson 1982), and when the business partners have made adaptations and when behaviours have been institutionalized it will demand an effort to take one's business elsewhere, something that means that a *interdependency* has been developed. As well as the exchanges being a part of the business relationship characteristics, so will be the involved behaviours.

By approaching the business relationship with the conceptual elements exchanges and behaviours, issues that transcend the product and money exchanges can be found. All the ongoing exchanges will involve periods of both cooperation and conflicts and, through this process, the business partners are tied to each other, which is why the business relationship also can lead to interdependency. The business relationship characteristics are based upon the logic that a business relationship is best understood as a dyadic phenomenon, i.e. it is something that must consider *both* business partners (a buyer and a seller). This also affects the empirical setting; to capture the business relationship characteristics, both of the involved companies need to be examined.

4.2.2 Enterprise system utilization

The second framework component is the *enterprise system utilization* that is supposed to capture the aggregated use of the focal company's enterprise system. The first conceptual element of this framework component is *system features* which is an 'open' concept related to the enterprise system's functionality. On an analytical level, the enterprise system can be described as having e.g. *controlling, facilitating, automating, informing, representing, and enabling* properties (Markus 1984, Zuboff 1988, Hammer & Champier 1993, Baraldi & Waluszewski 2005). As an example, the enterprise system can facilitate the utilization of a resource (e.g. support the production) but it can also represent the process (e.g. monitoring the ongoing exchanges with the business partners), impose control of a group of people, or automate the exchange between two partners. The system features also include

which type of data that are handled – given the experiences from the pilot study (Ekman 2004) the enterprise system was used for the activities that involved *structured data* and other information systems were used for handling *unstructured data*. The system features also involve the *interorganizational connections* that are available in, and maybe even a result of, a business relationship. Depending on how the interorganizational connections are arranged, if any, their role in a business relationship is interesting.

The other conceptual element is described as *enacted use* which refers to how the enterprise system is used on an individual level. On a conceptual level, enacted use involves time, context, and technology specific aspects, i.e. it incorporates the situation when and where the use takes place (Orlikowski & Iacono 2000). The framework component enacted use involves whether the enterprise system is used as it supposed to (i.e. *intended use*) or not (i.e. *tweaks*, augmented or even the *absence* of use). If the enterprise system is experienced as insufficient, if the organization has preferred to use other information system for some activities, or if the user has other preferences, *other information systems* (e.g. add-ons and office applications) may be used. These other information systems may be integrated with, used in parallel with, or used instead of the enterprise system. (Markus 1984, Davenport 2000, Askenäs 2004, Boudreau & Robey 2005). If the users do not get the support they need by the enterprise system, they may also use office applications such as MS Excel and email to be able to carry out their business activities, something that could be seen in the Kanthal case (Ekman 2004 page 77-98).

4.2.3 Contextual aspects

The third framework component is the *contextual aspects*, i.e. elements that have an effect on the business relationship studied and the enterprise system but are a part of the wider setting. The first conceptual element is described as the *general setting*. The web of computing that has been a foundation for the applied IS perspective involves the ‘infrastructure’ and the ‘macrostructure’ (Kling & Scacchi 1982). These concepts are described as holding both social and technical dimensions within and beyond the focal company (Kling & Lamb 2000). The business relationship perspective also acknowledges such environmental factors that affect how two companies can interact (Håkansson 1982, Campbell 1985), and later studies have even addressed the influence of the surrounding network (Axelsson & Easton 1992, Håkansson & Snehota 1995, Ford *et al.* 2002). To capture the prevailing situation that sets the boundaries for how the ongoing exchanges can take place, issues of the involved companies’ *technology*, their *organizational* (and societal)

setting, as well as the surrounding *business network* need to be considered. The later aspect can be discussed in terms of the *focal net* (Alajoutsijärvi *et al.* 1999) and *connected* relationships (Blankenburg & Johanson 1992). All the presented elements are aspects that are based upon the involved companies' present situation but they are not directed to a specific business relationship.

The second conceptual element that is a contextual one is the *system state*, i.e. the enterprise system's prevailing *life cycle phase* (Markus *et al.* 2000a), its *scope* (Markus *et al.* 2000c), and the *modifications* made to it (Ekman & Thilenius 2005). These are aspects that cannot be related to a specific business relationship and it is, hence, considered a contextual element. As described in chapter 2, enterprise systems are supposed to have reached a higher degree of use in the later phases. The scope, that indicates how many modules and functions have been implemented, also gives a hint about the enterprise system's impact. Finally, the modifications that have been made to the enterprise system can give a hint on whether it follows the preferred activity structures or if it has changed the users' procedures.

Finally, to be able to understand the business relationship and the enterprise system utilization requires an understanding of the momentum that is embedded in the setting studied. Inspired by Kling & Scacchi (1982), this can be achieved by capturing the *going concerns*, which involves both the state that the focal business relationships are in and the enterprise systems' potential development. It is thereby a concept that signals the future as well as the past. The going concern is therefore a contextual factor that can be expected to affect the utilization of the focal enterprise system and the business relationship.

4.2.4 The empirical capturing

By now the three framework components of business relationship characteristics, enterprise system utilization and conceptual aspects with their inherent elements have been presented. A bridging entity between the business relationship and enterprise system concepts are the *business activities* that are carried out. As has been presented, the business activities that are carried out can be internal activities (i.e. the transformation of resources which finally leads to a product) or exchange activities that can be related to a specific business relationship (Dubois 1998). The activities that are carried out will need some intervention by the focal company's employees, i.e. the activities involve people. As a product of the business activities these people are involved in, there will be a more or less complex pattern of *interpersonal contacts* in the business relationship. The unifying, and also empirically observable, entity is, hence, the involved people that carry out different forms of

activities. This approach to capturing this study's research object and its business setting will be further discussed in chapter 5.

4.2.5 The interrelations in the framework

By now, the theories and the resulting analytical framework used have been presented. The analytical framework is created to guide the data gathering and analysis to include both the enterprise system and the business relationships. The conceptual elements presented are the researcher's, but they are based upon the theoretical concepts that have been collected from both the IS discipline (with an emphasis on enterprise systems and approached with an ensemble view of technology) and from business relationship theories. The analytical framework is based upon the three framework components that have been presented in this chapter. By considering the framework components and their elements, both the business relationships and the enterprise systems' utilization can be captured in their context. The concepts must also be applied to a real life setting, which thereby means that some aspects are related to a focal company whilst other can be applied to the business relationships.

All the three framework components are interrelated. This means e.g. that the enterprise systems' element 'system features' can be a result of the adaptation in a business relationship. It may also be an element that is connected to the going concerns, i.e. the history or the anticipated future have resulted in a specific feature. The elements presented are thereby not seen as clearly separate variables but instead as interrelated concepts that highlight the enterprise system utilization in business relationships. The framework components and the conceptual elements are also used to different degrees depending on if they are applicable to each specific business relationship.

METHODOLOGICAL APPROACH

THE TWO CASE STUDIES PRESENTED IN this thesis are the second part of a research effort that investigates the utilization of enterprise systems, and its impact on business relationships. The research questions and the applied theories have affected the methodological approach. A *pilot study* presented in Ekman (2004) resulted in lessons on how enterprise systems should be studied from a business relationship perspective. The pilot study had the focal company's point of view, investigating how a company utilized their enterprise system in their business relationship with customers. The knowledge that the pilot study gave has then been refined and applied in two new case studies. This chapter discusses how the result from the pilot study (Ekman 2004) has been used, how the new case studies have been shaped, and how the three case studies are parts of a unified research effort. It also addresses the applied data collection techniques as well as how the empirical material has been handled and analysed. The chapter also contains a discussion regarding ethics and the research quality.

*A contemporary
phenomenon
within its real-
life context*

5.1 Approaching a contemporary and complex phenomenon

The introduction and the theoretical chapters have presented theories that aim at understanding two contemporary aspects of business – enterprise systems and business relationships. Both the research object enterprise systems and business relationship has been described as a dynamic and complex phenomenon and this is something the methodological approach has to consider:

In B2B environments both current and future technology – including design, engineering, manufacturing, purchasing, installation, maintenance, repair, systems, software and the surrounding services – is the soil in which corporations grow and flourish. [...] B2B firms live with complexity, ambiguity, chaos, uncertainty, fuzzy boundaries and continuous change in both technology and the marketplace. Research methodologies have to adapt to this reality.

Gummesson (2003 page 483)

When approaching a research theme which has not been studied that much (at least with an IS perspective), one approach could be to let the empirical data ‘speak freely’ by approaching it according to ‘grounded theory’ (Glaser & Strauss 1967, Strauss & Corbin 1990). With such an approach, the data would be collected and categorized through an analytical coding procedure leading to related concepts. Another approach would have been to use theories from the IS and business relationship area and create questionnaires that could signal a population’s use and non-use of enterprise systems in business relationships through multivariate analysis, i.e. see how different variables are related to each other (Bryman & Cramer 2001).

None of the approaches described have, though, been selected. Instead, the case study methodology’s closeness to the empirical setting in parallel with that it allows a support of theories has been considered valuable. The complexity of the research problem, illustrated by Gummesson (2003), has been approached with case studies though it is a methodology that encourages an iterative research process (Eisenhardt 1989, Cavaye 1996, Yin 2003). This study has thereby followed a traditional case study approach (cf. Dyer & Wilkins 1991, Yin 2003) where multiple case studies have been carried out (Eisenhardt 1989, Gable 1994). Case studies are appropriate in studies that aim at capturing a phenomenon that is theoretically novel (Ghauri & Grønhaug 2002) and it emphasises qualitative methods of analysis that allow the incorporation of the context (Gable 1994). An often quoted description of case studies is as an empirical enquiry that: ‘Investigates a contem-

porary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clear evident' (Yin 2003 page 13). There are also some types of questions, *how* and *why*, that are suitable for case studies. Further, it is also a method for situations where the researcher cannot gain control of the research setting. (Yin 2003)

5.2 Case studies

Case studies are no methodological monolith (Cavaye 1996) but rather a quite eclectic research description. For this study, case studies have been considered appropriate as they allow multiple data collection methods (Yin 2003), something that used to be described as 'triangulation'. Case studies also allow the researcher to get familiar with the empirical phenomena, for which a certain set of theories applies, and thereby it also lifts the context where the phenomena take place as 'it enables the capture of 'reality' in greater detail' (Galliers 1991 page 334). Case studies may be supported by theories (Walsham 1995, Dobson 2001) which make it a methodology suitable for theory tryouts and theory expansion. It is also a method that allows generalization to theoretical propositions, whether it may be concepts, frameworks, propositions, and novel or midrange theory, and these are also probably empirically valid. Besides this, the created theory is also easily testable and it is also suitable for the creation of hypotheses. (Eisenhardt 1989)

Case studies are considered a well-known methodological approach with a stable base of supporters that have an accepted role in the IS community. Within the IS discipline, seen from an international perspective, case studies are much less represented than more quantitative methods such as surveys and experiments (Chen & Hirschheim 2004), but following a European and Scandinavian perspective it is a common approach (Avgerou *et al.* 1999). On its downside, case studies create somewhat complex theories due to their closeness to the empirical material (Eisenhardt 1989). There are also critics raised upon their value regarding academic and scientific work – case studies often involve some degree of interpretation, which goes against what is considered traditional science (Galliers 1991). This aspect is explicitly attended to in this study and how the procedure that this study followed will be discussed in a separate section where the empirical presentation and analysis are presented (see section 5.3.5).

To summarize the discussion, case studies have their upsides through the empirical closeness (Galliers 1991, Yin 2003) but their weakness is their shortcoming when it comes to generalizing the results to a population. It is, in other words, not

possible to address a statistical significance for the results. Merriam (1988) mentions that the traditional quality measures from quantitative research is hard to apply on more 'interpretative' studies. But through the use of *a priori* theories, the results can be related to prevailing theories and concepts (Galliers 1991, Walsham 1995, Dobson 2001). By studying a phenomenon that concerns both the IS discipline and the industrial marketing area, supported by an analytical framework that is created by concepts from both areas, the results can be considered 'propositions' or 'conceptual frameworks' (Eisenhardt 1989) that can be used to enhance the existing theories. Based upon that the phenomena of interest (enterprise system and business relationships) are contemporary problems, consisting of several unknown variables, the methodology and knowledge-creation logic of case studies has been used (cf. Yin 2003).

5.3 The research design

The case studies have been carried out in two steps. The first one, the pilot study (Ekman 2004), was carried out as a tentative effort to test the theories and to get empirical input. Case studies, which used to be categorized as qualitative studies, are appropriate when the researcher tries to 'understand' a phenomenon (Gable 1994, Eriksson & Wiedersheim-Paul 2002) and by carrying out a pilot study followed by two more case studies, both the applied perspectives and the results could be refined (Gable 1994).

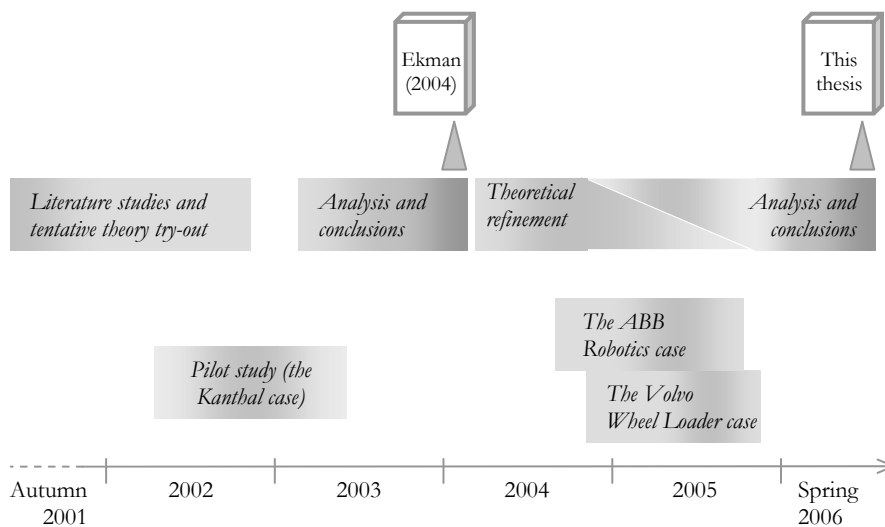


Figure 8 ► The research process

The figure above illustrates the research process. The first part, the ‘Kanthal case’ presented in a licentiate thesis (Ekman 2004) was performed as a traditional case study. The results worked as an input to the continued theoretical work as well as an indicator on what to search for in the continued empirical work, something that is encouraging in case studies – striving for a ‘frequent overlap of data analysis with data collection’ (Eisenhardt 1989 page 538). Some of the theories that were used in the pilot study were abandoned in the following second and third case studies and others were further developed. Parts of the research results were also presented at international conferences (Ekman & Révay 2004, Ekman & Thilenius 2005, Ekman *et al.* 2006) which resulted in useful feedback. The theories have thereby been refined in parallel with that the empirical data and the data collection methods, as well as the analysis, have been continuously evaluated and developed.

5.3.1 Case selection

The selection of the three cases had different purposes. While the selection of the pilot study (Ekman 2004) was one of convenience, the two following cases were selected on specified premises. As all *Fortune 500* companies were described as having, or implementing, enterprise systems (Seddon *et al.* 2003) the first criterion was given. By carrying out the case studies at companies within *Fortune 500* company groups the selection became a ‘probability sample’, i.e. the cases were supposed to display the research problem (Bryman 2002, Saunders *et al.* 2003). The second criterion was that it should be industrial companies involved in business with each other, i.e. a business-to-business setting. This means that the setting was a replica of the settings that the theories on business relationships presented (Ford 1980, Håkansson 1982, Johanson 1989), a strategy that makes theory extension possible (Eisenhardt 1989). The third criterion was that the cases should be accessible, which means that proximity and availability were considered. The selection of the two focal companies (ABB Robotics and Volvo Wheel Loaders) was a result of initial contacts at company group level, and both companies fulfilled the criterions. The two cases were not selected in an attempt to make a comparative analysis but to get a richer description of the phenomenon. Yin (2003) discusses the differences between single and multiple case studies and declares:

To begin with, even with two cases, you have the possibility of direct replication. Analytical conclusions independently arising from two cases, as with two experiments, will be more powerful than those coming from a single case (or single experiment) alone. Second, the contexts of the two cases are likely to

differ to some extent. If under these varied circumstances you still can arrive at common conclusions from both cases, they will have immeasurably expanded the external generalizability of your findings, again compared to those from a single case alone.

Yin (2003 page 53)

Eisenhardt (1989) holds 4-10 case studies as a suitable number; with fewer it is difficult to generate not too complex theories and with more cases it becomes hard to cope with the volume of data. She also mentions that the number of cases can also depend on how many 'within cases' there are. This thesis's case studies are only based upon two focal companies, but through these two case studies 10 business relationships, i.e. 10 within cases (cf. Yin 2003), are available for analysis and theorizing. Thereby, the empirical data is considered enough for fulfilling this thesis's purpose while, at the same time, it has been manageable and defensible according to the resources available to the researcher.

5.3.2 The empirical setting

During the pilot study the data collection was only carried out *within* a focal company, Kanthal AB, which had its downside as it did not offer any insight into the customers and suppliers perspectives (Ekman 2004 page 132). The two following case studies that are presented in this thesis were therefore carried out from a focal company's viewpoint (i.e. where the enterprise system is found) but the study also considered the customer's and supplier's perspective, see the figure below.

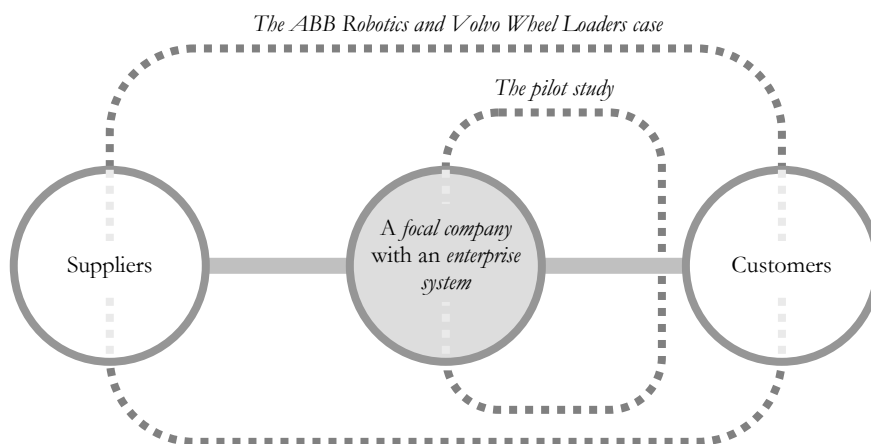


Figure 9 ► The case studies setting

By expanding the empirical setting, the dyadic nature of business relationships could be better understood and captured. By following each businesses relationship (i.e. focal company-customer and supplier-focal company), a quite large number of within cases were captured. The expanded setting also came with a price; whilst the pilot study involved interviews with 13 people, the following two cases involved interviews with 81 people (see appendix C).

The capturing of an enterprise system needs to take its starting point within a focal company as an enterprise system is usually manifested within an organization. To start with a focal company is the most common approach to capture business relationships (Halinen & Törnroos 1998) and it is also the approach that was used in the pilot study (Ekman 2004). It also worth mentioning that when starting with a focal company some elements in the analytical framework (figure 7) will be more related to the focal company, whilst others will be found in the studied business relationships that the focal company has with its customers and suppliers. As illustrated in the figure, the focal company and its enterprise system were covered more completely than the customers' and suppliers' information systems. The empirical chapter therefore offers a more thorough depiction of the focal company's enterprise system, but the analytical focus is on the 'enterprise systems boundary' based upon the lessons learned in the pilot study (Ekman 2004 page 128). The setting also allowed connected effects to be found (Blankenburg & Johanson 1992), i.e. how one business relationship affects another. When studying the customers and suppliers, the focus was the business activities that could be considered the basis for their business relationship with the focal company. Practically, these business activities were captured by asking questions that revealed what was done, how it was done, and why.

Inspired by Ford *et al.*'s (2003) description of different types of customers and suppliers, the respondents at ABB Robotics and Volvo Wheel Loaders were asked for different customers and suppliers (i.e. 'large', 'small', 'important', and so forth) that would illustrate the business relationships they have. The request was quite open, meaning that the respondents could select those business partners they thought were suitable. The international aspects have, though, been forsaken as the respondents were told that it was an advantage if the supplier could be visited (something that resulted in that nine of ten partner companies were Swedish companies). The initial inquiry for partner companies resulted in customers and suppliers of different characteristics (see chapter 6 and 7). One might think that the respondents would have selected well functioning business relationships, but

the interviews have revealed both positive and negative aspects of the business exchanges, which has been interpreted as a sign that they are representative.

5.3.2.1 Dealing with the temporal aspect

Both enterprise systems and business relationships are dynamic entities (i.e. ‘moving targets’) where the enterprise system’s use is emergent (Markus *et al.* 2000a, Orlikowski & Iacono 2000) and the business relationship develops through the repeated exchanges. The exchanges between a buyer and a seller also involve adaptations and institutionalized routines (Håkansson 1982, Johanson & Mattsson 1987), and to depict the utilization of enterprise systems in these business relationships means that the temporal aspect needs to be considered. This study does not involve a traditional longitudinal approach that captures the implementation of an enterprise system or the stages of a business relationship (cf. Ford 1980, Dwyer *et al.* 1987). The scenarios studied are instead ‘time slices’ where the time bracketing has been based upon the respondents’ descriptions of a business episode as a way to depict the prevailing business situation. Beside this, the respondents’ views on their history and anticipated future are incorporated to give a view of the going concerns (Kling & Scacchi 1982).

5.3.2.2 A focal product as a guide for empirical consistency

The foundation for the business relationship is the exchange of resources that can be physical or intangible such as: products, knowledge, innovativeness, the business relationship *per se*, and so forth (Håkansson & Snehota 1995, Dubois 1998). A common approach to capture the activities that surround these heterogeneous resources is to follow *a focal product* (Wedin 2001, Baraldi 2003) or a specific form of service (Gidhagen 2002). To follow a focal product, an ‘individual resource’, or a ‘focal resource’ is an approach to capture the dynamics of a business relationship and the resource handling problem (Wedin 2001, Baraldi 2003, Bengtsson 2003). The nature of the product and its handling has a direct impact on how the enterprise system must form its product structures; this also means that the product’s characteristics need to be captured. This study thereby follows a focal product, which in this thesis is synonymous with ‘an example product’ that works as a beacon to achieve an empirically consistent description of the studied actors’ business activities and ongoing exchanges. The aim is, though, not to scrutinize the resource-handling problem, but to relate the enterprise system utilization to the product’s characteristics and the business activities needed for the production and exchange of that product.

5.3.3 The theoretical support

When addressing two phenomena that transcend two disciplinary different areas the theories applied need to be combined. The theories selected have supported the data gathering and analysis, something that has lead to new insights that are related to the applied theories. Another way of describing this approach is as ‘theories is both a way of seeing and a way of not-seeing’ (Walsham 1993 page 6), i.e. theories make us sensitive to a certain perspective but it comes with the price of missing others (Walsham 1995). This thesis is, thereby, not aiming at giving a total explanation of enterprise systems’ utilization, but to bring forth aspects that can be related to the studied companies’ business relationships. Dobson (2001 page 286) describes this approach a ‘multiple theory’ and adds that such an approach means that there is no ‘best theory, only different ways of seeing the world’. As stated in the introduction (chapter 1), this research effort is based upon an interest in offering an alternative perspective to the organization/strategy theories. But how does the combination of different theoretical and disciplinary bases affect the study’s results? With the basic assumption that the use of enterprise systems is never a central issue for the individuals that constitute the business (Lamb & Kling 2003), there is an advantage to including a perspective on both information systems’ use and business relationships to fully grasp the phenomena studied. As declared by Orlikowski & Barley (2001 page 149) ‘Technology can be used in multiple ways, user shape the implications of technologies as they integrate them into everyday practice’. This means that the theoretical perspective must support an understanding of the enterprise system’s use, but it must also be able to methodologically support the study of aspects that constitute the business relationships that the individual, as a company representative (cf. Halinen & Törnroos 1998), is involved in.

When evaluating the applied theories, they suit the case study methodology. The web of computing presented by Kling & Scacchi (1982) is described as a specific effort within the IS tradition of case studies (Lee 2002) and it is an approach that is considered a minor research stream, described as a ensemble view of technology, that needs more supporters (Orlikowski & Iacono 2001). Even Walsham (1993) has both theoretical and methodological (epistemological) elements which follow this tradition and the analytical framework is inspired by his theoretical framework. The business relationship perspective is also a theoretical base that has proven its usefulness in several case studies (cf. Melin 2002, Baraldi 2003, Bengtsson 2003).

The theories have also enriched and corresponded to each other. The tradeoffs are the compromises regarding the concepts used; sometimes similar concepts have different denominations and sometimes the same denomination has different meanings. There is also a difference between the analytical levels. Whilst IS theories are ‘closer to the technological object of interest’ (Orlikowski & Barley 2001 page 151) and hence consider the individuals use (i.e. promoting a analytical level where the individual is distinguished), the business relationship theories are more focused on the companies or even the wider business network (i.e. the analytical level addressing interorganizational exchange or the dynamics of a group of organizations). To deal with this analytical difference, both the business relationship and the information system utilization have been seen as entities manifested in people’s everyday activities. The enterprise system utilization is seen as the aggregated use of the enterprise system and the business relationship is considered to be made up of all the business exchanges (i.e. also an ‘aggregate’) that are a result of the involved companies’ business activities. To sum it up, even if a theory combination as has been done in this thesis involves difficulties, it has been considered manageable and rewarding.

5.3.4 Data collection methods

As has been mentioned, the case study methodology encourages multiple data collection methods, something that used to be described as *triangulation*. Following Burgess’ (1984 page 145) description of triangulation, this study has applied: (i) *data triangulation*, i.e. it has used multiple data sources such as face-to-face meetings, observing technical artefacts, printed papers, CD-ROMs, on line material, and so forth, (ii) *method triangulation* through semi-structured interviews, non-participant observations, and respondent participating sketching, and (iii) *theory triangulation*, which means that the research phenomena have been studied with support from more than one theory (i.e. IS and business relationship theories). The following sections will address the applied data collection techniques.

5.3.4.1 Interviews

Interviews are one of the most used data collection techniques in case studies (Merriam 1988, Walsham 1995, Yin 2003) and it is a flexible technique (Bryman 2002) where the individual’s experiences, and their descriptions of contextual rich data, can be captured (McGivern 2003). Before each interview, the respondent got some *a priori* information via telephone or email. The interviews were semi-structured, i.e. the respondents were informed that they going to be interviewed about their duties and their information systems use. The approach means that

there were issues discussed, and data collected, that is not written in the empirical chapters but that gave a sense of the context.

The interviews contain both ‘informant’ and ‘respondent’ interviews where the first means such people that have knowledge about a situation and the second a person that is directly involved in what is studied (Holme & Solvang 1996). As an example, the interview with an IT manager could involve the description of the enterprise system modules that were available and give a clue about the use, a picture that was confirmed or revised by the interviews with the actual users. The respondents were selected based upon the prior respondent’s recommendation, i.e. new respondents made it possible to follow ‘the chain of business activities and enterprise system use’. Sometimes the recommended respondent was occupied, but then he or she often asked somebody else to ‘jump in’ so the interview could be performed anyway. There were also times when the respondent brought a colleague. This was usually the case when they were new on the job or if they needed others to discuss the enterprise system’s technology and so forth.

To support the data collection an *interview protocol* (see appendix B) was used. The protocol was created for the pilot study (Ekman 2004) and revised at the beginning of the following two cases. As seen in the protocol, some of the concepts did not make it to the theoretical framework. The protocol was thereby used more as a notebook than as a form that had to be completely filled in. During the interviews, the interview protocol was used as a memorandum to highlight all the aspects that needed to be asked for. Initially the interviews were also recorded on an mp3-player, which allowed re-listening and transcription, but when data saturation seemed to be reached, complementary interviews were only written down in the protocol. There were also occasions when the interview could not be recorded due to the situation, such as when it took place in office landscapes or when the interviews were performed over the telephone.

It is also worth commenting on the interview situations. Merriam (1988) recommends that the researcher shall have a tone that is non-valuing, sensitive and respectful towards the respondent. What is not mentioned is that the interview also may be a demanding situation for the researcher. To deal with the situation, many interviews started with coffee. After a short but casual discussion, the interviews and observations were usually carried out in a stress-free manner. To make the respondent at ease, they were given the possibility of withdrawing or changing their statements after the interview. The data collection for this study has, there-

fore, been carried out without compromising the respondents' integrity as far as possible.

5.3.4.2 Sketches

During the case studies several sketches, inspired by what used to be referred to as *rich pictures* (Checkland & Holwell 1998, Checkland 1999), have been drawn. Rich pictures is a form of diagram or sketch that shows interfaces, boundaries, subsystems, resources, organizational structure, roles of personnel, organizational goals, problems and possibilities, and so forth. Basically, it is a technique that captures an empirical situation, often by the examination of elements of structure and process, but also the situation's climate. This study also follows a real life situation that is complex and that may involve aspects that are hard to retrieve through formal descriptions. The ideas from rich pictures have therefore been used in both the pilot study and this study, primarily to capture individuals, their activities, and their information system use. During the pilot study the intention was to get the respondents to draw these sketches. This was troublesome, which was why the researcher (based upon the interviews and the documents shown) made most of the sketches in the two follow-up cases. There have also been several occasions of 'co-drawing', i.e. where both the respondent and the researcher have drawn people, their interaction, used information systems, and so forth on a paper. The use of sketches has also been useful as it has been possible to take one drawing from one interview and get it explained and revised on the follow-up interview.

Many of the figures in chapters 6 and 7 are based upon the sketches. As the earlier discussion may have revealed, the sketches have been drawn quite informally. The respondents and their colleagues have been illustrated with small stick figures and their exchanges marked with grey lines. When they have described that they use a certain information system, this is marked with a black line. If the exchange or use has been described as frequent, the lines are solid. When the exchange and use has been described as: 'it happens', 'sometimes', or 'occasionally', the line has been dotted. The enterprise systems, other information systems, documents, and other artefacts have usually been illustrated with boxes with a descriptive text attached to them.

5.3.4.3 Observations, photographs and other data collection methods

To get 'first-hand information' about the studied companies' business activities and their use of the enterprise systems, the interviews and sketches have been complemented with *observations*. The advantage with interviews is that they allow

the capturing of behaviours and the situation, but with the price that it is difficult to make this information scientifically useful (Ghauri & Grønhaug 2002). Observations can be used as a complement to the interviews, i.e. as a part of the data triangulation (Burgess 1984), which means that it has enriched the quality of the empirical data. The observations have been of how the enterprise systems and other information systems have been used, but they have also covered several of the companies' production and logistic processes.

During the case studies, photographs of the respondents and occasionally their offices or the workshop have also been taken. By doing so, the recorded interviews and the photos made it possible to 'relive' the situation when analysing the empirical data and when writing the case stories. Finally, other data sources such as *documents, reports, process schedules, CD-ROMs, and commercial texts* were used to complement the empirical data from the interviews and observations. During the study, university students' theses and Ph D candidates' research writings about the companies and their business or technologies were also reviewed. When new software came across, the Internet was a valuable source of basic information about the technology found. All together, the use of documents and other information sources have had a verifying function leading to more accurate data. (cf. Yin 2003)

5.3.5 Empirical presentation and analysis

During the data collection the material was arranged into binders filled with the interview protocols, sketches, and other documents that had been handed out by the respondents. Thereafter, coloured marking pens were used to indicate texts and quotations about the information systems, business activities, business actors (individuals and companies) as well as expressions that the respondents used. With this procedure, the rich data (that exceeded three binders plus two folders with printed material) could be manageable when writing the case stories and doing the analysis.

5.3.5.1 Data extraction and respondent validation

The empirical chapters were structured as *case stories*, which means that they originate from the researcher's interpretation of the situation. All the collected data went through a process where business relationship and enterprise system aspects were extracted, supported by the analytical framework, with the aim of creating the foundation for an explanation building analysis (see section 5.3.5.2) Once the 'raw text' and the illustrations to the empirical texts were created, they were sent to key respondents for comments. This procedure is described as *respondent valida-*

tion or *member checking* (Trauth & Jessup 2000, Silverman 2001, Bryman 2002) and, depending on the ontological standpoint; it can be more or less valued. Walsham (1995) describes three 'reality' stances: *external realism* where the 'reality exists independently of our construction of it', *internal realism* where 'reality-for-us is an inter-subjective construction of the shaped human cognitive apparatus', and *subjective idealism* where 'each person constructs his or her own reality' (Ibid., page 76). The business relationships discussed in this thesis are one example of a human construction, i.e. the concepts address phenomena that are possible to discuss through our cognitive apparatus. Following the assumption that humans, to a satisfying degree, can communicate and understand each other's viewpoints this study follows the logic of internal realism, i.e. that the reality is possible to share inter-subjectively. Following this reasoning, by having the case stories commented on by the respondents, they have been verified or corrected. Even if there is criticism against such a procedure (Silverman 2001) the positive effects such as trustworthiness (Merriam 1988), reliability (Bryman 2002) and creditability (Trauth & Jessup 2000) have been more valued. A positive side effect was that this procedure resulted in that new empirical material was offered, i.e. it was a technique to gain even more data. Seen in retrospect, the majority of changes that were made in the empirical texts were clarifications. There were also some quotations redrawn based upon integrity or commercial issues. In such cases, the text was rewritten to describe the standpoint or situation, but the quotation was removed or the detail level reduced. Once the respondents had given their comments, the detail level was reduced even more to make it comprehensible for the reader. The final texts in chapters 6 and 7 are therefore solely the researcher's case stories even if they have been created in dialog with the respondents.

Aspects that must be considered when the respondents' are allowed to influence the empirical depiction are the rigor and relevance aspects. By addressing accepted and well tried-out theories by structured data collection and strict data handling, the rigor aspect may be fulfilled. And by giving the respondents a chance to react to the empirical findings it is possible to get reactions that indicate the study's relevance. As mentioned by Benbasat & Zmud (1999 page 11): 'In order for IS research to be more relevant, it is important that authors develop frames of reference which are intuitively meaningful to practitioners to organize complex phenomena and to provide contingency approaches to action'. The feedbacks were given via email, post or telephone calls. Besides this procedure, some key informants have been contacted for a follow-up discussion. During these discussions they were given a preliminary analysis which resulted in them signalling if they re-

cognized the situation. Most of the corrections made at this point were ‘facts’ about the organization or the enterprise system. It also worth mentioning that the key respondents thought that, from their perspective, the empirical description is a satisfying depiction of the ‘reality’.

When exposing the respondents’ situation and their company in a thesis, issues of ethics must be considered. To give the respondents information about what they were going to participate in an initial email or telephone call gave them a chance to be prepared and reflect upon if they wanted to participate. They were also informed about that they would be asked to read the case story before it would be printed. They also got the possibility to change or withdraw their statements afterwards (which some did). During the interviews and observations the respondents were also given the possibility to react to the data collection techniques. Some did not want photographs to be taken, others told things in confidence, and so forth. By this approach, all the measures possible were taken to not intrude on the respondent’s integrity. A concrete measure was also the respondent validation which Silverman (2001), even though being a critic about this way of validating the empirical data, describes as a way to handle ethical issues.

5.3.5.2 Analysis

Based upon the collected data, marked with colour pens to signal the information systems used, the activities performed, the people involved, and specific expression they used, a case story was written. The involvement of the respondents to check this material can then be seen as a form of pre-analysis that supported the work with creating the ‘explanation building’ text (Yin 2003) that is presented in this thesis. Structurally, the analysis is presented in two steps: first, each case is scrutinized as single case analysis, which is done directly after each case story (chapters 6 and 7) and thereafter the cases are brought together in a cross-case analysis (chapter 8). As described by Eisenhardt (1989), such a procedure is advantageous as the single case analysis gives the investigator a familiarity with the data as it ‘allows the unique patterns of each case to emerge before investigators push to generalize patterns across cases. In addition, it gives investigators a rich familiarity with each case, which in turn, accelerates cross-case comparison.’ (Ibid. page 440) As will be evident in the chapters that hold the analyses, the single case analyses are closer to the empirical data whilst the cross-case analysis is more theory driven. The reason for this is to drain the data of possible findings before putting the parts together and scrutinize them based upon the analytical frame-

work as a support in the process of reaching analytical and theoretical generalization (Eisenhardt 1989, Walsham 1995, Yin 2003).

5.4 Research quality

To meet the validity and reliability criterions the theories applied and the empirical data collection as well as the empirical setting must be considered. Yin (2003) suggests strategies for coping with some central issues that affect a study's quality. The following section presents how some 'quality criteria' have been dealt with in the ABB Robotics case and Volvo Wheel Loaders case. The *construct validity* addresses if the operationalized concepts measure what they are supposed to measure (Ghauri & Grønhaug 2002). This can be enhanced by using multiple sources of evidence (Yin 2003), something that is met by the use of data triangulation (Burgess 1984). Other criterions are if there is a chain of evidence and if key informants have been able to review a draft case study report (Yin 2003), something that has been done through, as far as possible, the transparent empirical and analysis presentation (in chapters 6-8) and the use of respondent validation. To increase the *internal validity*, i.e. if there is a matching between the researchers observations and the theories he develops (Bryman 2002), pattern-matching and explanation building should be made (Yin 2003). Through the two step analysis, that allows the empirical patterns to appear, and by letting the empirical and analysis be aimed at finding 'implications' transcending the cases (Ghauri & Grønhaug 2002), this criterion is considered. The *external validity* refers to whether the findings can be considered valid beyond the research setting and this can be enhanced by using theories in single case studies and by applying a replication logic in multiple-case studies (Yin 2003). This question is hard to address as some lessons would be rather situation specific whilst some are supposed to be found at other companies. Even if the case study methodology is weak on the external validity criteria, this has been weighted against the empirical closeness and the possibility to include the context. Given that this research effort has included eleven companies business (one in the pilot study and ten in this follow-up study), patterns that have been found are likely to be found in similar companies. Finally, the *reliability* criteria addresses if the same study can be repeated with similar results. The use of case study protocols and case study databases can fulfil this criteria (Yin 2003). As has been described, the study has been performed with a well-structured approach involving interview protocols (see appendix B) and with a structure collection of all the data in binders which was considered a more flexible solution than a computerized database.

THE ABB ROBOTICS CASE

THIS CHAPTER STARTS WITH A description of the case setting, with *ABB Robotics*^{*} as the focal company. The first part offers an overview of ABB Robotics' organization, followed by a presentation of their products and their enterprise system SAP R/3. Thereafter the case story continues, covering three of ABB Robotics' customers: (1) *Volvo Cars*, (2) *Specma Automation*, and (3) *SKF*. Finally, three suppliers and their business with ABB Robotics are described. The suppliers are: (1) *YIT*, (2) *Kablageproduktion*, and (3) *Mekanotjänst*. The aim with the case story is to offer an insight into the studied companies' business and also to lay a foundation for the coming analysis and conclusions. To achieve this, the language in chapters 6 and 7 is kept casual and as close to the respondents' explanations as possible, even though the text is the researcher's. It is also important to stress that *the case story describes the situation during the spring and summer 2005*. The chapter is based upon the data that was collected during this time (see Appendix C for exact dates). Changes thereafter are therefore not considered.

*Unleashing
the enterprise
system*

^{*} ABB Robotics is a company within the *ABB Group* which was placed as No 207 on the Fortune 500 list in 2003. For a description of the ABB Group, see appendix D.

6.1 The case setting

This case study's focal company *ABB Robotics* has three production facilities and they sell their products through 24 business area units spread around the world. In this study, the research is delimited to the Swedish setting, and especially, the head office and its production in Västerås plus the sales office in Gothenburg holding approximately 640 employees of this product responsible unit's 800 employees. The case setting also includes ABB Robotics' business with three customers and three suppliers (see the figure below).

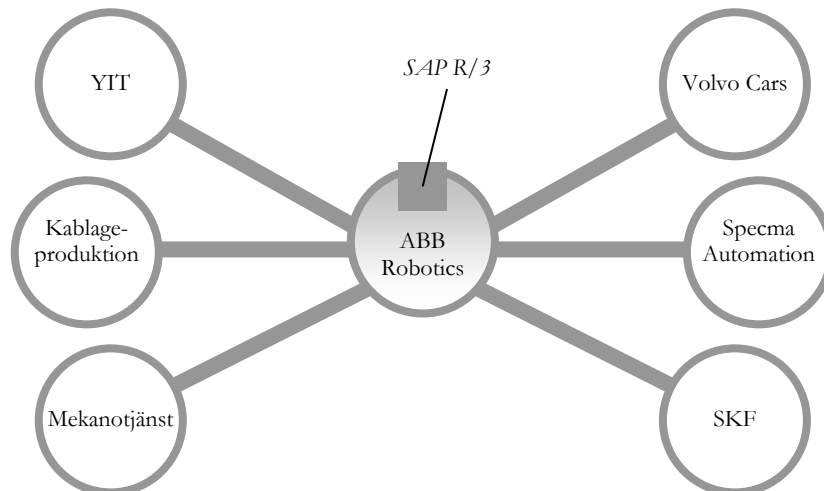


Figure 10 ► The companies that were investigated in the ABB Robotics case study.

The suppliers were chosen with the support of a Buyer at the Purchasing Department, and the customers were selected with support from the Marketing Department's personnel. The supplier and customer companies are representative of a variety of business partners, and the case setting thereby offers insights into different degrees of information systems use and multiple ways of doing business. As with both case studies, the descriptions can only cover a part of the focal company's 'reality', but through discussions with employees at ABB Robotics, the chosen setting is considered representative of their business.

6.2 Introducing ABB Robotics

In 1988 there was a merger between Swedish *ASEA AB* and Swiss *BBC Brown Boveri Ltd. of Baden*, leading to the establishment of *Asea Brown Boveri* (ABB). The history of ABB Robotics goes back to 1974 when ASEA introduced their first robot IRB 6, and today the yearly production capacity is more than 12.000 robots

per year. ABB Robotics has its production in Bryne (Norway), Västerås and Laxå (Sweden). When this case study started, ABB was divided into a Power Technologies (PT) division and Automation Technologies (AT) division. ABB Robotics is a part of AT, and they have their main production located in Västerås. This study takes its departure from the Västerås plant, which is the largest production plant of the three[▲]. The head office is also located at the Västerås plant, which means that it also houses the company's core business processes (e.g. R&D, production, and marketing).

ABB Robotics core processes are *product development*, *delivery*, and *aftermarket*, whilst processes such as marketing, sales support, and purchase are considered support processes. This case story touches upon the core processes, but it starts with the personnel that meet the customers (the salesmen and market support personnel), followed by a description of those who deal with the orders. It finishes with the supply and purchase activities leading to a delivery. To get this picture the description also goes beyond the Västerås plant, capturing some of the sales organization's activities.

6.2.1 The companies visited

The production plant in Västerås feeds the ABB Automation Technology sales offices, which in this study are represented by one office in Västerås and one in Gothenburg. All the ABB personnel that are interviewed have 'ABB manufacturing Technologies' on their business cards, which is why their roles will be described when they appear in this chapter rather than illustrating their position with an organizational chart. The distribution of the robots sold is approximately 1/3 to the *automotive industry* (Auto), like car manufacturers, 1/3 to *channel partners* (CP), companies that have robots in the systems they sell, 1/6 to *tier-one* (T1) companies, suppliers to the automotive industry, and 1/6 to the *manufacturing industry* (MI), also called general industry (i.e. other industries than automotive).

6.2.2 The structuring of the ABB Robotics case

The continued covering of ABB Robotics' business will begin with their *sales organization*, starting with the group that sells to: (1) the automotive industry, (2) the channel partners, and finally (3) the general industry. In parallel with this description, the *sales and marketing support* at the Västerås plant are interwoven. When the sales and marketing activities have been covered, the description moves over to

[▲] And according to an ABB Robotics slideshow it's the 'world's largest robot factory' (2005).

describing how an *order* is handled (i.e. the order department), followed by the *R&D*. To be able to produce robots, there is also a need for purchased components, which is why the *supply and purchase management* is looked into. When all the supporting functions have been covered, the *production* of the robot is described, and finally the ABB Robotics description ends with some *after sales* information. But before moving over to those who sell and manufacture ABB's robots, the product itself will be described. As has been mentioned, ABB's robots have been sold for more than 30 years, serving customers like General Motors, Toyota, Renault, Philips, Astra, and Nestlé. The major markets during 1995-2003 were Europe followed by the Americas and Asia.

6.3 The robot product

ABB Robotics core product goes by the name 'IRB' followed by a serial number. A naked robot is 'worthless as a wrench' as long as you do not equip them. Even though the robot can be equipped with some basic features at the production plants, the buyer or salesman has to 'dress' it before it can be seen as a productive unit in a production line. The application areas for ABB's robots are, based upon more than 140.000 installations, in order of occurrence: (i) *spot welding*, (ii) *material handling* and *machine tending*, (iii) *arc welding*, (iv) *assembly* (including some other processes), and (v) *painting*.

Figure 11 ► [on the right side] A 'naked' robot - the IRB 6600 [with courtesy of ABB Robotics]



The car industry is clearly the single largest, most mature, and demanding customer, though they have a tradition of using robots as a natural element in their production. It is also a customer group that has developed sophisticated methods to plan and simulate their production with robots.

A robot can basically be divided into three functional parts: (a) the mechanical unit called the *manipulator*, (b) the *control module*, and (c) the '*dressing*' (i.e. the cables and other equipment that shall do the operations, like e.g. welding, gripping or painting). A 'naked robot' does not add value in itself; it needs to be integrated into a production system supported by other equipment. The applications for a

robot are up to the production developer's creativity and imagination. Basically, a robot is ideal when it comes to monotone, precision demanding, or dangerous tasks. As the IS Manager expressed it: '[A] premium car is built by hand, a quality car is built by robots' (for an example of a production line-up in the car industry, see the figure below).

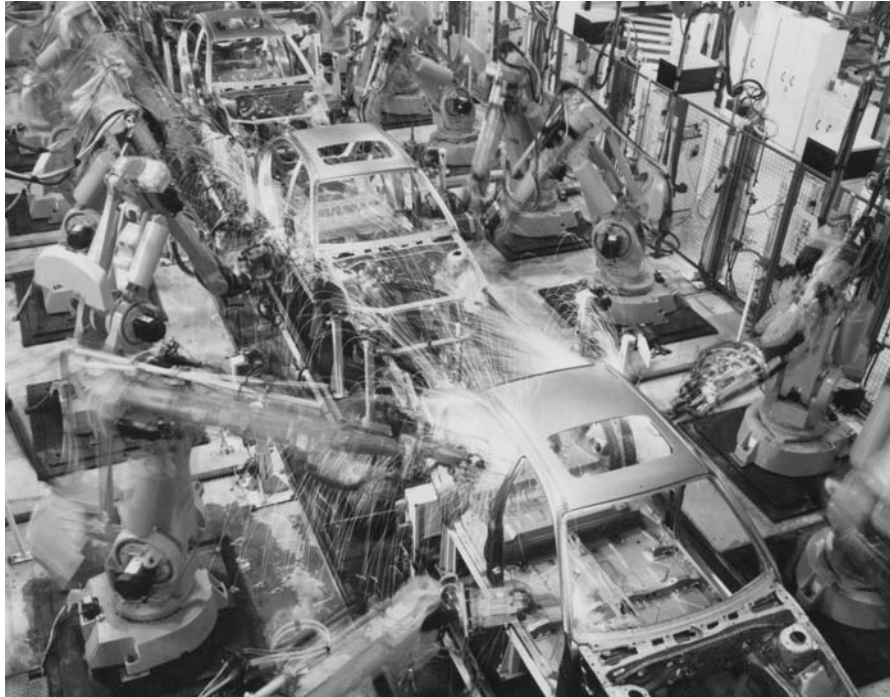


Figure 12 ► Example of car production with robots [with courtesy of ABB Robotics]

Besides being equipped with cables (for electricity, pneumatics or water) that will be used to feed a welding unit, a gripper, or some other tool (something that is described as the robot being 'dressed'), the robot, i.e. the manipulator and the control unit, often are complemented with *peripheral products*. These peripherals can be: (i) *Track motions* that let the robot move over a larger area or work at several places. (ii) *Motor units* that serve the robots with e.g. the material that the robot should work with. (iii) *Tool systems*, i.e. a robot may change its tool during an operation based on what operations it is supposed to do and this is handled by a separate supporting 'tool system'. (iv) *Spot welding systems* involve supply of electric power, cooling water, and compressed air. (v) *Positioners*, i.e. machines that move the material that the robot will work with. As an example, a positioner can rotate a

material so that the robot can weld it on both sides.* Besides these products, there are many more possibilities to provide the robot with supporting peripherals for their task, something that the ABB's sales organization or ABB Robotics partners can do themselves.

6.3.1 Controlling the robot

A robot can be programmed to work simultaneously with other robots, side-by-side, each keeping their 'arms' out of the way of the other robots. The robot steering is controlled through a control module, the *IRC 5 Controller*, which can control up to four robots simultaneously. Besides the control module that holds the robots CPU, each robot has a *drive module* that feeds the robots motors (i.e. the control module steers the robots and the drive module feeds the robots motors with power so it actually moves). Finally, the robot can be equipped with a *process module* (also called an 'application module'), which is a controlling device for the tool that the robot will use. ABB Robotics supplier YTT, that is described later in this chapter, produces such process modules for spot-welding applications.

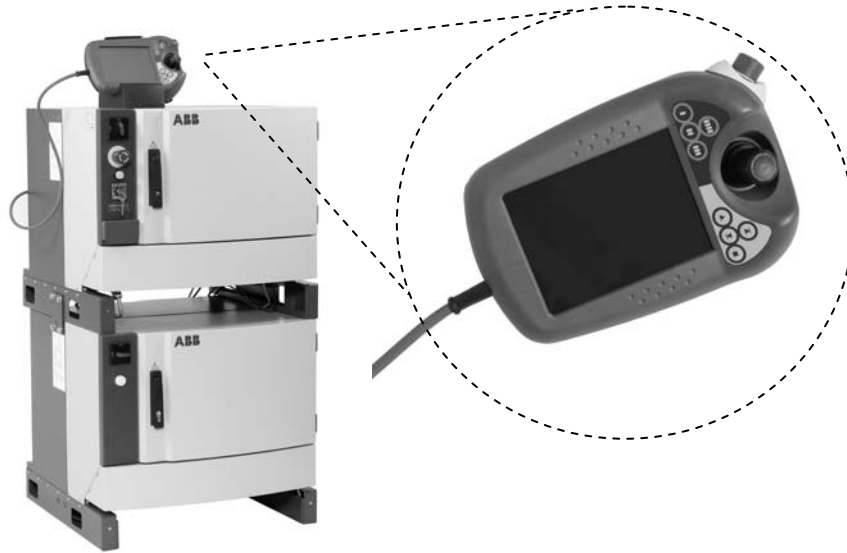


Figure 13 ► An *IRC5* control module with an drive module on top (left) plus an *FlexPendant* handheld device (right) [with courtesy of ABB Robotics]

* Information about the peripherals is taken from ABB's robot information on www.abb.se (visited 1 October 2005).

The robots have traditionally been programmed with a *handheld device* called the *FlexPendant* (see the figure above) that gives input to the control module. But the programming can also be done on a PC in a MS Windows environment with the software *RobotStudio*. The advantage of using RobotStudio instead of the handheld device is that the former can be used to simulate optimal robot configurations whilst the production is running or even before the robot is purchased. This means that there is no lost time due to programming; a production line can be up and running in parallel with adjustments or changes in the robot operations. RobotStudio is exclusively developed for ABB's robots and this software has two major advantages: (a) *Time*, the production is not disturbed, and (b) *Precision*.

6.3.2 The focal product(s)

The robots that ABB produce come in a range where the max pay load goes from 1 kg (as with picking robots) up to 500 kg and with a maximum reach up to 3.9 m. Some examples are shown in the table below.

Table 2 ► Some examples of the IRB robot series [information from a ABB Robotics advertising brochure 2004]

Robot	IRB 140	IRB 340	IRB 1600	IRB 2400	IRB 4400	IRB 660	IRB 6600	IRB 7600
Maximal payload^(a)	5 kg	1 kg	7 kg	16 kg	60 kg	250 kg	225 kg	500 kg
Maximal reach^(a)	0.8 m	-(^(b))	1.4 m	1.5 m	1.9 m	3.1 m	3.9 m	3.5 m

^(a) The maximum payload and maximum reach are usually for different versions of the same IRB-serie.

^(b) The IRB 340 is a picking robot with a work range of 1.0 m².

In this case study, ABB Robotics best selling robot *IRB 6600* (whose largest customer group is the automotive industry) and the bestseller for 'general industry', *IRB 4400* are selected as the focal products. The IRB 4400 was selected along with the IRB 6600 when, during the ongoing case study, it was obvious that the IRB 4400 was a better example of a 'general' robot. The IRB 4400 and IRB 6600 robots can be seen as traditional robots with six leaded axis and designed to be equipped with a variety of tools (i.e. 'dressed') as a; welding unit, gripper, painting device, and so forth.

6.4 ABB Robotics enterprise system

During 2002, ABB Robotics carried out the *Freja* project which meant that they evaluated their legacy system and planned for their future enterprise system. According to an internal ‘evaluation document’, presented in August that year, there were risks with the legacy system (named *Protos*) that supported their business at that time:

ABB Robotics are situated with legacy ERP-systems (+ surrounding applications) that do not support main business processes in a sufficient way. The main system Protos were implemented 10-15 years ago and they do not build the right platform for future development and integration with standard ABB applications. Protos also faces a severe risk on future technical support from the vendor. The same applies to the PDM.

The complexity of the IS-landscape makes system operation difficult and the specialisation of each custom made system makes processes inflexible. Most systems are custom made, some are even developed by our own employees. In the absence of an integrated system a large number of databases and interfaces are in place. This means that real-time information is not always available, although our way of working assumes transparency. Recently incorporated departments/divisions [...] often use different systems for the same tasks compared to the rest of ABB Robotics.

Internal evaluation document for ABB Robotics project Freja (2002)

The prevailing information systems were inefficient with double entries of data, long lead times in some processes, inflexibility, high cost operations, costly interfaces, and leading to a high dependency on external consultants. ABB Robotics decided to migrate to a new enterprise system that could handle these shortcomings but it was not so much a choice but rather a management decision from Zurich; ABB Robotics should implement the enterprise system SAP R/3!

One of the ideas with SAP R/3 was to have the same enterprise system for all the production facilities (Västerås, Laxå, and Bryne). There was also an intention with the implementation of SAP R/3 to treat all the processes in the production plants similarly, leading to a higher flexibility among the three units. Another outspoken reason was the risks with having several legacy information systems and applications running. As an example, the prior PDM system was very person-dependent. To deal with the flaws of the old information systems, ABB Robotics installed SAP R/3 during spring 2003. The Västerås plant was first to ‘go live’, soon fol-

lowed by the Laxå and Bryne plants during 2004. The implemented SAP R/3 installation covers the basic features of the old system, and the strategy during the Freja project was that SAP R/3 should support ABB Robotics' core business processes after the implementation. Even though the implementation of SAP R/3 was carried out in a period where ABB Robotics sold at an 'all time high', the problems encountered were moderate and the IS personnel interviewed are quite pleased with how it has turned out. The new SAP R/3 enterprise system is easier to operate and many of the flaws with the legacy systems have disappeared. Another benefit is that SAP R/3 supports a process-oriented structure, something that has affected the organization positively.

6.4.1 The SAP R/3 environment

The following picture illustrates some of the SAP R/3 modules that were implemented (all modules will not be covered in this case story though it was not presented by the respondents).

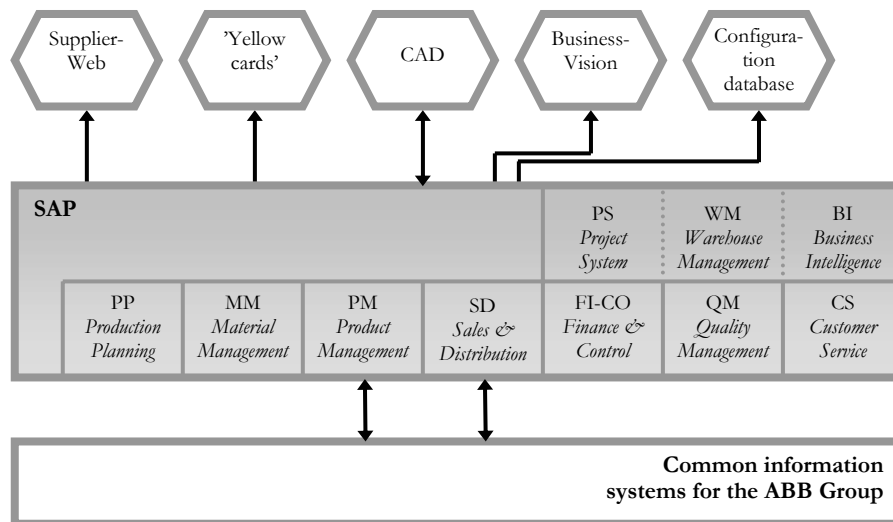


Figure 14 ► ABB Robotics SAP R/3 with complementary information systems [modified from an information system architecture drawing in the spring 2005]

Prior to SAP R/3, ABB Robotics' information system architecture had approximately 50 different applications that were used in their business processes. After the Freja project, ABB Robotics main information system's infrastructure can be described with less than 20 applications if SAP R/3 with all its modules is seen as one single application.

6.4.1.1 *The implemented modules*

SAP R/3 is based upon a ‘functional core’ that handles the database, applications (modules), and presentation functionalities. Depending on what functionality is needed, different modules can be added. In ABB Robotics’ case the initially selected modules were:

- The *Production Planning* (PP) and *Material Management* (MM) modules, which holds information about the components, logistics, and production activities. These two modules are also the base for the MRP II calculations that are carried out in ABB Robotics’ day-to-day business.
- The *Product Management* (PM) module, an application package that holds the production development management (PDM) functionality.
- The *Sales and Distribution* (SD) module which involves e.g. order handling functionality and a product configuring application.
- A *Financial and Control* (FI-CO) module, which is the basics for accounting information.

The figure also presents the *Project Systems* (PS) module for the Automotive & Manufacturing personnel and the *Quality Management* (QM) module that supports ABB Robotics’ quality work offering triggers for service points in the production, storing quality documents, etc. Other modules are the *Customer Service* (CS), *Warehouse Management* (WM), and *Business Intelligence* (BI) modules. These modules were not fully explored and implemented during Freja, but they have gathered attention in the ongoing expansion of ABB Robotics SAP R/3. Whilst the first is used for service scheduling and so forth, a functionality that is not used at the Västerås plant, the two later (WM and BI) are functionalities that could not be observed during this case study.

6.4.1.2 *Expansion of the enterprise system*

Even though ABB Robotics’ management decided to have a rather conservative scope in the Freja project, the number of information systems was heavily reduced. But SAP R/3 could not replace some of the old information systems to a reasonable effort, which was why they were kept and sometimes modified so they could be integrated with SAP R/3. There were also information systems that are a part of ABB Group’s infrastructure. One such example is a data warehouse and business intelligence tool named *BusinessVision* that gathers data from SAP R/3. BusinessVision was used even before the Freja project and the vendor calls it a

‘management and accounting solution’*. BusinessVision consolidates ABB Robotics’ financial transactions, data that also are sent to ABB Group’s global monitoring and control system *Abacus*.

If queries and calculations were to be carried out directly in the SAP R/3 database it would slow down the system's performance. That is why some sort of data warehouse is interesting; it can be used for queries without disturbing the SAP R/3 performance. Today, the production generates about 24,000 SAP R/3 transactions per week, something that requires a huge data handling capacity in itself. This means that there are many things to consider before implementing a data warehouse solution, both regarding what data to store and how the solution can be incorporated into the ABB Group's IT-strategy.

6.4.2 Interorganizational (electronic) communication*

ABB Robotics has a *SupplierWeb* that the suppliers can access to get their orders from ABB Robotics (see figure below).

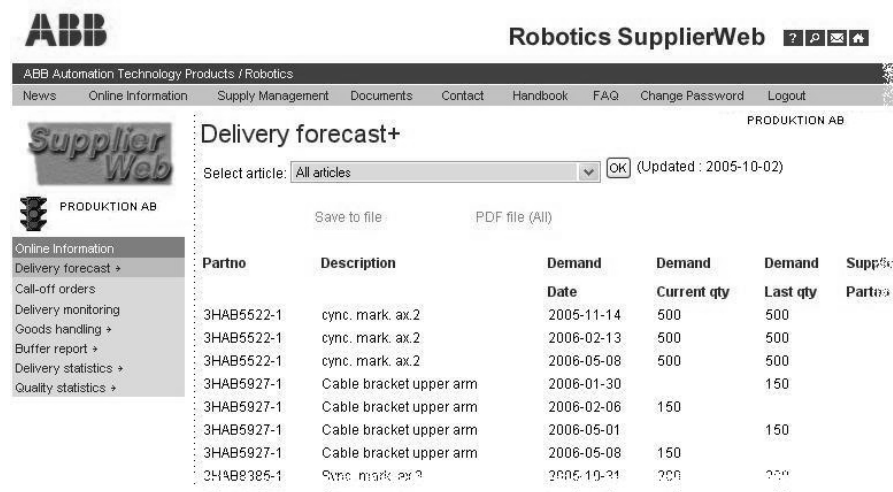


Figure 15 ► ABB Robotics SupplierWeb [modified, with courtesy of ABB Robotics]

* Product information from the vendor's homepage www.businessvision.com (visited 7 October 2005).

* The following description focuses on the supply side (the customer side is, according to the empirical material, not applicable) and it does not cover the integration with the other ABB companies' information systems (usually of a financial and logistic nature).

SAP R/3 is 'mirrored' to the SupplierWeb each night, meaning that the SupplierWeb presents batched data holding the orders that were placed the day before. The orders are stored in XML format with material numbers, product or article name, size, purchase group, quantity, and so forth. Beside the orders, ABB Robotics also transfers their prognoses to the SupplierWeb, giving their suppliers information on what is ahead. For the suppliers that have agreed on holding a stockpile, they also use the SupplierWeb to give a 'buffer report' on a weekly basis. The SupplierWeb also has a traffic light indicating how the supplier performs. When this traffic light signals green then the products and the delivery precision are considered fine, but with a red light; measures must be taken.

ABB Robotics also communicates with *EDI* or by other means such as *email* and *fax*. A supplier that uses EDI or the SupplierWeb can e.g. receive ABB Robotics' 'pallet label' holding ABB Robotics' own bar-codes. This means that the material that the supplier sends to ABB Robotics can be 'shoot' by ABB Robotics logistic personnel with a handheld bar-code scanner, whereafter SAP R/3 gets a signal that the material has arrived. With this procedure, all the delivered packages may already hold ABB Robotics' own marking, but if a supplier does not use these possibilities; it can also be printed and attached to the package by ABB Robotics personnel.

Beside the information systems mentioned, the development of a *Product Specification Tool* (PST) was going on during the case study. The 'dummy' that was observed worked as a robot configurator. When used, the configuration process starts with a screen showing the different robot models followed by more and more specialized selections like application area, peripherals, etc. The advantage with the Product Specification Tool is that it supports the user in his or her selection of robot options, something that hinders the buyer from specifying 'impossible' or 'inappropriate' robots. The PST project is sponsored by ABB Robotics' sales and marketing function and the aim is not to integrate this software into SAP R/3, but to simplify the market and sale personnel's work and to get better robot specifications when the robots are ordered. In parallel with this project, the IS/IT Department also reviews the market for a 'front-end' configuration tool that can be integrated with SAP R/3. Such an integrated solution would lead to what ABB Robotics describes as 'one order entry', i.e. the front-end configuration tool helps the salesman to create quotations and then allows him or her to place the order in the same application. With such an application, the order can be activated directly at ABB Robotics' production plant with less manual administration.

6.5 The sales and marketing organizing

The following section will illustrate how robots are sold to customers. The presentation of the organizing of sales and marketing activities will follow the same order as the presentation of the customers, i.e. the (1) *automotive*, (2) *channel partner* (CP), and (3) *manufacturing industry* (MI) sales organization, which (in the discussions with the respondents at ABB Robotics) also can be seen as a ‘major’, ‘medium’, and ‘small’ customer regarding sold quantities. The description starts with the automotive sales which is the, organizationally, most complex business. It also involves ABB Robotics’ *Project Managers* at the Marketing Department in Västerås.

6.5.1 The automotive market

The automotive industry, and especially the car industry, is one of ABB Robotics’ major customer segments and they are described as a customer with high demands and with a good knowledge of robots. The treatment of these customers requires ABB Robotics’ full attention, which means that the organizing around marketing and sales to this customer category is an interesting starting point. *The text in the following section exemplifies with a project with Volvo Cars but the example is written to illustrate the ‘normal’ automotive project. The description of the business with the automotive industry organizing is therefore ‘generic’, i.e. all that is described is not related to the Volvo Cars case even though it figures when practical examples are given.*

In projects with large automotive customers like Volvo cars there is often a *global agreement* specifying fundamental conditions as a base for the business. As an example: The Ford Motor Company owns Volvo Cars as well as Jaguar, Land Rover, and Mazda among others. Every second or third year, the Ford Motor Company contacts a selection of suppliers with the purpose of carrying out ‘frame agreement surveys’, later leading to some sort of general agreement. The Senior Specialist Automotive Sales at the Västerås plant describes this process as ‘a rather complex procedure’ and it involves forms with the demands that the Ford Motor Company has on their suppliers. The forms state what can be seen as ‘basics’, that must be fulfilled, and optional aspects that can be negotiated. The results are *general agreements* that, in ABB Robotics’ case, involve basic robot configurations and feature a fixed pricelist. When the agreement process is finished the companies within the Ford Motor Company can use the general agreement without having to negotiate the specified conditions and prices.

When it is time for the automotive manufacturer to purchase robots the supplier evaluation process continues (leading to even more detailed specifications). At this point, the robots *per se* are not interesting. Instead, the discussions and negotiations are about functional packages, i.e. a robot and peripheral equipment that can handle a specific task. During this process, several people from ABB Robotics, its sales organization, and the customer will meet to discuss and negotiate both commercial and technical issues. The personnel from the automotive industry can roughly be described as purchase and technical personnel. Usually, these people hold engineering degrees, which means that the discussions often involve technical matters on a rather complex level:

The car industry is [...] drowned with engineers. Many of the purchasers are former engineers [...] so the sales personnel that go there have a solid technical competence.

Project Manager at the Västerås plant (2005)

To be able to deal with all the business matters that occur in such a purchasing process, ABB Robotics gathers several people from both the sales organization and the production plants (see the figure below). From ABB Robotics' side, there is the assigned salesman (titled *Account Manager*), a *Chief Engineer* (which is a person from the marketing department), a *Sale Support*^{*} who is responsible for the sale at the ABB Robotics plant and also a *Quotation Engineer* at the local sales office[^]. The *Swedish Sales Manager* automotive industry can also be involved when there are large or strategic projects. All these people are called a 'capture team'. Such a team is a gathering of ABB personnel that have the competence needed to meet the customer's demands. There are several reasons for this arrangement such as being able to act on the customer's requirements, but also to take other aspects than the sole product into consideration. As an example, the aftermarket can be valuable in these large projects, something that needs to be evaluated when the purchase conditions are negotiated.

If a sales effort is successful, ABB Robotics receives an 'award' which means that the customer (e.g. Volvo Cars) has selected ABB Robotics as the exclusive robot supplier to their project. The sale then becomes a 'project', which means that even

^{*} The title based upon this person's role in the sales process, a role that was held by a Senior Specialist Automotive Sales in the Volvo Cars case.

[^] If ABB receives the order, the Engineer can also be considered the 'Project Leader', i.e. the one that is responsible for managing the technical matters and keeping the project together.

more people will be involved. When ABB Robotics and the customer have agreed upon the purchase conditions, the Sales support at the production plant passes the sale over to a *Project Manager*. This means that the Project Manager is informed about the sales conditions, whereafter he or she is responsible for all the sub-orders and possible product adjustments.

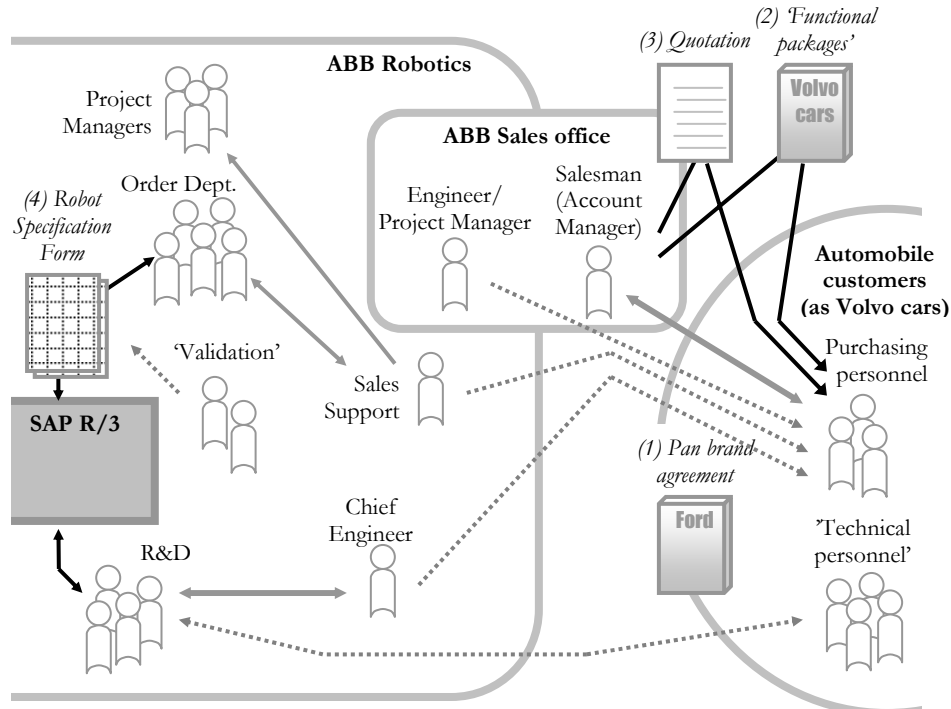


Figure 16 ► ABB Robotics' organizing in Automobile sales projects [Own, simplified, illustration based upon interviews and exemplified with Ford/Volvo]

The order personnel are also closely involved in this process, especially when it comes to create *Robot Specification Forms*^{*} in SAP R/3. The KAP Group[^] at the order department formalizes the robot configuration in SAP R/3. There is also a group that does quality checking and 'validates' the specifications that are stated in automotive projects like the Volvo Cars case. Finally, the Product Management can be involved if the project has specifications that can be standard, e.g. if a product feature has been occurring as 'special' in a number of projects and orders.

^{*} 'Krysslista' in Swedish.

[^] The acronym KAP stands for 'Krysslista, Avtal, Priser' in Swedish which can be translated to Robot Specification Forms, Agreements, and Prices.

6.5.1.1 A chain of business documents

The following text looks into the documents that such a project may enclose. First, there use to be a (i) *general agreement* as earlier described. When the automotive customer needs robots for a project, the process continues with a more detailed specification of how the robots will be equipped which results in (ii) *functional packages* or more specified robot packages. These specifications are also tightly linked to (iii) *quotations*, i.e. every position in the function package list can be matched with a fixed price. In the Volvo Cars case, the final business document is a binder full with lists of robots and complementary equipment including their prices. When the functional packages are specified the KAP Group creates (iv) *Robot Specification Forms* based upon the robot structures in SAP R/3. When addressing the business documents described, it is important to point out that the sales organisation (e.g. the Gothenburg sales office) and the production facility (e.g. the Västerås plant) can perceive an automotive project differently. From the production plant's perspective it is a delivery of robots with some specifics that needs to be fulfilled. From the sales office perspective the project involves robots from ABB Robotics plants but also other equipment from other suppliers. As an example; the Assigned Engineer at the sales office will consider both the robots and the peripheral equipment from other suppliers. This means that the origin of the documents that are used in a project come from a variety of sources and that the involved persons will use them differently.

6.5.1.2 Used information systems

Several of the documents that have been described are created in *MS Word* or *MS Excel* and some customer information is stored in *Lotus Notes* databases. It is only the sales office's Controller that uses SAP R/3 when he books and follows up projects. But even if the Controller uses SAP R/3 on a daily basis, he sends separate orders to the Västerås plant. When the Controller books a project such as Volvo Cars his booking involves both ABB Robotics products and other equipment. Practically, this means that he orders a robot from the Västerås plant and then a specific tool from another supplier. All products will then be delivered to the ABB Business Center in Gothenburg where the local ABB service personnel will equip the robot with the specific tool and test it so the equipped robot work as it is supposed to. When the Controller places such an order in SAP R/3 it will contain the; robot, tool, and workshop cost (for assembly and testing). The order containing these three posts will then have another structure than the order that the Västerås plant requires (i.e. the robot are not specified according to how it is done at the production plant – it is one 'product' among others).

The Salesman in the Volvo Cars project does not use ABB Robotics' SAP R/3. The quotations and other documents that are used in the business process are instead written in the sale organizations *quotation application* in Lotus Notes. If needed, the quotation is complemented with MS Excel spreadsheets that the Salesman creates himself. The marketing group at the Västerås plant that supports the sales organization also shows a low degree of SAP R/3 usage, and the reason for this seems to be that the enterprise system does not support their way of doing business.

I think, if I shall be frank, that the enterprise systems I have been in contact with so far have to a very low degree been based upon the needs that the market has [i.e. the customers] and more from the internal needs. That is how I think about our SAP system also. [...]

[Those who run the production thinks:] 'We would like better stability and better prognoses; then we should manage it better. It would be easier. We would like to have the orders earlier; then we would have time to 'line up' the suppliers and ourselves. And it should be untouched – it should not change.' And this is the medicine against the complaint we have today and it was also the medicine 15 years ago when I began. Nothing has changed! And to achieve this [stability] you have to change the customer's behaviour. And that is something we never manage. That's a behaviour that will prevail. We must, instead, create work processes and tools that make us good on acting, and take care, of the changes from outside.

Senior Specialist Automotive Sale at the Västerås plant (2005)

The interviews reveal that the enterprise system does not support the marketing department's way of working. The Senior Specialist Automotive Sales describes that the personnel working with the marketing function often know more about what ABB Robotics' management wants than the average employee, and these managerial targets are not that easy to represent in SAP R/3. Today, the robot structures are based upon the *Robot Specification Form* that is demanding to set up in SAP R/3. The problem is that you have to perform the same routines in SAP R/3 despite if you want to sell 10 or 500 robots. One sales support respondent describes that they would 'administrate themselves to death' if they used SAP R/3 for all potential orders.

The internal quotations, i.e. those which are sent to the sales office in Gothenburg, from the marketing personnel in Västerås are written in a *Lotus Notes applica-*

tion. If a specific robot configuration needs to be made, the KAP Group support the sales and marketing personnel with a customized Robot Specification Form (which is a robot structure manifested in SAP R/3) for that project. When ABB Robotics receives a project it is time for the Project Managers to execute the orders and supervise and control any changes. These Project Managers do not have any extensive SAP R/3 use either; it is instead *Lotus Notes applications* that support their work:

Then we have Lotus Notes. That is maybe our most important system. It is used for all email communication, internal, bookings, databases [...] All delivery information is found in the database 'delivery situation'. And we have, even if SAP R/3 is used for all the order bookings, an order database where all the orders from [the sales offices] land. [...] So you can go into the database and see the specifications, what they have sent in, and all the communication in that errand.

Project Manager at the Västerås plant (2005)

ABB Robotics' enterprise system offers the Project Managers and marketers an overview of the order and production status. SAP R/3 is used for following up the sales and marketing support's time (how much time has each project got), controlling orders, checking material supplies, and so forth. There are also other information systems that use the enterprise system SAP R/3's data. One example is *BusinessVision* that the Project Managers use for checking their present sale and project status (i.e. the financial status). Another application is the *Robot Specification Form* that is available in MS Excel, created from the robot structures in SAP R/3.

6.5.2 Selling through channel partners

ABB Robotics also sells their robots through *Channel Partners* which are companies that have been certified as; (i) ABB Robotics Partner, (ii) ABB Robotics Preferred Partner or (iii) ABB Robotics Strategic Partner. The partners are placed in some of the three categories based upon their purchase volume, their competence, and their strategic importance for ABB Robotics. Before 1997, ABB Robotics constructed entire systems of robots and peripheral equipment themselves but nowadays ABB Robotics plants focus on the production and final assembly of robots. The Salesman that is responsible for Channel Partners describes that ABB Robotics will be a 'factory' that focuses on the robot production and that 'buying a robot will be like buying furniture at IKEA'. The Channel Partner agreements are described as 'a formalized and mutual commitment'. Some Channel Partners are

old ABB companies that have been sold out. Such a Channel Partner has a solid knowledge about ABB Robotics products, but they act as an independent company. The Channel Partners are, besides being given the attention that a partner receives, invited to a yearly 'global partner seminar' (usually 300-400 people) and to other local seminars and meetings. They are also given access to a web page where they can get CAD and pdf-files on ABB Robotics products.

ABB's sales units choose whether to carry out the system engineering or to let other companies, as Channel Partners, do it. The Salesman interviewed focuses on the partner sales and he describes that he can sell products other than robots as well but the main products are robots. The basic idea with Channel Partners is to let the system engineering be carried out elsewhere and thereby have a wider contact net within the market. The Marketing Manager, supporting the Channel Partner sales at the Västerås plant, describes the engineering that makes the robot into a functional unit as 'integration':

[A robot] needs to be integrated in a line or in a system. [It also needs to be dressed.] It needs a gripper, or something else [such as] complementary equipment, and it will need security equipment in Europe and America, such things. And all of this is taken care of by ABB's front-end business units [...] who are responsible for the selling and the customers. Or, external partners may carry it out!

Marketing Manager Industry & Partner Sales at the Västerås plant (2005)

By letting the sales organization decide how to sell the robots, ABB Robotics production plants can focus on producing robots more efficiently. The Automotive Industry & General Industry sales organizations also have workshop capabilities, i.e. they can equip and test the robots themselves. This solution means that the Västerås plant can focus on the Robots and that the surrounding organizing is structured to equip the robots according to each customer segments requirements. ABB Robotics has four Channel Partners in Sweden today and that number may increase in the future. The Channel Partners can use ABB Robotics in their advertisements and vice versa, an arrangement that increases ABB Robotics possibility to sell robots and also to be exposed to potential customers.

6.5.2.1 Organizing the channel partners sales

A Channel Partner sale seldom involves such support as was described for the automotive market. A sale to an automotive customer often results in a 'delivery project' that is supervised by a Project Manager at the Västerås plant. The Marke-

ting Manager Industry & Partner Sales estimates that 95% of the project organization's work is carried out for the automotive customers. The support that the salesmen for Channel Partners receives is more about offering good product and price information, i.e. their customers seldom have similar demands regarding special solutions. An explanation for this can be that modifications are expensive and adjustment costs hit hard on small quantities. The following figure gives an overview of the organizing around the channel partner projects.

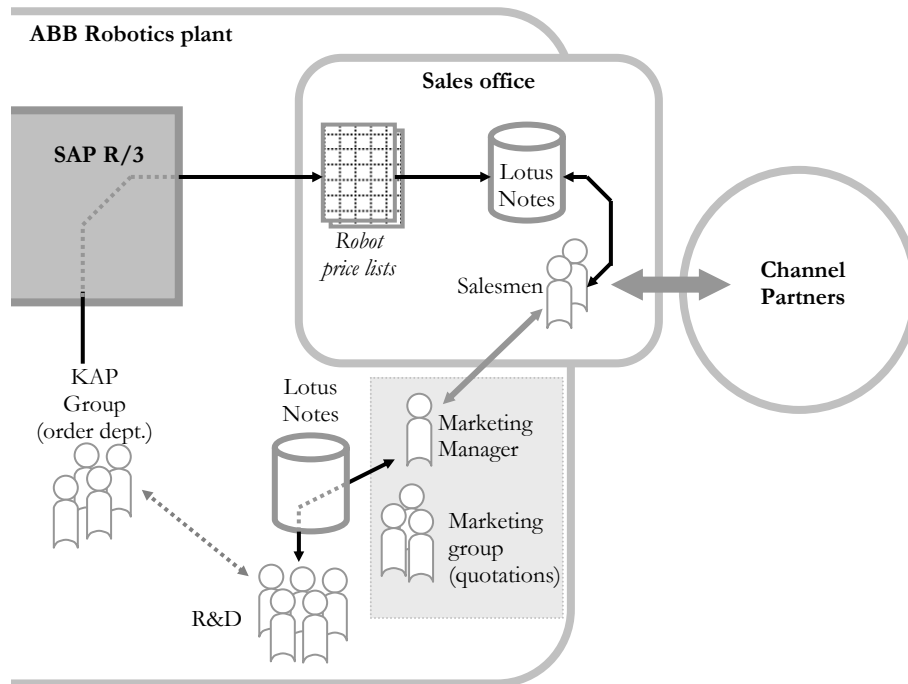


Figure 17 ► The organizing for the marketing and sales activities for channel partners [own illustration based upon interviews]

The Channel Partner sale is handled by two Salesmen at the sales office located in the ABB Business Center in Gothenburg. There is also a group of 'Marketers' dedicated to Channel Partners and General Industry located at the Västerås plant. The Salesmen can also get engineering support from ABB Robotics R&D when needed, but the majority of activities that the salesmen carry out are sales and order handling, i.e. basic administrative tasks surrounding the sales of robots. The Salesmen describe that they would like to meet their Channel Partners more often, but the last years increased demand for ABB's robots means that they have to increase their staff to manage that.

6.5.2.2 Used information systems

The Salesmen that handle the Channel Partners use *Lotus Notes* as their main supporting information system. They do not use SAP R/3 and they place their orders directly at the Västerås plant (i.e. they do not use a Controller as does the Salesmen that handles the Automotive Industry). The Salesmen are instead dependent on the Robot Specification Forms that the Västerås plant offers them. The Robot Specification Form is used for price calculations that can be used as quotation supplements. The Salesmen also have a version that is sent to the Channel Partners but these are seldom used:

We have a Robot Specification Form that nobody understands. Instead, they calls or mail us and say: 'fix this'!

Salesman Channel Partners at the Gothenburg sales office (2005)

When the Channel Partners refuse to use the Robot Specification Form the Salesman has to arrange the order himself, i.e. the Channel Partner sends their requests or order with a structure that fits them. Thereafter, the salesman organizes the documents so they fit into ABB Robotics' order procedure. In practical terms this means that the Salesman fills in the Robot Specification Form, a *Customer Order Specification Form* (COSF)^{*}, an order form and, when needed, other documents that the ABB Robotics plant needs to produce a robot. The salesman sends these documents to the Västerås plant via email and they also register the product calculation and perform an order registration in a *Lotus Notes order database*. Thereafter, the order is sent to the order department at the Västerås plant. A Salesman describes that his order is then checked by SAP R/3's robot configuration controller, but [with a tone of humour] unfortunately this does not signal when the Salesman has missed a part. The Salesman must therefore control that everything is stated according to the Channel Partner's specification and perform a final quality check, i.e. 'does the order to the plant state a complete robot?'

The *Product Specification Tool* has been demonstrated to the salesmen and they think it looks promising. With such software they will be able to focus less on administration and more on the sales process. Instead of having many pages of selections (with numerous options) in the Robot Specification Form, the Robot Selection Tool will let them specify a robot in six steps by a point-and-click technique in an MS Windows environment.

^{*}The COSF is a form holding the customer and the robots application area.

At the time of the case study, the Robot Specification Form is sent to the sales organization as an MS Excel file. The Robot Specification Form in MS Excel is generated from ABB Robotics SAP R/3, i.e. the enterprise system has both the Robot Specification Form's structure and its content stored. SAP R/3 also holds a 'price master', something that the Marketing Manager describes as a great enhancement since the old system. Prior to SAP R/3 prices were handled in MS Excel spreadsheets and with a 'homemade system' that was much less secure with the risk of faults.

6.5.3 Selling to manufacturing industry

The last description of ABB Robotics sale and marketing activities focuses on the sales to the 'manufacturing industry' (also called general industry). Some large companies prefer to do business with ABB Robotics directly and there is one Salesman that serves this customer group. His customers usually buy a complete robot function, i.e. not only a robot but also controlling and peripheral equipment. To get a robot to function in a production line, the ABB Powertrain and Robot Automation plant in Västerås support the Salesman^{*}. They help him constructing a complete robot unit and they can also carry out a complete project if needed. But the work with a potential customer's requirements takes a lot of time, which is why the salesman evaluates the chance of getting an order before even starting the quotation and negotiation process.

The Salesman describes that a common business process often starts with a rather rough specification. The customer sends some sketches or questions and asks 'What can you do with this?' This is usually the starting point for a process that can go on for months; where the salesman gets more and more information about the customer's needs. Often, it is about educating the customer about the robot's possibilities. But working in the industry branch also requires patience and long-planning skills. For this category of customers, a robot project may start every year or even more seldom. The salesman describes that 'You have to sow a seed all the time, so they can turn to you when it is time.' The Salesman spends three days on the road each week, meaning there is a lot of 'selling' in his work. You have to know the customer, his needs, and his organization. It is often useful to have a close contact with the customer company's management to evaluate if there will be finances for a robot investment. The Salesman has a quite good overview of what is going on and his average sales are approximately 15 robot systems

^{*} **Note!** This is not the same plant as the ABB Robotics plant.

a year. Due to the work needed for each project he declines 50% of the customers' inquiries. The frequent orders come from 10-15 customers and the average lead-time from request to sale is six months.

6.5.3.1 The organizing around the manufacturing industry sales

The Salesman manages his work quite independently. It is the *Concept Builders*, i.e. engineers from ABB Powertrain & Robot Automation, that give him the main technical support. He is also supported by ABB Robotics personnel but to a lesser extent. There is a close collaboration between the Concept Builders and the Salesman, and usually he is supported by them (with technical matters) in the interaction with the customers. There are always tough negotiations in his projects and the Salesman describes that he often needs to have some technical advantage up his sleeve, such as better work cycle times, to get an order. Once an order is won, he also assigns a Project Leader which is usually a person from the ABB Powertrain & Robot Automation plant.

6.5.3.2 Used information systems

The Salesman uses a lot of information systems and applications in his work (see the figure below).

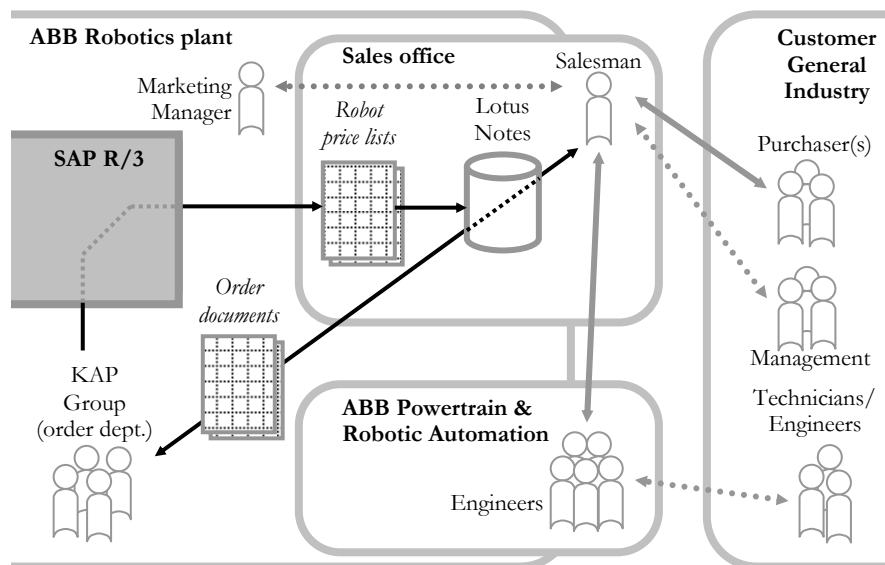


Figure 18 ► The sales organizing around 'general industry' [own illustration based upon interviews]

A *Lotus Notes application* is used for registering possible and on-going projects, something that results in statistics to the sales organization's manager. The Salesman has developed this application himself in a prior position at another ABB company. Beside that application, he uses the same *Robot Specification Form* in MS Excel as the other salesmen. He also has *personal notes* to keep track of the customers, but many of these self-made applications are rather static. To be able to take strategic decisions the information must be correct and it requires a lot of face-to-face communication internally to keep track on what is up next. The salesman has also created a personal 'memorandum' that he uses during his projects. The memorandum is structured so it notifies him about important issues during the sales process: 'Have you thought about this?' To be able to sell to the manufacturing industry, the Salesman also has to get products from other producers than ABB Robotics. This is why there are more information systems accessed and other applications used besides ABB Robotics.

Once a robot is sold it lives its own life. The only way for the salesman to get information about how it is used is through personal visits or through ABB Service if they have serviced the customer's robot.

6.6 Producing a robot

Before a robot can be produced at ABB Robotics, and represented in SAP R/3, the R&D department must have ordered the new product from the *Product Management* ('Produktkontoret' in Swedish). ABB Robotics Product Management gets their input from the market and sales organization and they decide what products to develop next. An equally important task is also to decide what products to remove from the robot product range, i.e. the Product Management sets the frame for what ABB Robotics shall offer their customers. The Product Management is not that dependent on SAP R/3 in their task, but the department's manager describes that their task would be easier if they could be supported by some kind of information system that would let them 'twist and analyse' all sorts of data such as; gross margins, customers, products, and so forth. But even if they do not use SAP R/3 as a decision support, they are directing the KAP Group (that creates the Robot Specification Forms in SAP R/3) by specifying what shall be a standard or extended offer.

A robot feature can also be produced even if it is not considered a standard or extended offer. Such customized offers are based upon customer demands (e.g. from the automotive industry). As has been described earlier in this chapter, a

Project Manager executes such customer demands. In these cases, the Project Manager is responsible for gathering the personnel needed to get the requested feature into production. An example may be a customer that requests a special 'dress-pack', which means that the assigned Project Manager gathers cross-functional teams to deal with the issues that need attention. The following descriptions of ABB Robotics business will follow the 'normal progress' where a feature or a robot is initiated by the Product Management department, but it also touches upon the 'project progress'.

6.6.1 How a robot is manifested in SAP R/3

The figure below illustrates the procedures between a 'product order' from the Product Management until final production.

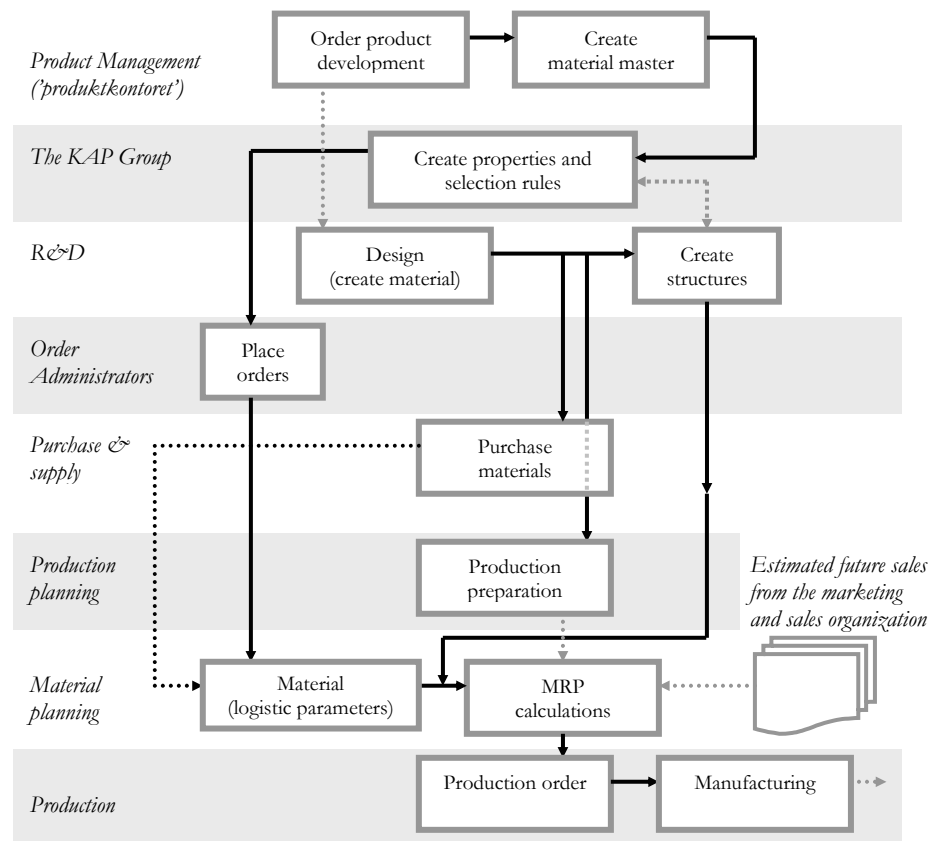


Figure 19 ► The product development according to ABB Robotics SAP R/3 [own illustration based upon process schemes and interviews]

The figure is a simplified overview of how SP R/3 is used. The scheme indicates 'steps' in SAP R/3 and it also shows how different departments work together (dotted lines indicates 'data' that is passed over from one department to another). The basic principle to manifest a robot in SAP R/3 is to have a *Bill-Of-Material* (BOM), which involves the *material* (components) that ABB Robotics purchases to their robots and the *drawings* belonging to these materials. The R&D department carries out the creation of materials based upon an order from the Product Management or from a Project Manager. The material does not need to be finished before ABB Robotics' personnel use it. Instead, the personnel (e.g. purchasers and production planners) can use the material in their work before the final version is released. This means that the purchaser can use a draft of a material in the quotation process with suppliers or that the production planners may put the future production of the not fully developed products into their MRP runs.

6.6.2 Dealing with an order

Once a robot is sold an order is sent to ABB Robotics *Order department*. The personnel that handle the order are housed close to ABB Robotics Sales and Marketing department as well as to the Project Managers, which means that they can easily be updated on what is said and done prior to an order. The order personnel are divided into an 'Order team' (called *Order Administrators* in this thesis) and a 'KAP Group' (called *Variant Configurators* in this thesis). The first category focuses on order administration and the second on the product structures in SAP R/3.

6.6.2.1 Registering an order

When an order is sent from a Salesman to the Order department it lands in a Lotus Notes inbox called *Robotics order mail*. Each week, one of the Order Administrators handles these orders and places the order in a separate Order database in Lotus Notes together with the other documents that have been sent from the salesman. The routine means that the Order Administrators can handle each other's orders and that they can cover if one of them is sick or on leave. When the assigned Order Administrator receives an order, he or she puts the order into SAP R/3 with customer information and the products requested. This results in an order receipt generated by SAP R/3, whereafter the order confirmation is sent to the Salesman as a pdf-file via email.

To be able to register an order the Order Administrator must have a Robot Specification Form that has been correctly filled in and a Customer Order Specification Form (COSF) that is used for statistics. The COSF states: salesman, end user,

robot application (welding, packaging, etc.), purchase order number, quotation references, customer segment, and so forth. Orders that do not have any COSF will not be treated. In such cases, the Order Administrator contacts the Salesman to get this information.

The *Robot Specification Form* that contains all the information about the robots comes in three forms: (i) *Standard offer*, which is ABB Robotics' basic offer. The selection document created as an MS Excel spreadsheet by SAP R/3 for the standard offer contains choices on a number of pages [an example; one robot model contained six pages]. The standard offer has the shortest delivery time. (ii) *Expanded offer* that holds many more selections and even more 'dress pack' options. This selection document contains choices on more pages, and when selecting an extended offer the delivery time will be longer. (iii) *Customized offer*, which is based upon a specific customer's requests. When a type of robot configuration is sold in huge quantities it may get a customized Robot Specification Form. The extent of this document varies and so does the customized offer's delivery time. Sometimes the salesmen has chosen incompatible combinations or mixed offers such as wanting a feature from the 'Expanded offer' delivered as a 'Standard offer'. When this happens, the Order Administrator has to contact the Salesman and get a new specification that can be processed in SAP R/3.

The Robot Specification Form and the COSF, and any other documents that have been sent with the order (e.g drawings and sketches), are stored in the Order database. This means that all the order history can be found at one place. The Manager for the Order Department thinks that SAP R/3's SD-module that is used for the order registering works well. There are of course times when the enterprise system slows down or stops, but it has certainly been an overall positive lift for the order administration. But even if SAP R/3 is a great support, the most important tool for the Order Administrators seems to be Lotus Notes databases:

The Order mail and Order database in Lotus [Notes] is ours. That is; made for us in the Order department. And sometimes it feels like you could not manage without it, because we work as a team. [With the databases in Lotus Notes] there is not any risk that something will be forgotten!

Order Administrator at the Västerås plant (2004)

The Order department also uses other information systems connected to the SAP R/3 systems as a transport administration system that offers logistic information from the transportation companies.

6.6.2.2 The 'KAP Group'

The 'KAP Group' is a part of the Order Department and they create robot configuration rules in SAP R/3. These rules support the Order Administrators by hindering them from booking faulty or impossible orders. Whilst the R&D works with the robot materials^{*} and sets the rules for their fundamental structures, the KAP Group sets the rules for which configuration combinations are going to be possible to order in SAP R/3. The Product Management department supports the KAP Group in specifying the options that shall exist in the Robot Specification Forms (see figure 19). The KAP Group, R&D and Product Managers work closely together, all with the aim of formalizing the robot structure and its configuration possibilities. The syntax in SAP R/3 is seemingly based upon common Boolean logic.

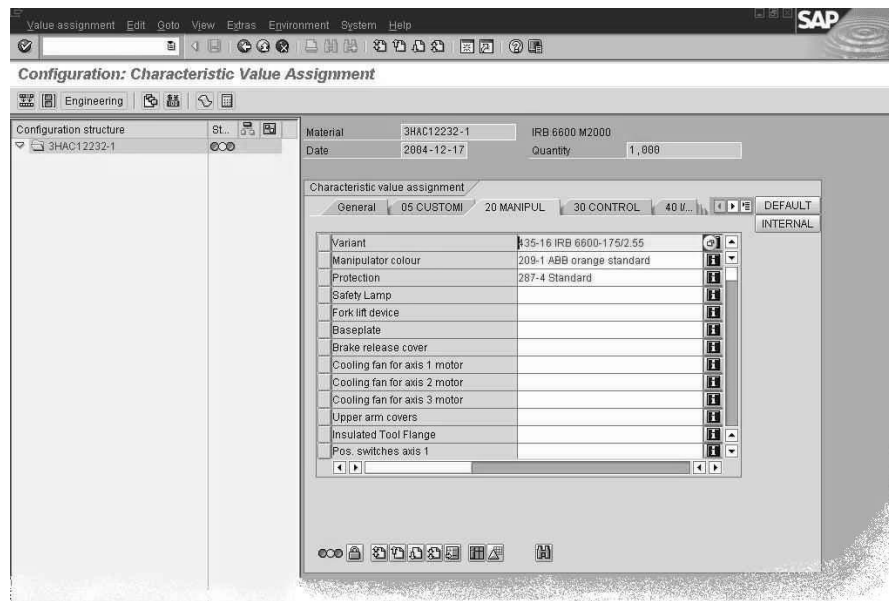


Figure 20 ► A screen dump from ABB Robotics SAP R/3 configuration view [modified, with courtesy of ABB Robotics]

As seen in the figure above, SAP R/3 is based upon a standard Windows environment with 'click' possibilities. A robot is selected in steps through the selection of

^{*} SAP R/3 sees every part of a robot as 'material'. The production of robots, though, involves a lot of parts, of which almost 80% are manufactured elsewhere. This thesis uses the name component for the physical parts that the robot is build of, even if they are bought as 'materials', 'parts', 'articles', and so forth. The naming material is hence SAP R/3's.

different ‘Tabs’ such as ‘05 CUSTOM’, ‘20 MANIPUL’ (the manipulator), ‘30 CONTROL’ (the controller cabinet), and so forth. A Variant Configurator describes how the configuration engine works when a robot is ordered in SAP R/3:

A robot shall maybe have a ‘foundry environment’ option. This means that the robot will lift newly foundered parts and lower them into water [which means that] it will splash and it will be hot! This puts an extra demand on the product – and some of the parts that are attached to [the robot may not manage this treatment]. Then we write rules that block unsuitable combinations.

KAP Group member at the Västerås plant (2004)

The Order Administrators also have the possibility to look into each configuration setting, but the Variant configurator describes that the SAP R/3’s solution is not that user friendly. Usually, this is not a problem as the KAP Group and the Order Administrators are located in the same office landscape. If they run into a problem, they simply ask one Variant Configurator for help.

SAP R/3 can indicate if a selection is appropriate and if the robot has been configured correctly. There is a system with green, yellow, and red signals used for indicating if a product is correctly selected. When the traffic light signals yellow or red more or other selections need to be done. There is also another signal beside these ‘lamps’ indicating if there are conflicts. Besides these indicators, the Variant Configurator has the possibility to write in text-based warnings and instructions in SAP R/3, but this is done with care. To avoid too many and too complex syntaxes, the warning texts are seldom written due to problems with getting an overview of how they relate to each other. This also involves a risk when moving from one robot to a new version. Another problem is that SAP R/3 hides ‘impossible’ combinations while the legacy configuration application showed all options even if they were not possible to select, i.e. you had a better overview. Whilst the Order Administrators need administrative and social skills, the KAP assignment is dependent on structural and logical thinking. The KAP Group’s mission is strictly ‘internal’ today but it has been different. The legacy system had a configuration system, but this functionality was not possible to achieve in SAP R/3 during the Freja project, so this functionality will be added later on.

6.6.3 Constructing and preparing a robot for production

Before a robot can be produced it must be constructed and the parts needed must be purchased, tasks that are performed by the R&D and Purchase Departments.

6.6.3.1 R&D

The development of robots is divided into two sub-processes: the R&D process for 'mechanical & electrical' and for 'software'. Whilst the Constructors in the former group use the SAP R/3's PD-module on a daily basis, the latter only uses SAP R/3 when it is time for completely new software. This means that when the Software Engineers need to use SAP R/3, they usually contact a Mechanical Engineer who uses SAP R/3 more frequently and ask for help.

The R&D Departments often work together with the suppliers and sometimes also with the customers. The advantage with having a customer involved in the development process is that their need can be considered when creating the robot or the robot feature. The formalization of the constructions that such cooperation results in is SAP R/3's Bill-Of-Material (BOM) that has all of a Robot's components related and listed. The 'material' is represented by a number in SAP R/3 (see figure 21), which is the entity to which all drawings and other information is attached. Basically, a component (i.e. 'material') has a profile containing; (1) *properties*, (2) *property values*, and (3) *connections* (i.e. relations to other material). These are the basic structures that manifest a robot in SAP R/3. The R&D personnel set the pace for when a robot can be produced and when components can be ordered. By using different statuses in SAP R/3, the R&D personnel communicate how the development process has proceeded (i.e. are the drawings ready, is it time for purchase, and so forth). The construction work involves a number of software, such as SolidWorks and AutoCAD, and the files from these applications are stored in SAP R/3. One of the R&D Process Owners describes that the PDM functionality in SAP R/3 unfortunately is not as good as the old PDM system. A R&D Process Owner mentions that: 'It was possible to improvise in the old PDM system, but this is devastating in SAP R/3!' The new enterprise system is more difficult to use and faults are harder to trace, especially since they usually turn up later in the process (i.e. at other departments). This means that the R&D personnel must be active in communicating with other departments to hinder possible mistakes and avoid problems.

6.6.3.2 Purchasing management

The purchasers' tasks vary depending on the assignment, but their overall mission is to (i) manage the contacts with suppliers and continuously evaluate them as partners to ABB Robotics and (ii) negotiate purchase conditions for each component bought. The Purchasing department works closely with the R&D department and the Project Managers and they also evaluate if a component can be produced

technically, economically, logistically, is purchasable, and so forth. The department is divided into those who carry out supplier evaluations and *Purchasers* who work primary with the commercial conditions such as negotiations, agreements, price management, collecting and evaluating quotations, and so forth.

In parallel with the development of a new product, or if a Project Manager has a specific customized order with a component that is not standard material, a Purchaser is involved. It is SAP R/3 that sets the agenda for what the Purchasers need to do in the near future. To get a purchase proposal SAP R/3 needs; (i) an order or a planned production, (ii) the material structure (BOM), and (iii) an MRP run. The order or the planned production can be on a prototype and the material can be 'under construction', but this information forms the basis for the purchase process. At this point, the purchaser sends out a request for quotations to a selection of suppliers.

Before a company is accepted as an ABB Robotics supplier it must fulfil ABB's standard supplier demands. This means that the supplier must pass the *Supplier Quality Process* (SQP). Roughly, this can be described as a survey covering the supply company; the management and quality systems, its production, its strategy, and so forth. When an SQP is done, more evaluations are carried out on component level, focusing on the delivered product, the logistic routines, etc. All the information that the purchasers collect results in a 'supplier status'. A Purchaser describes that the supplier can be divided into three categories spanning from those who they (a) can continue to develop business with, (b) who are 'frozen' (i.e. they do not have any business together at the moment), or (c) are 'on their way out'. The purchasers also use the *Kraljic Matrix* as a support when evaluating a supplier. This matrix helps the supplier to evaluate if the suppliers resource is a scarcity or if it is 'catalogue material' easily available.

ABB Robotics has more than 200 suppliers and approximately 40 of them are considered 'strategic', which means that they may receive some extra attention in the continuous business development. The supplier evaluations that the purchasers carry out, and the handling of requests and supplier quotations, are handled in *Lotus Notes databases* and *MS Office applications*. This means that a supplier's status is not displayed in a SAP R/3's MM-module. A Purchaser describes that the supplier's present status 'is information we want to keep for ourselves!' A supplier's position is thereby not seen in SAP R/3, it is only the Purchasers who hold this information. When a Purchaser has evaluated the incoming quotations and when the supplier has been checked (i.e. its 'status' is known) the Purchaser selects a

supplier that receives the ‘contract’. When an agreement is reached, the Purchaser writes in the supplier’s contact information and the purchase conditions into SAP R/3. Thereafter, the Purchaser ‘drops’ the supplier and the component to the Production Planning personnel. Often the purchase process also ends with a sample test on some components to see that the supplier delivers as promised. Thereafter, it is the Production and Material Planning’s task to place sub-orders and to decide how to order the components (via EDI, SupplierWeb, auto generated email, etc.).

6.6.4 Planning and producing robots

The *Production and Material Planning* takes over when a Salesman (or the Production Management) has placed an *order*, when the robot is *constructed* by R&D and when the components are purchased (see figure 19). The Production and Material Planning sets the parameters needed to do an *MRP run*, which involves the (i) product structures (BOM), (ii) operation lists (i.e. the work operations), (iii) lead-times, (iv) quantities, and (v) probabilities (in percentages). They also manage the ‘Master plan’ that holds the sales prognoses. Based upon the Master plan and the present order status, an MRP run is done each night, resulting in a material need for the upcoming months. The Production and Material Planning also uses SAP R/3 for a comprehensive prognosis calculation that is done each weekend. This calculation results on material prognosis for a year, information that is also communicated to the suppliers.

On a process level, the Production Planning and Material Planning work side by side. The figure below offers an overview of how the robots get produced and how SAP R/3 and other information systems are used in this process. As illustrated, the sales and business planes are not manifested in SAP R/3, but they are manually written into SAP R/3’s Master plan. The present orders and the Master plan lay the foundation for the production. This means that the material need (i.e. information for the material planning) and the production capacity need (i.e. the Production Planners’ detail planning) are calculated and presented.

Once the production is started, the components will be in place. The material handling is supported by a database called *Yellow cards* (the former solution was simply a yellow card register) that controls the components’ warehouse positions. Due to the robots construction – it is hard to find a ‘standard robot’ but they are all unique in some way – the requested components are of various quantities, which is why they are not given any specific warehouse place. Instead, the components place is dynamical, a task that the yellow cards system handles.

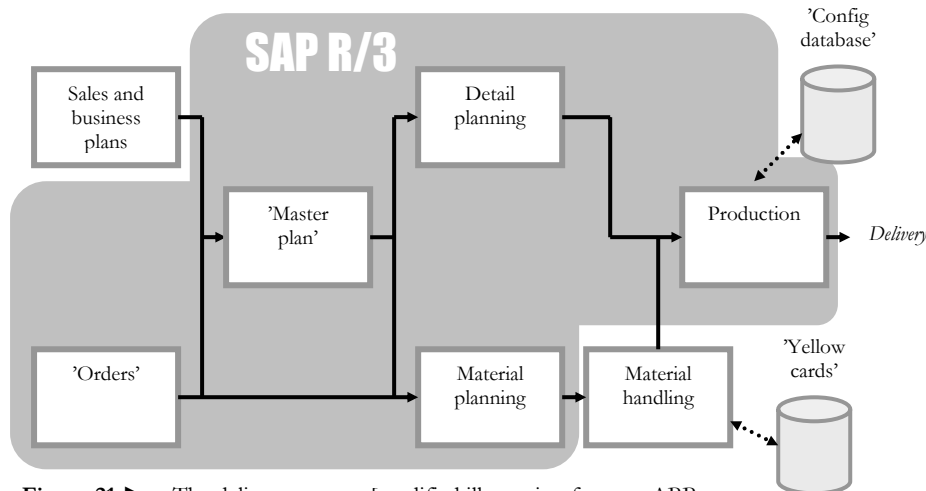


Figure 21 ► The delivery process [modified illustration from an ABB Robotics process map]

When a robot is produced it is given a unique identity marked with a bar-code. The bar-code is used to identify the robot and there are also bar-codes on important components. The robot and component identities are sent to the *Config database* so that can be used to identify and trace any robot.

6.6.5 The robot 'has left the building'

Once a robot has been produced and sent, resulting in a delivery and an invoice created by SAP R/3, the after market is managed by *Customer Support*. This group manage the *Config database*, an information system that has received information about every robot produced and serviced since it was implemented in 1994. Based upon the information received from SAP R/3 and the service companies that uses the *Config database*, it has information about more than 100.000 robots and their components. Customer Support and ABB's sales and service companies constantly update the information in *Config database* through an application called *Web config*. The *Config database* is also used to send messages about *directed upgrades*. If a robot is found to have flaws in the software or hardware, *Web config* is used to contact ABB's service companies to send them customized information about what robots to upgrade, and when the work is done they report back in the same system. The *Config database* is also used for claim handling. The local sales company access the *Web config* and report claims directly to the Customer Support department who can supply spare parts. The *Config database* is, thereby, a valuable tool in ABB Robotics' quality processes.

The Config database can also be used for queries such as ‘how many IRB 4400 have been delivered during 2004’. One could also think that it would be a valuable tool for directed offers to customer and to see product trends but this is, though, done to a lesser extent, partly depending on that it is not made for data mining. Some of the data that SAP R/3 feeds it with, such as the customer, is stored as ‘open text fields’. An IT and Business Developer at Customer Support describes that searching such data is difficult: ‘[As an example:] the one that reports the robot in SAP R/3 may write a customer such as General Motors in many ways [e.g. ‘GM’, ‘General Motors’, ‘General Motors Corp.’, ‘GM Corp.’, etc.]’. Customer Support also uses SAP R/3 in their business, but not the CS-module as they do not have any service of their own. Instead, they use the MM- and SD-module to keep track on their own materials and the orders for spare parts.

ABB Robotics sales and service organizations can also access a web based service called *Parts on line*. This web based application sends its data to *CompScot* which handles deliveries (e.g. shipping and invoices). These applications handle spare part orders and they let the sales and service organizations get spare parts from a large ABB warehouse in Germany, where all orders are handled and sent within 24 hours. This procedure is handled automatically if the ordered spare parts are standard, i.e. the Customer Support does not have to treat such orders manually.

We now move on to the customer and supplier descriptions.

6.7 The Volvo Cars project

Volvo Cars (Volvo Personbilar AB) is a Swedish car manufacturer with high standards and an outspoken safety and environmental profile. More than 13.000 people work at Volvo Cars plants in the Gothenburg region and more than 70% of Volvo Cars’ total numbers of employees (approximately 27.500 people) are located in Sweden. *Ford Motor Company*^{*} bought Volvo Cars in 1999 and nowadays Volvo Cars is a part of Ford’s *Premier Automotive Group* (PAG, including Aston Martin, Jaguar, Land Rover, and Volvo). Within Ford Motor Company, Volvo Cars holds the ‘Centre of Excellence for Safety’ and within PAG they hold the ‘Centre of Excellence for Telematics’. Volvo Car Corporation (‘Volvo Cars’) and AB Volvo (‘The Volvo Group’) jointly own the Volvo trademark.

^{*} Number 6 on the *Fortune 500* list (2003).

Volvo Cars has two production plants in Sweden, Torslanda and Uddevalla, plus five production plants in other countries. The Torslanda plant that was visited for this case study produces Volvo's S80, V70, XC90, and XC70 models (i.e. Volvo's larger models). In a global perspective, Volvo Cars is a rather small actor with 456.000 of the more than 60 million cars sold in 2004. But in Sweden, which is the second largest market after the USA, every fifth new car that is sold carries the Volvo logo!

6.7.1 Volvo Cars purchase of robots

This illustrating 'customer case' evolves around a production development project that involved more than 200 robots, and ABB Robotics was one of the companies that competed to be this project's supplier. Before Volvo Cars selected the robot supplier, they drove a purchase process that involved both commercial and technical evaluations. Ford Motor Company's 'general agreement' on basic robot configurations worked as a framework in the purchase process but besides the general agreement, Volvo Cars also had demands of their own. One key aspect for Volvo Cars was the robots life cycle cost, another demand was that the robot supplier should offer 3D-models that Volvo Cars could use in their RobCAD simulator. The 3D-models should also be offered 'free off charge', i.e. be included in the robot purchase. *RobCAD* is a simulation environment that the software vendor Tecnomatix has developed, offering the user a 'general tool' to simulate their production equipment. RobCAD accepts models created in, e.g. AutoCAD, which means that it can simulate equipment from a variety of suppliers, as long as the supplier of the equipment can offer Volvo Cars a 3D-model.

Volvo Cars' engineers use RobCAD to design and verify 'line-ups' and 'robot cells' before the production equipment is in place. RobCAD is also a reflection of the 'real' production lines when they are in place. If anything is changed in the line, it will be changed in the RobCAD simulator and vice versa. When Volvo Cars' engineers have made their simulations, the results from RobCAD are transformed into Volvos Off Line Programming (VOLP). The VOLP application is based upon RobCAD's functions, but with extra features and modifications added, and it is used for programming the robot before it is in place. When the off-line programming is done and the robots are mounted into the production line, the robots movements are calibrated before the programmes are downloaded into the robots. This initial calibration must always be done as there is usually a slight discrepancy between the 'virtual' and the 'real' robots placing and movements.

6.7.2 Structuring the robot requests

Volvo Cars' purchase process involves both *Purchasers* (assigned 'machinery and tooling purchases') and *Manufacturing Engineers* to deal with the commercial and technical issues. One could assume that ABB Robotics would have an advantage in this process, being a Swedish brand, and that is partly true. But Volvo Cars also have robots from other suppliers in their present lines, so the technical and commercial issues are crucial. The Volvo Cars personnel interviewed describe that they do know the ABB staff through earlier business, but the same goes for ABB Robotics' competitors. Even if the suppliers of robots are well known by the Volvo Cars personnel ('they are not that many'), the business between the companies is carried out strictly professionally.

Volvo Cars strives for a 'commonality' within the company, so for a given project an *exclusive supplier* and a selection of validated robot models are selected. The requirements that Volvo Cars have on suppliers can roughly be divided into (a) *the robot specification* and (b) *the complementary software* (i.e. the 3D-models for the Rob-CAD environment). The robot specifications involve general specifications such as functional demands, cable standards, motion sensors, cabinet equipment, and so forth. The 'application level', i.e. the specifications that hold the robots 'dressing' (i.e. if it shall weld, gripper, paint, etc.), is more detailed. An example of this detail level is the stated 'inverter' (Swedish: 'Svetsvakt') that shall be from the electrical manufacturers Bosch, Matuschek, or another preferred supplier. For such parts, Volvo Cars already has other 'general agreements' that a supplier such as ABB Robotics can use when purchasing the parts. This also means that the selected supplier (in this case ABB Robotics) can use Volvo Cars prices and delivery conditions by calling upon Volvo Cars' agreement with e.g. Bosch. Another aspect with these general agreements is that Volvo Cars can turn directly to the supplier, in the exemplified case to Bosch, when they need spare parts or services. Practically, the 'application level' resulted in 'Volvo specifications' for each robot application needed such as: welding, gripping, gluing, and so forth. This resulted in 'compliance documents' that ABB Robotics and the competing robot suppliers had to complete. During this process, there is a continuous dialogue between the business partners, involving both engineers and commercial personnel. The result of this business process was a general agreement based upon Volvo Cars' specifications, ABB Robotics' compliance documents and technical specifications to which a pricelist was tied.

6.7.3 The 'general agreement' principle

When Volvo Cars has signed a 'general agreement' it is valid for a specified period (usually 2-3 years). During this time, Volvo Cars or any company they assign for a major project can refer to the agreement when ordering products. As with the inverters that ABB Robotics can purchase from Bosch for Volvo Cars robots – the same principle applies to the robot specifications that Volvo Cars has made agreements for with ABB Robotics.

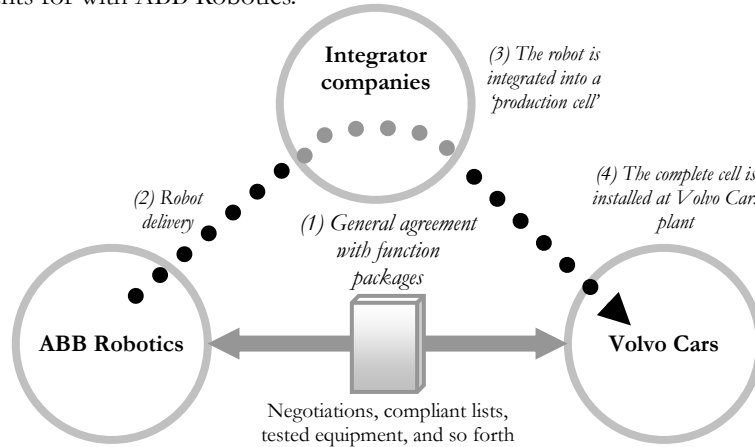


Figure 22 ► The principle with Volvo Cars' general agreements [own illustration based upon interviews]

When an 'integrator', i.e. those companies that build production lines, receives an order from Volvo Cars, they use the general agreement, whereafter they get the robots at a price and with a basic functionality that is approved by Volvo Cars. As illustrated in the figure above, (1) Volvo Cars and ABB Robotics have agreed about the function packages that are given prices and technical content. In parallel, Volvo Cars has also tied a number of 'integrator' companies to the project. These integrators must use ABB Robotics' products according to the specifications in the general agreement between ABB Robotics and Volvo Cars. When it is time to set up the production lines at Volvo Cars, the integrators order their robots from ABB Robotics who (2) sell and deliver to the integrators. The robots and their function packages, including application 'dressing', are then (3) integrated into production cells (i.e. used together with other equipment that the integrator has selected to get the functionality they have promised Volvo Cars). When this is done, (4) Volvo Cars get their production cells, designed by the integrator but holding the robots and the functionality that Volvo Cars has demanded in their business with ABB Robotics. This way of working means that there is a common-

ality in the production cells, even though there can be several ‘integrators’ involved. Another factor is that the supplier of the production equipment must guarantee that the product will live for at least ten years in the form of service and spare part agreements, things that the integrators can hardly do. The project studied involved purchases from both integrators and Volvo Cars. The integrator companies purchased the majority of robots, but Volvo Cars has its own production line planners who designed and arranged some of the new production lines

6.7.4 Information systems used

The purchase process described involves some information systems. The ‘general agreement’ is basically a binder filled with customized Robot Specification Forms and pricelists [looking like MS Excel spreadsheets]. During the negotiation and compliance activities, there is also other information sent such as product specifications, CAD-drawings, and technical documents by mail or by CD-ROM (digital 3D models). When it is time for Volvo Cars to order robots they use Ford Motor Company’s web based purchase system^{*}. When Volvo Cars needs a robot, a ‘Property Manager’ (Swedish: ‘rekvisitör’) at the production plant sends a request to one of the purchasers that supply the production plants with equipment. A robot order is thereby written into the purchase system requesting a product that fulfils the general agreement. When the order has been registered in the purchase system, the supplier can observe it on a supplier web page or get an email. When the supplier has processed and sent the product to Volvo Cars, they notify Volvo Cars in the purchase system. This generates a message to the ‘Property Manager’ who accepts it when he receives the product. Thereafter, the order is approved, leading to the generation of a self-invoice by the purchase system, whereafter the supplier will receive his payment for the delivered product.

6.8 The partner Specma Automation

Specma Automation (called Specma in this thesis) located in Laxå is a part of Specma AB, a company whose business is engineering technology. The company is owned by Investment AB Latour, which is a company group with more than 3,000 employees. Specma’s office and workshop in Laxå houses between 22-40 employees depending on workload, and many of the people involved in Specma’s projects are sub-contractors or hired as consultants. As a company within the

^{*} Due to a change of purchase system in adjacent to the case study it is only referred to as the ‘purchase system’.

Latour group and, at the same time, having a small office in Laxå has its advantages. Being a part of a large company means that Specma can compete for large projects that require a stable financial status, and being a small office means that it is possible to attract the local customers. The Business Area Manager describes that these two sides of Specma are used when needed; the local manufacturer often wants the small company's 'closeness' whilst customers like the car industry require financially stable business partners.

6.8.1 Robots as a business idea

Specma was founded 1993 and they describe themselves as 'system integrators' ('systemintegratörer' in Swedish). Specma offers their customers custom-made production solutions and they are specialists in handling and foundry applications that involve a 6-axis robot. Specma Automation is involved in any project where their customers need a solution that automates their production processes except for welding applications. Besides being an engineering company that designs automated robot-based systems, Specma Automation also offers their customers training, aftermarket support, pre-studies, and other services. As an actor on the industrial market, quality and environmental standards are considered obvious.

6.8.2 Being a partner – a blessing and a curse

Many of Specma's employees have a background at ABB or ASEA, which means that they have a good knowledge about ABB's products. Specma have been a Channel Partner for some years and they have been doing business with ABB Robotics since the company was founded. Even if the formal contact is the *Salesman Channel Partners* in Gothenburg, they know many other people at ABB Robotics and other ABB companies that help them in their work. Specma also participates in all those activities that ABB Robotics arranges for Channel Partners such as product presentations, seminars, and so forth. The partnership with ABB Robotics is described as having both its upsides and downsides. ABB is a well recognized company with goodwill in the industrial market, something that can be beneficial for their partners. But being a Channel Partner also brings the risk of being perceived as only a sales company working for ABB:

Many customers see Specma as a robot supplier, but we deliver systems and gladly the [equipment] training also. The robot is only a component, indeed a vital one, amongst many others. But we have a very good relation with ABB, which is an asset.

Business Area Manager at Specma Automation (2005)

The robot stands for 20-60% of the total project cost, i.e. Specma also adds complementary equipment and features besides the robot. Specma orders 60-80 robots during a year. But having this partnership with ABB Robotics and using so many of their robots also means that some projects are out of reach:

A customer with many yellow [robots] will not call us. Our relation [with ABB Robotics] may thereby also be a disadvantage.

Technical Manager at Specma Automation (2005)

The Technical Manager describes that there is not that big a difference between orange, yellow or white robots* that they would not be able to use other products. The advantage of having a partnership with ABB Robotics and using their strong brand name thereby has its price. The advantage is obvious; ABB Robotics is successful in its home market and they have won contracts with many of the large companies in Sweden. But at the same time as a Channel Partner gets their benefits of a partnership, they also miss the opportunity to do business with some potential customers as they are being pooled together with ABB. Specma's largest competitor is also ABB Robotics' own sales organization that sells robots directly to the manufacturing industry. Despite this, ABB Robotics' handling of this seemingly conflicting interest is seen as professional.

6.8.3 ABB Robotics' handling of channel partners

Being a Channel Partner means that you receive some special treatment, but it also means that you are directed to a personal Salesman. Specma's contact at ABB Robotics (the Salesman Channel Partners in Gothenburg) seems to have had an increased workload during the last years, which has lead to a longer response time. The personnel at Specma can of course use the Robot Specification Form that ABB Robotics has sent them and carry out the calculations and configurations themselves, but as a respondent said: [with a tone of humour]:

If we use [the Robot Specification Form], we take away the Salesman's job!

With a risk of losing 50% of the sales offers, it is time consuming to go through the Robot Specification Form for each customer contact. The present handling of quotations also involves risks; it opens up for errors and mistakes but they think there are solutions ahead.

* The Technical Manager describes robot types based upon their color. ABB Robotics and KUKA's robots are orange, Fanuc's robots are yellow, and Motoman's robots are blue.

The partnership with ABB Robotics is sometimes passed over by other agreements. During the last years, the robot sales have continued to increase and this market has to 99% something to do with cars. Nowadays, fewer manufacturers have their own 'line builders' (i.e. integrators) which means that Specma regards the future as bright. But many of the large actors, such as Volvo or Scania, are writing agreements with ABB Robotics, meaning that Volvo or Scania provides Specma with robots in those projects. When they construct solutions for customers with ABB Robotics' agreements, Specma uses the Salesman that the customer has specified [as an example; when working for the car industry, it is the Salesman Automotive that handles the order]. The Business Area Manager does not seem to think there is anything wrong with the agreements and the procedures that follow, but the aftermarket can cause problems. Often these agreements specify that ABB Robotics is responsible for the aftermarket, but the robot users often contact Specma as they now have designed the system. When this happens, Specma's Engineers usually help the users with their robot problem, even though ABB Robotics should handle it. The same goes for spare parts: Specma is often contacted about issues that ABB Robotics should handle due to the end-customer's misinterpretation of who it is that is responsible.

6.8.4 Information systems used

Specma uses the enterprise system *IFS*, the financial transactions (see the figure below). They also use software such as *AutoCAD*, *SolidWorks* and other product selection applications that they receive from different equipment manufacturers. The Business Area Manager also believes they were one of the first to buy ABB Robotics' *RobotStudio* which they pay a yearly fee for. RobotStudio is used when designing robot cells with one robot, but the software does not support multiple robots working simultaneously. When Specma's project involves whole production lines, they need more powerful software such as *Igripper* (a production equipment simulation tool). During these larger projects, Specma usually hires the competence needed. Many of the hired consultants are theoretical experts but they seldom have the practical skills. When combining Specma's practical experience from numerous projects with these engineers' theoretical skills, the results are great.

During the projects ordinary *MS Office* applications are used as well as *MS Project* to track the projects. Being a partner also means that you are constantly updated with product information via CD-ROMs. Besides this, Specma has access to a *web-server* where they can download product information. The business documents needed to get robots from ABB Robotics are usually sent by *email*.

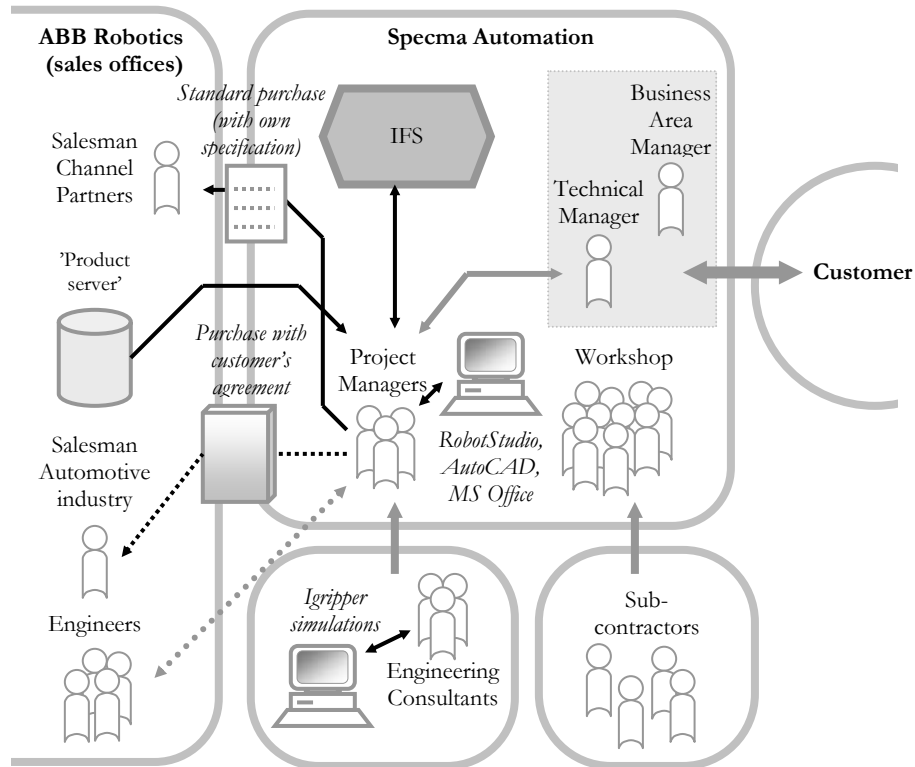


Figure 23 ► Specma Automation's information systems and their business with ABB Robotics [own illustration based upon interviews]

Specma uses the order routines that IFS supports and they also send the project documents as they are. There is, in other words, no formalized way of requiring information or sending in orders. IFS does not contain that much information about the robot *per se*, i.e. the robot is only a cost beside other costs that will be addressed a certain project account.

The next section describes a customer that orders robots more seldom. The customer that will be described belongs to ABB Robotics' customer segment 'manufacturing industry'.

6.9 SKF Mekan's robot investments

The *SKF Group* is an international manufacturer of rolling bearings and seals founded in 1907. Today, SKF is represented in more than 70 countries and has more than 100 production plants around the world. SKF Mekan AB is a manufacturer of bearing carrying units (with diameters below 1000 mm) located in

Katrineholm, Sweden. Their production plant has approximately 180 employees and most of them are directly involved in the production. SKF Mekan is in a branch where there is a continued need for rationalization, something that may be realized with the support of robots.

6.9.1 A late history of robots

The Manager for quality and production development describes that a robot is never a main issue. From SKF Mekan's perspective, it is just one possibility among others when looking at how to make the production more efficient. As he sees it, a robot can be the solution to three things: (i) economics, (ii) ergonomics and safety, and (iii) quality. A robot is, in other words, just production equipment as any other. SKF Mekan has more than ten robots in their production and all of them are from ABB Robotics. SKF Mekan has embraced more and more technically complex solutions during the last ten years. The first robots they bought in the middle of the 90s handle simple 'picking tasks', moving material from one place to another, whilst the later ones locate the material with optical sensors.

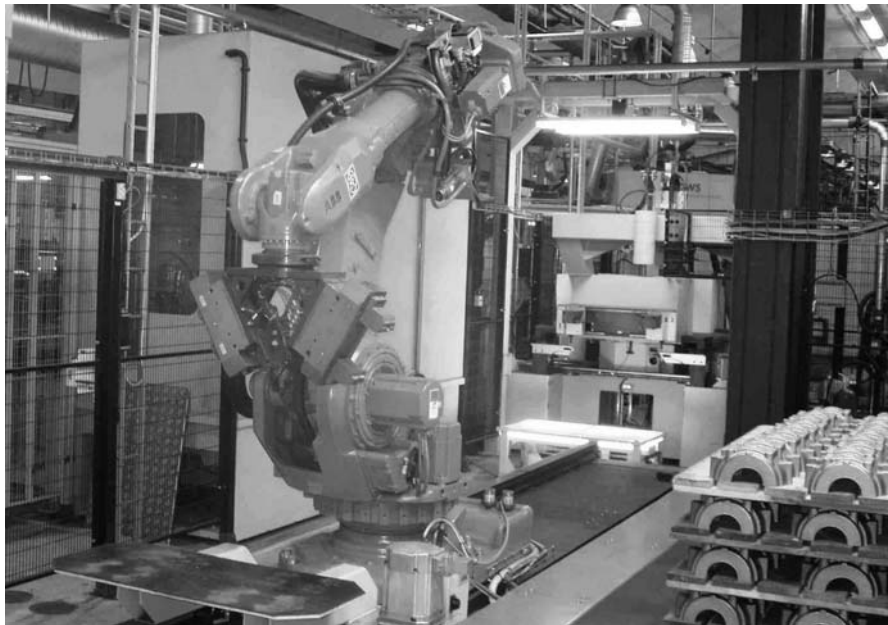
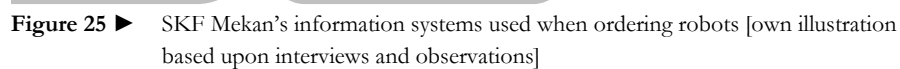


Figure 24 ► The latest robot installation on motion track [with courtesy of SKF Mekan AB]

The newest robot investment involves two large robots working simultaneously, loading CNC machines with material. This installation includes both a robot with motion tracks (see the figure above) and optical material recognition. The Man-

SKF Mekan uses the enterprise system *Movex* as their business application (see figure below). If the Manager orders a robot system, the internal routines direct him to do it together with a Purchaser, but technically he can order a 'robot system' in *Movex* by himself. This means that *Movex* does not limit the purchase of robot systems: he uses the specifications he wants together with the stated cost in *Movex*. This means that the communication tool used with the selling company can be whatever fits. Often, email with attached drawings and other documents are used for this communication.



SKF Mekan has also received a demo of RobotStudio but the Manager does not think such software would be valuable to him. RobotStudio is developed for ABB Robotics and this means that it has a quite narrow application area. The Manager uses *3D Create* instead, a ‘general’ simulation programme, that can be used to sim-

ulate both robots and other equipment. 3D Create is sponsored by the robot manufacturer KUKA that offers digital models of their products. The Manager describes that the 3D Create simulation is useful when he wants to show SKF's management possible improvements in the workshop.

Thereby, the customer description ends and we move over to the suppliers.

6.10 YIT supplies application cabinets

The *YIT Group* is a Finish company with 22.000 employees in eight countries in Northern Europe. Sweden is YIT Group's second largest market and this supplier case takes its starting point at one of YIT Sweden's branch offices in Kvänum (this office is called 'YIT Teknik Kvänum' and it will be referred to as YIT Kvänum in this thesis). *YIT Kvänum* offers custom-made electrical solutions to the industry and there are more than 20 people involved in the manufacturing and assembly plus 20 people working with electrical installations in the field.

6.10.1 The business with ABB Robotics

YIT Kvänum has been doing business with ABB for more than 10 years, starting with ABB Flexible Automation hiring some of the Branch Manager's personnel when they had a peak in their workload. The business contact was then inherent by ABB Robotics when some of ABB Flexible Automation's was reorganized. Today, the major business with ABB Robotics involves the construction and assembly of their application cabinets (called application controller in the product description in section 6.3) shown in the figure below. YIT Kvänum assembles all the application cabinets that are used for spot welding and ABB Robotics has stood for 40-50% of YIT Kvänum's production during the last year, but the normal workload is usually 25% of YIT Kvänum's turnover.

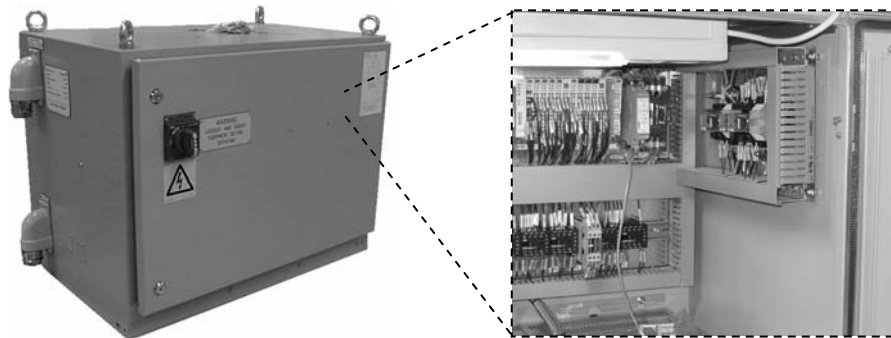


Figure 26 ► A spot welding application cabinet [photo montage with courtesy of YIT]

6.10.1.1 Being an ABB supplier

The Branch Manager describes that the business with ABB Robotics runs well with continuous contacts and orders. ABB Robotics made a supplier overview a couple years ago and they had remarks on YIT Kvänum's test protocols. This led to the development of a new test protocol in collaboration with ABB Robotics and today everything works smoothly. The Branch Manager describes it as: 'This is what they want, and this is what they get!' The application cabinet manufacturing also involves the documents and manuals that follow the cabinet, and these documents are partly sent to YIT Kvänum from ABB Robotics. But the routines described do not distinguish ABB Robotics from any other large customer; YIT Kvänum receives similar demands from their other customers as well.

6.10.1.2 Dealing with large projects

Having ABB Robotics as a customer involves many contact people. Both the Branch Manager and a Constructor mention that they are in contact with a lot of people at ABB Robotics: purchasers, engineers, and those who order the cabinets. The standard order usually comes from the ABB Robotics plant in Västerås and they are also the receiver of the application cabinet produced. But it also happens that they receive orders and send the cabinets to the sales offices, as during a recent project, even if the majority of orders come from Västerås. There are also times when the end-customer requires a specific cabinet component, as in the Volvo Cars project described in section 6.7, which involved a new complex cabinet with higher security, more couplings and a special type of inverter. The treatment of this project was special as every change had to be approved by both the plant in Västerås and the sales office in Gothenburg.

6.10.2 Information systems used

YIT Kvänum handles their orders in *WorkOffice*, an older administrative system from the vendor Hogia (see the figure below). WorkOffice has been used for some time and unfortunately the vendor has stopped with the support and update service on that software. A full MRP system would be an advantage but YIT Kvänum is too small to manage such a system. The YIT Group has future plans to implement a new enterprise system and the Branch Manager hopes that it will have an order module that fits their business. Today, they get their order numbers and packet labels from WorkOffice but they also use a financial system called *PAM*. This financial system is used to keep track of the orders financially and it is also used to get the invoices that are sent to customers as ABB Robotics. PAM has an order module, but that module does not fit YIT Kvänum's (called YIT in

the continuing text) processes, which is why they have developed their own application. One of YIT's employees has made an *MS Access* application that is used as a *planning system*, scheduling when to manufacture a product. The MS Access application has construction and manufacturing time stored and it then calculates backwards, in a similar way as MRP systems, to get the time when the manufacturing of a product must start. Even if the planning system has been a great enhancement since they used manual lists, they still use *MS Excel spreadsheets* to keep track on large projects.

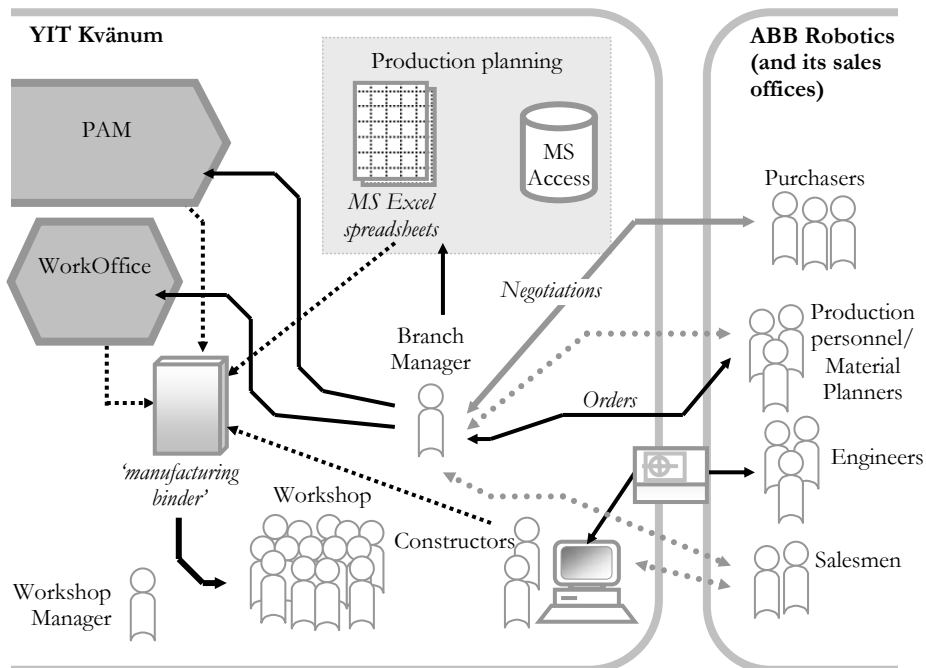


Figure 27 ► YIT Kvänum's information systems used for order handling [own illustration based upon interviews and workshop observations]

When ABB Robotics order an application cabinet, usually via fax, it is registered in WorkOffice and PAM and thereby scheduled for production in the MS Access application or in an MS Excel spreadsheet depending on how many shall be produced. When this is done, the Branch Manager or the Workshop Manager gathers the necessary order information and drawings in a binder (called 'manufacturing binder' in the figure above) and places it in the production queue. Roughly, each order is a customer specific one, but YIT seldom knows the end-customer except in large projects. In parallel with administrating the binders, the material needed to

produce the cabinet is ordered from YIT's suppliers. When the workshop has assembled the ordered cabinet, they arrange the transport and then they leave the dispatch note to YIT's administrative personnel who declare the delivery completed and print out the invoice in PAM.

Besides manufacturing cabinets, YIT supports ABB Robotics with construction work. YIT's assigned Constructor describes how he spends about 80% of his time working with CAD. He usually receives some basic data from ABB Robotics engineers as pdf-files via email. He also mentions that he normally uses AutoCAD, but it happens that ABB Robotics customers require other CAD formats, something that they can fulfil. As in one project when the end-customer wanted all drawings to be made in a specific CAD environment. YIT heard if there would be more requests for such format, which ABB Robotics said it would, which is why they decided to acquire such a CAD licence and send their constructors on courses. The interviewed constructor was the first to get such training and he managed the first project with that CAD application himself. There are, in other words, sometimes requirements that do not come from ABB Robotics themselves but from their end-customers. If these have a bearing on the future business, YIT tries to comply with that request.

6.11 Kablageproduktion and state of the art 'dress cables'

Kablageproduktion i Västerås AB is a company within the *Lagercrantz Group*, a company that manufactures and deals with electronic and communication products. Kablageproduktion was founded in 1995 and they took over Cable Commercials' business that had started in the late 80s. Everybody in Kablageproduktion's management group has a past at ABB Robotics and the Managing Director describes that they have lived in symbiosis since the start. Kablageproduktion has approximately 75 employees and 15 extras on their payroll. They manufacture and assembly cables and other electronic equipment for customers like ABB, Bombardier, and General Electrics. ABB is the largest customer group and ABB Robotics is the single biggest buying customer. The company has had a continuous growth during the last years and they have also expanded their production plant.

6.11.1 Working within a niche market

To be able to compete within the cable branch, Kablageproduktion only produces small and midrange volumes of what they describe as 'complex cables'. The lead-times are usually short, meaning that they need to work in close collaboration with

their customers. The Logistic Manager mentions that most of their materials have longer delivery times than what they have to their own customers. This means that they are dependent on frequent information from their customers regarding the upcoming orders.



Figure 28 ► [On the right side] An ABB Robot with Kablageproduktion's dress cable [with courtesy of ABB Robotics]

The power cable that ABB Robotics uses in their robots is custom-made to have an extreme flexibility (see figure above). The cable is bought on cable rolls in batches on 3.500 meters, which means that each purchase of such cable is in the million SEK class. Besides offering these state of the art cables, Kablageproduktion also uses parts and suppliers that ABB Robotics has specified, i.e. they can be directed to ABB Robotics' sub-contractors.

6.11.2 A closeness to ABB Robotics

Having owners and employees with a past within the ABB Group means that Kablageproduktion has an insight into ABB's business and their processes. Almost 80% of Kablageproduktion's business is carried out for ABB companies and ABB Robotics' engineers are usually in their workshop on a continuous basis. Kablageproduktion does not offer R&D but they usually support ABB Robotics in their development. If there are any problems, they are usually solved rather quickly:

We have a close cooperation [with the purchaser at ABB Robotics]. If there are any problems, we can have lunch together and sort them out.

Managing Director at Kablageproduktion (2005)

The collaboration with ABB Robotics is described as open. Kablageproduktion uses 'open sales calculations' which means that ABB Robotics is welcome to see what margins Kablageproduktion have on each order. The Managing Director describes that as long as they get their percentage, everything is fine.

6.11.3 Information systems used

Kablageproduktion has been going through some years of extreme growth. They have more than doubled their personnel since 2002, something that has put demands on their IT-support. During spring 2003 they implemented the enterprise system *Navision Axapta* (a Microsoft solution). Before Axapta was implemented, Kablageproduktion used an information system called *Amanda*. The Logistic Manager, with a prior career at the IT-company ABB Business Systems, describes that their legacy system was based upon the needs of a store rather than a producing company. By implementing Axapta, Kablageproduktion has moved from 'being last in line' to move up in the middle in its branch. During 2005 they have continued to develop and explore Axapta's functionality with the aim of becoming one of the best when it comes to using enterprise systems as a business support.

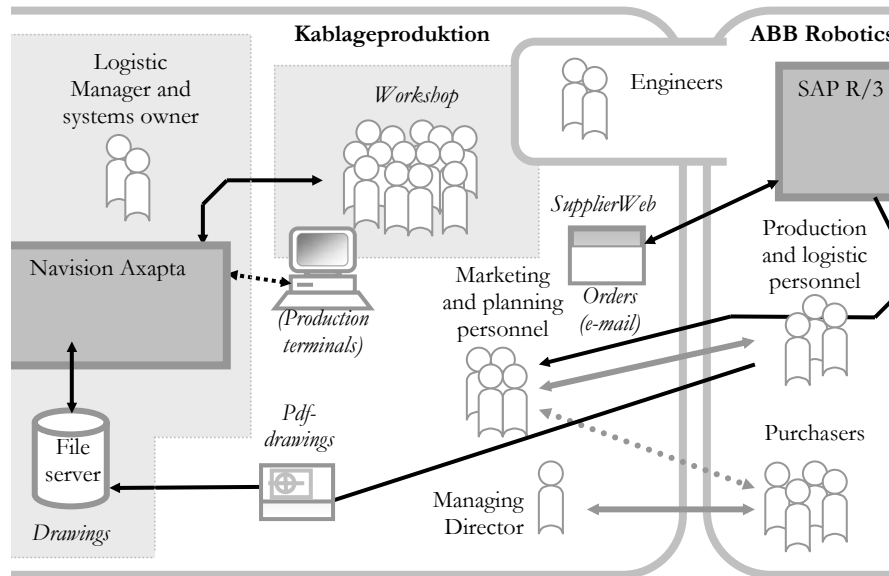


Figure 29 ► Information systems used in the business with ABB Robotics [own illustration based upon interviews and observations]

The implementation of Axapta was a managerial decision though another company within the Lagercrantz Group had started to use it. Wise from his experiences, the Logistic Manager decided that Kablageproduktion should use as much of Axapta's standard parameters as possible. 'I realize that the more you wriggle with it, the harder it gets in the future!' By following the standard, the risk for problems was reduced. Many of Kablageproduktion's staff also had a quite low 'IT' matu-

rity' so changes had to be made with care. Now they have used Axapta for a year but they are still in the 'cleaning phase' even if it is used throughout the production. During the autumn they will introduce production terminals where each worker logs in with employee cards. This means that every order can be monitored regarding where in the process it is and who works with it.

6.11.3.1 Adjustments in Navision Axapta

Even if Navision Axapta has been left intact as much as possible, there have been some tables added. One example is a table that handles the customers' article numbers. Kablageproduktion has its own article number for each product, but that article can have several other article numbers from their customers and another article number belonging to the supplier can also be bought on. To deal with this, a function and a table were created in Axapta. There have also been some adjustments in Axapta to deal with the ABB companies. Nowadays, all ABB companies are legally one company and that must be manageable in Axapta. When it comes to ABB Robotics they hold three customer identities in Axapta, but there is only one address for their invoices.

6.11.3.2 Other information systems

Kablageproduktion has a *file server* that is used for the storage of drawings and other documents. The file server was used even before Axapta was implemented but Axapta can have the drawings 'connected' to a specific cable or a specific order, i.e. Axapta fetch drawings from the file server. Kablageproduktion has also an outspoken policy of not keeping any drawings on paper as it involves the risk of producing based upon old drawings. Today each worker prints a new drawing for each order and when the production terminals are introduced the workers will get all the manufacturing information direct via their PC screens.

6.11.3.3 Dealing with the information from ABB Robotics

Navision Axapta is Kablageproduktion's information backbone and it brings order to their business processes. As a complement, Kablageproduktion has their file server with all the drawings and documents needed to manufacture their customers' products. The orders from ABB Robotics are traditionally sent via fax, but they have recently started to use *email*. The emails usually contain all necessary order information, but there may also be drawings in pdf-format when a product has been modified. Kablageproduktion can also see their delivery precision and get prognoses from ABB Robotics' *SupplierWeb*. The Production Planner mentions that they have not been that good in using the prognoses in their own work,

but this has increased in the last year. The Logistic Manager also mentions the possibilities to download the SupplierWeb information into Axapta. 'The raw data is there' so there is a plan for using it in Axapta. The ideal situation would be to even receive R&D information from ABB Robotics, but the Logistic Manager guesses that there is a limit to how tight they want their collaboration to be.

6.12 Mekanotjänst – a new supplier

Mekanotjänst Järvsö is the largest company within *Mekanotjänst Industrier*. Mekanotjänst Järvsö has 120 of Mekanotjänst Industrier's approximately 250 employees and they stand for more than half of Mekanotjänst Industrier's turnover. Mekanotjänst Järvsö (referred to as *Mekanotjänst* in this thesis) is specialized in 'high-speed milling' in series of 100-1,000 products. If a customer orders larger series, Mekanotjänst makes foundry forms to rationalize the manufacturing process. A product can also first be produced with high-speed milling machines and after it has been tested and used in a pre-series, a foundry form is made.

6.12.1 Serious business

The Sales Engineer that is responsible for Mekanotjänst's business with ABB Robotics describes a situation where they want to work in close collaboration with their customers. Mekanotjänst does not offer R&D services, but they actively co-operate with their customers' in their development, as described on their homepage^{*}: 'With Mekanotjänst as your production partner, we can build strong relations together. And our co-operation will result in mutual benefit.'

ABB Robotics is Mekanotjänst's single largest customer when it comes to turnover, but they have other large customers from the metal, electric, and medicine industry with higher 'refinement values' and better profits. The collaboration with ABB Robotics started in the late 90s and they have been developing a tight collaboration rather quickly. The Sales Engineer describes that Mekanotjänst is an 'ABB World Class Supplier' which means that they participate in supplier meetings gathered by ABB. They have also been visited by many ABB Robotics employees that have controlled their workshop, their processes, and that have been discussing the products. Mekanotjänst is also an active partner in ABB Robotics prototype manufacturing. They have sent 15 of their own employees to 'ABB Robotics Supply University' and the Sales Engineer describes that they considers themself-

^{*} www.mekanotjanst.se, visited 11 October 2005.

ves, and also put their stake on being, a serious ABB Robotics supplier. At the present time, Mekanotjänst produces 300-400 components for ABB Robotics and many of them are made up of several parts.

The business with ABB Robotics has lead to the development of new workshop tools and routines. One example is a specially designed machine that is used to put the robots balance suspension into its container. That machine uses an enormous pressure and it took many engineering hours to construct it. Today, Mekanotjänst has a small workshop dedicated to the work of putting the suspensions into their containers, something that is surrounded by security routines and a special production rig including pressurise equipment and special measuring instruments.

The Sales Engineer describes ABB Robotics as a customer with high demands but that takes mutual responsibility for the jobs they have with Mekanotjänst. They keep their words if you have 'shaken hands' on something, so they represent stability, even if they are tough negotiators.

6.12.2 Information systems used

Mekanotjänst has a close collaboration with the enterprise system vendor Monitor which has lead to that they are described as a 'referent installation' of the *Monitor* enterprise system (see figure below).

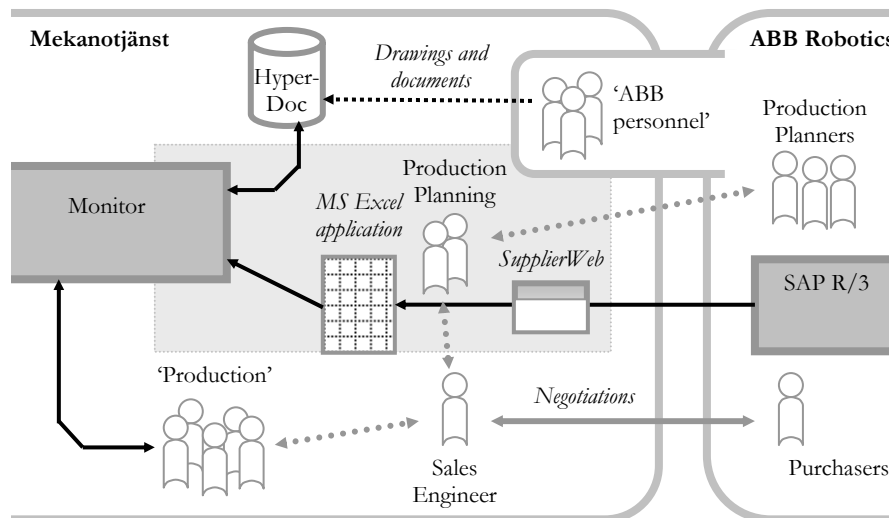


Figure 30 ► Mekanotjänst's information systems and their business with ABB Robotics
[own illustration based upon interviews and observations]

Mekanotjänst sees their IT strategy as a part of their business development process and they state that their IT strategy follows three central aspects: 'security, rational system use, and client benefits'. Monitor has been used since the early 90s in a DOS environment and they have constantly updated it to today's MS Windows environment. Mekanotjänst also uses *Lotus HyperDoc* content management system to store and administrate drawings. Their IT Manager mentions that this is nothing that the employees have to care about – they only experience that they use Monitor, i.e. the enterprise system gets its documents from HyperDoc automatically.

6.12.2.1 Semi-integrated business

Mekanotjänst gets their orders via ABB Robotics' *SupplierWeb*. They download the prognoses that are updated every Monday morning and put them into an *MS Excel application* that the IT Manager has created. The Excel application is needed as the SupplierWeb prognoses even hold dates that have been passed, data that Mekanotjänst's Monitor system cannot handle (i.e. it gets errors in its MRP runs). When the Production Planning Manager has arranged the prognosis so the 'expired dates' have been changed to dates that are in the near future, the prognosis is downloaded into Monitor and it there becomes the base for Mekanotjänst's MRP runs. When ABB Robotics later sends their orders they are manually 'activated' by the Production Planning Manager as they already are in the system in the form of prognoses. This is described as the prognosis being 'released', i.e. the order is connected to the prior prognosis in Monitor.

Mekanotjänst also uses the SupplierWeb to check how they are performing as a supplier according to ABB Robotics, information that they also compare with the statistics that Monitor offers. The SupplierWeb is also used for reporting the storage volumes. Mekanotjänst had agreed to have a storage covering a certain time and this is written into the 'Buffert report'. Their overall impression is that ABB Robotics' SupplierWeb works well. The Sales Engineer describes that ABB Robotics' implementation of SAP R/3 was a nervous time. During ABB Robotics' implementation of SAP R/3, Mekanotjänst had to produce according to the last laid prognosis. But they managed to handle the deliveries during that implementation and everything has worked well since then.

6.12.2.2 Future IT support

The Sales Engineer describes that Mekanotjänst has aimed at using Monitor as much as it is possible and that there are even more improvements on the agenda.

One improvement would be an increased access to ABB Robotics' drawings: this usually requires phone calls today. Another improvement that is under investigation is EDI communication with ABB Robotics. Mekanotjänst already uses EDI in their business with other companies, a technique that facilitates the business positively.

6.13 Analysing the ABB Robotics Case

The following sections present the researcher's analysis which means that this part has not been checked by the respondents. The ABB Robotics case revolves around their SAP R/3 system that was implemented less than two years before the case study started. As an introduction to the single case analysis, the enterprise system, the focal company, and their products are analysed.

6.13.1 ABB Robotics' enterprise system

ABB Robotics' enterprise system SAP R/3 had been used for less than two years when the case study started. The implementation of SAP R/3 was supposed to replace a legacy MRP system that was lacking functionality and that had problems with getting continuous support. The selection of SAP R/3 was a top management decision, and from the business units perspective, not that much of a choice. During the case study, ABB Robotics' SAP R/3 can be considered as having reached the onward and upward phase (Markus *et al.* 2000a), which means that the respondents could describe the new functionalities and the enterprise system's use could be observed. The implementation of SAP R/3 during the Freja project had a limited scope (Markus *et al.* 2000c) where 'the major business processes' was covered. The enterprise system's impact IS thereby expected to be apparent, but not fully developed. The enterprise system's modifications (Ekman & Thilenius 2005) can mainly be seen as evolving from the prevailing infrastructure. Due to the limited scope some functions needed to be supported by other information systems (e.g. the Config database or BusinessVision). There are also other information systems used in parallel with SAP R/3 as the SupplierWeb that lets the suppliers get their orders via a website or the Yellow cards database that handles the warehouse component administration.

During the case study, ABB Robotics' marketing and sales organization was active in developing a Product Specification Tool and the IS/IT department was scanning the market for a similar 'front-end' solution that can be integrated with SAP R/3. There is, in other words, a movement where the enterprise systems utilization in the exchange activities will increase, and also be more evident in the busi-

ness exchanges, but that is still to come. Finally, it is worth mentioning that the technological progress that was taking place during the study was an enterprise system homogenisation at ABB Group level.

6.13.2 Robots – a technically complex product

The focal product has some core properties that can be considered fixed, but its ‘dressing’ (i.e. equipping) and its functioning can take many forms. The product can thereby be considered complex, i.e. it is a heterogeneous resource that can be combined with other resources (Alderson 1965, Penrose 1995). The business activities, that are caused by this complexity, are seen both at the customer and supplier side. From the customer side, the marketers and salesmen may sell ‘a naked robot’ but usually the robot needs to be put into a ‘system’, i.e. there is engineering required. This engineering can be handled by ABB Robotics’ sales organization (as with general industry), via certified partners (as Channel Partners) or by the customer themselves (as with the Volvo Cars case that engaged ‘integrators’). The product ‘robot’ is thereby not given, and the final manifestation can be out of ABB Robotics’ influence.

The Purchasers evaluate if a robot component is possible to purchase at a reasonable cost and is it possible to handle logistically. Even if the purchase activities are quite straightforward, the suppliers’ descriptions also illustrate that the robot’s components are not static. As with the customer relation, the exchanged resources are thereby not given but instead evaluated and negotiated by the involved partners. Because the robot is a technically complex and multifaceted product, there are several people surrounding both the purchase and sales activities. As illustrated in this chapter’s figures, the exchanges with customers and suppliers involve a lot of people with both economic (commercial) and technical roles. As described by one Project Manager, one of the customer groups (the car industry) is ‘drowned with engineers’. The same goes for other customers: each figure shows technical representatives involved. When moving over to the supplier side, we also see both salesmen and purchasers but also technical (that sometimes visit the supplier’s production plant) and production personnel. This indicates that the exchange of a robot, or its components, requires multiple interpersonal contacts to deal with all the business activities that are carried out (Turnbull 1979, Håkansson & Snehota 1995, Ford *et al.* 2003). The characteristics of a robot thereby influence the business relationship characteristics by involving many people, which in turn lead to the need for coordinated activities and (as the analysis later will indicate) involve trust, commitment, adaptations and interdependencies which are elements

that can be seen in the analytical framework's 'business relationship characteristics' (Ford 1980, Håkansson 1982, Cunningham & Homse 1986, Johanson & Mattsson 1987).

6.13.3 The robot industry

Before moving over to the business relationships that the ABB Robotics case study has followed, ABB Robotics' (the focal company's) industrial setting and the focal net captured needs a comment. This part of the analysis is the researcher's own interpretation that has been carried out by taking part of trade fair brochures and interviewing customers and suppliers. All these empirical sources have indicated that ABB's robots are well known on the Swedish market.

ABB Robotics utilizes different interpersonal contacts and information systems in their business relationships. One example is Kablageproduktion, made up of former ABB employees', that lives in 'symbioses' with ABB Robotics. This business relationship has allowed Kablageproduktion to expand their production and today they also serve other large customers such as Bombardier and General Electrics, something that has made it possible to invest in both production facilities and new information systems (see section 6.11). ABB Robotics is thereby an important customer for supplier and contractor companies. The different adaptations that the suppliers' make can thereby be seen as a result of the advantages of having a customer like ABB Robotics.

From the customer's perspective, the competition on the robot market is increasing. Even if ABB Robotics sold at an all time high during 2005 they moved the Laxå plant's production (after the ABB Robotics case study was finished) to Västeraås as a measure to control their costs. According to ABB Sweden's Information Manager, the robot prices are decreasing by some percentages each year, which is why they must be very cost focused to be able to compete*. The cost pressure described should thereby be taken into account when analysing ABB Robotics' business relationships.

6.13.4 ABB Robotics' business relationships

The six business relationships that have been studied in the ABB Robotics case cover the span between many and few interpersonal contacts, regular or intermittent business exchanges, as well as more or less mutual adaptations regarding the products, business activities, and the utilization of information systems. This sec-

* Information from the local newspaper: *VLT* 24 November 2005 page 15.

tion starts with the analysis of the ABB Robotics/Volvo Cars business relationship and then presents each business relationship studied one by one.

6.13.4.1 Volvo Cars and their robot purchases

Volvo Cars are a part of Ford Motor Company, a global car manufacturer placed sixth on the *Fortune 500* list, and it is an interesting business partner for ABB Robotics. When receiving a 'general agreement' with Ford Motor Company, ABB Robotics becomes a potential supplier to several companies (from a European perspective; Volvo, Jaguar, Land Rover and Aston Martin). By 'winning' such agreement, the first step to a sale is taken. Once a company within the Ford Motor Company initiates their robot purchase activities, ABB Robotics will be contacted.

The business exchange that takes place in a project between ABB Robotics and Volvo Cars involves many robots and thereby also a large purchase sum. The exchanges in such business relationship, especially during a project, is frequent and intensive, involving both product and financial information (such as robot specifications, quotations, and general agreements) that requires interpersonal contacts involving different functions as negotiating and engineering roles (see figure 16). From ABB Robotics' side, the organizing of 'capture teams' – a group that can respond and act on all the requests Volvo Cars has – indicates a high degree of commitment. The interviews indicate that 95 % of the projects that ABB Robotics' Project Managers handle originate from the automotive industry, i.e. Volvo Cars is part of an important and demanding customer group. From Volvo Cars side, a robot purchase also involves both purchasers and production developers, i.e. personnel that deal with both commercial and technical matters. The Volvo Cars respondents also pinpointed that, even though ABB Robotics is a well-known robot supplier in Sweden, the business between them is carried out strictly professionally.

There are several routines that need to be followed in the business activities and the exchanges that take place; Volvo Cars requires that the robot supplier follows their general agreement and that the robot supplier creates robot packages according to Volvo Cars specifications. During this process, ABB Robotics even arranges customized Robot Specification Forms based upon Volvo Cars requirements (i.e. ABB Robotics' KAP Group formalizes these robots in SAP R/3). There are, in other words, both adaptations regarding the product and customer specific structures carried out in the enterprise system. Volvo Cars also requires 3D models of the robots for virtual line-ups in their RobCAD environment, something

that ABB Robotics complies with (i.e. an adaptation) even though they also have developed their own RobotStudio models.

Another adaptation is seen in the products – the delivered robots are produced according to Volvo Cars requirements. An example is that Volvo Cars required Bosch or Matuschek inverters for their robots, something that ABB Robotics fulfilled. When studying the supplier YIT Kvänum it was also mentioned that they needed to construct a new application cabinet based upon Volvo Cars' requested functionality. Both ABB Robotics, and their suppliers, must thereby conform to Volvo Cars' demands. From YIT Kvänum's perspective, some demands are transferred within ABB Robotics focal net (cf. Alajoutsijärvi *et al.* 1999) where they become connected (Blankenburg & Johanson 1992). This means that what takes place in the business relationship between ABB Robotics and Volvo Cars also affects the relationship between ABB Robotics and YIT.

The business relationship between Volvo Cars and ABB Robotics does not hold any interorganizational connections between their information systems. ABB Robotics' salesmen combine the Robot Specification Form information with price information. All this product and price information is presented in binders that hold robot packages, information that the purchasers at Volvo Cars are given. When Volvo Cars purchases robots they use the information in the binder that ABB Robotics' salesmen have given them to address specific robot packages in their orders. All these orders are sent via Ford Motor Company's web based purchase system. ABB Robotics' enterprise system thereby plays a peripheral role in this business relationship. The absence of use can though not be said to have to do with the salesmen's resistance (Markus 1983) but rather to the organizational structure where the more frequent uses of SAP R/3 are taking place at the ABB Robotics' plants. Whilst SAP R/3 are based upon structured data at the plants (as with the Bill-Of-Material), the salesmen's data have several forms and it can hence be said to be more unstructured (i.e. even if the binders are well arranged, they contain different data sources that are arranged and systemised by the salesmen based upon the customers demand). It is also worth mentioning that many of the robot purchases go via third parties, so called integrators (see figure 22), which makes it even harder to predict the final form of the sales. This 'connected form' of business relationship in a triad setting certainly also affects the structuring of the robot packages (from both ABB Robotics' and Volvo Cars' perspective). To sum it up, the complexity of the product and the required sales/purchase activities in parallel with the existing business network have lead to this limited use of ABB Robotics SAP R/3 and interorganizational connections.

6.13.4.2 *The channel partner Specma Automation*

Specma Automation and ABB Robotics have a formal partnership that means that their business interaction follows agreed routines and designated people (i.e. an assigned Salesman supports Specma). ABB's Salesman describes that the Channel Partnership is 'a formalized and mutual commitment', i.e. the business relationship between ABB Robotics and Specma involves a form of interdependence based upon a form of 'legal tie' (Håkansson & Snehota 1995). This business relationship is coloured by a customer with good product knowledge, i.e. Specma's personnel have a history as ABB employees and this means that they have a good insight into ABB Robotics' business processes and their products. Even ABB Robotics invests in the business relationship by having two assigned salesmen working solely with Channel Partners. By having partner relationships, ABB Robotics also widens their interface towards potential customers. There are, in other words, different forms of interdependencies (such as 'legal ties' and knowledge bonds) between the companies.

Being an ABB Robotics partner also involves side effects. It is not possible for Specma to do business with end-customers that advocate other robots than ABB's (such as 'yellow' or 'blue' ones). Other side effects of the close collaboration with ABB Robotics are the 'borderline' problems such as with the after sales support. Even if a customer has bought the robots through an agreement with ABB Robotics, which thereby shall handle the service and support, the customer turns to Specma because they have assembled the final robot system and they have also been in close contact with the robot users. Specma's other business relationships are thereby affected by the closeness to ABB Robotics, i.e. it is a question of connectedness (Blankenburg & Johanson 1992).

Despite a formalized business relationship and continuous exchanges (60-80 robots a year), the use of information systems in the business interaction between the partners is less apparent (see figure 17 and 23). ABB Robotics offers Specma Robot Specification Forms that they can use for carrying out their own calculations and orders but the respondents at Specma do not think it is worth the effort. It is time-consuming to go through the Robot Specification Form and ABB Robotics assigned Salesman helps them with this, i.e. it is a question of non-use from Specma's point of view. Even though the Channel Partner arrangement should facilitate a well-developed infrastructure, the mutual adaptations and institutionalized routines (Håkansson 1982, Campbell 1985, Johanson & Mattsson 1987) have lead to this division of labour.

Specma also has access to product databases that ABB Robotics offers their partners access to when they need product information. Besides the Robot Specification Forms and product databases, Specma has invested in RobotStudio that they use for single robot systems. RobotStudio can only be used for ABB Robotics' products, which makes it an idiosyncratic investment (Anderson & Weitz 1992). If RobotStudio does not support Specma's design of robot systems they hire consultants that work with more powerful software. The cost for RobotStudio can therefore only be directed to the single robot systems that Specma sell and not all of Specma's projects.

Specma use an enterprise system from IFS when handling project and financial information, but a financial post only mirrors the orders from ABB Robotics in the IFS system. There are also no interorganizational connections involved or data exchanges between the partner's enterprise systems. The business relationship between ABB Robotics and Specma is therefore quite free from the enterprise system's influence, even if their business relationship can be considered strong (cf. Hadjikhani & Thilenius 2005).

6.13.4.3 SKF Mekan's robot purchases

The business relationship between ABB Robotics and SKF Mekan holds a small number of business exchanges and a rather intermittent frequency of interpersonal contacts. ABB Robotics has assigned a salesman to the 'general industry', which are companies that want to purchase their robots from ABB instead of via 'integrators' and engineering companies. Even though SKF Mekan's Production Manager describes that the robots themselves are not interesting, they have purchased more than ten ABB robots during the last decade and the robot cells have also been more complex for each purchase. SKF Mekan thereby seems to have increased their knowledge about robots, something that facilitates upcoming business exchanges. But even if SKF Mekan considers robots for their manufacturing, they prefer to purchase 'turn key solutions' instead of single robots. By doing so, they reduce the boundary problems. The future business between ABB Robotics and SKF Mekan can thereby be going through a third part, i.e. ABB Robotics has to sell their robots to an engineering company (an 'integrator') that has a business relationship with SKF Mekan. The business relationship's strength can thereby be considered moderate. Even if all SKF Mekan's present robots are from ABB Robotics, the Manager has purchased software (3D Create) that simulates a competitor's (KUKA) robots. The respondent at SKF Mekan also signalled a neutral view

regarding the robot's brand. There are, thereby, also no interdependencies: not regarding the products, not according to the respective business activities.

The use of information systems is also following the less formalized business relationship between the companies (see figure 25). The ABB Robotics Salesman does not access the SAP R/3 system when performing exchange activities and SKF Mekan's Product Manager uses SKF's enterprise system freely from any ABB Robotics specific data. There are, in other words, no interorganizational connections between the systems at all. The ABB Robotics Salesman can also create and offer SKF Mekan whatever documents are needed – it will still only be an order post in SKF Mekan's Movex. The ABB Robotics Salesman has also created an application for following up projects as well as a memory note, i.e. two facilitating and personal information systems, but these are not available for SKF Mekan but are only a support for the Salesman in the interpersonal contacts that take place. The information that is exchanged in this business relationship can thereby have any form needed, i.e. it can be described as being based upon unstructured data.

6.13.4.4 The application cabinet supplier YIT

YIT Kvänum has been doing business with ABB for more than 10 years and ABB Robotics has 'inherited the business relationship from ABB Flexible Automation. ABB Robotics' part of YIT's business has grown and during the last year they were undoubtedly YIT's single largest customer. When being such an important customer it is natural that YIT gives ABB Robotics some attention. As described by YIT's Branch Manager: 'This is what they want, and this is what they get'. YIT can thereby be described as a committed supplier (Morgan & Hunt 1994). The business relationship has resulted in some mutually oriented adaptations such as the test protocols that are used for the application cabinets that YIT produces. There are also a lot of people involved in the business exchanges such as purchasers, production personnel, engineers, salesmen, constructors, managers, and so forth (see figure 27). These people are also organizationally placed at different business units as at the ABB Robotics plant in Västerås or at the sales office in Gothenburg.

The products that are exchanged are all more or less customer specific and YIT has routines and information systems that deal with this variety of cabinets. YIT has an information systems portfolio that reflects their role as a smaller branch office (about 40 employees) within a large company group (the YIT Group has 22,000 employees) and where the products cannot be described as 'standard'. Their infrastructure is instead a result of being a small actor that offers customer

specific products. The financial system PAM is common for the YIT Group, whilst the order handling is carried out in an administrative system called Work-Office and by an in-house developed MS Access application with a basic MRP functionality. All the information needed to produce an application cabinet is put into binders, which follow the cabinet until it is transported to ABB Robotics. The material needed to produce a cabinet can also include material supplied by ABB Robotics (such as manuals). YIT's information systems' status is thereby refined to facilitate today's business activities, i.e. supporting their activity structure (Håkansson & Snehota 1995, Dubois 1998), including managing the diversity of customer specific materials, but for further support they need to migrate to newer information systems. Being a part of the YIT Group is, though, setting the agenda for such changes, i.e. a new information systems environment will probably not grow as a result of the branch office's business relationships with customers such as ABB Robotics, but based upon a decision on a company group level.

The orders that ABB Robotics send come via fax and the drawings are sent via email, i.e. there are no interorganizational connections that require structured data. The exchanges also illustrate connectedness (Blankenburg & Johanson 1992) as when customers required a specific CAD application or when Volvo Cars requested specific inverters. Having a customer such as ABB Robotics thereby involves adaptations; sometimes based upon requirements beyond ABB Robotics themselves. All these efforts are though not facilitated by ABB Robotics enterprise system, nor represented. The enterprise system only holds purchased and delivered quantities as well as YIT's performance. ABB Robotics utilization of their enterprise system SAP R/3 in this business relationship is thereby restricted to internal activities (what Dubois 1998 refer to as production) and the same goes for the information system infrastructure that YIT has created.

Before moving over to the next supplier relationship it is also worth mentioning that YIT carries out construction work based upon pdf-drawings from ABB Robotics. There are, in other words, more business exchanges than the products, but even this exchange is governed by 'open' formats (such as pdf-files), which mean that the selection of YIT's CAD environment is not regulated. The exception is when the customer has specified the CAD format. The business exchanges also follow different paths. Usually the orders are sent from ABB Robotics production plants but sometimes also from the sales offices. This means that there is a complex web of interpersonal contacts, with people coming from different business units or companies, involved in the continuous exchanges.

6.13.4.5 *Getting dress cables from Kablageproduktion*

Former ABB employees established Kablageproduktion and they have a very close business relationship with ABB Robotics who is their single largest customer. The closeness in this business relationship is e.g. manifested in Kablageproduktion's 'open sales calculations' – an indication of a high degree of trust (Anderson & Narus 1990) though ABB Robotics are supposed not to act opportunistically when they get this information. Such closeness also governs the exchanges between the partners. As mentioned by Kablageproduktion's Managing Director: 'If we have any problems, we can have lunch together and sort them out'. The organizing in this business relationship involves complex interpersonal contacts holding managers, logistic personnel, engineers, workshop personnel, and so forth (see figure 29). The business relationship with ABB Robotics has resulted in customer-made cables that meet ABB Robotics' need for flexible cables, i.e. there have been product adaptations made (Johanson & Mattsson 1987). Overall, the business relationship is considered close and is characterised by openness – an atmosphere that affects the ongoing business exchanges and necessary adaptations. This has also lead to a situation that can be seen as interdependency based upon structural, knowledge and social aspects (Håkansson & Snehota 1995).

Even if ABB Robotics' business relationship with Kablageproduktion is strong, there have been few interorganizational connections between their enterprise systems. Kablageproduktion implemented a new enterprise system, Navision Axapta, at about the same time as ABB Robotics implemented SAP R/3. The selection of Kablageproduktion's enterprise system was on a company group level, i.e. it had to be in line with Lagercrantz Group's other companies. But Kablageproduktion had a less developed systems portfolio before migrating to Navision Axapta, which is why the IT maturity in the company was rather low. This also means that Axapta was in the shakedown phase (Markus *et al.* 2000a) during the study. The use of interorganizational connections has thereby been absent (i.e. non-use) until recently when Kablageproduktion's employees discovered the possibilities with ABB Robotics' SupplierWeb. As the IT maturity enhances at Kablageproduktion, so will the utilization of the interorganizational possibilities. Even if the business relationship thereby has created both the structure and form for the business activities carried out and the ongoing exchanges, the possibilities to utilize interorganizational connections in the business exchanges between the partners has been quite low based upon that this knowledge have not been fully developed. Kablageproduktion has also been careful not to 'wriggle' Navision Axapta – i.e. their enterprise system has been as close to its original setting as possible to avoid trou-

ble with updates. And even if the use of Axapta increases, the information handled is focused on the internal activities that are needed for the production of cables (cf. Dubois 1998). Other types of exchanges, such as the mutual development and upcoming R&D information, are probably not going to be handled by ABB Robotics and Kablageproduktion's enterprise systems (as described by the Logistic Manager: 'there is a limit to how tight ABB Robotics want their collaboration to be'). Even though the case story describes a strong business relationship, such information is not facilitated by the enterprise systems.

Besides the order information, Kablageproduktion has other information systems as a file server assigned for the drawings needed in their production. The drawings stored at the server are related to identities in Axapta. When the case study ended, Kablageproduktion should place terminals in their workshop. By getting the order information directly on a screen, and being able to print out the relevant drawings associated with that order, the workshop personnel always produce the right product version. The file server can be seen as a complementary information system used for the product information that is exchanged. The system features thereby have a facilitating role for the product exchange, but the other forms of exchanges are less facilitated or represented by the information systems described.

6.13.4.6 *The subcontractor Mekanotjänst*

Mekanotjänst and ABB Robotics have been doing business since the late 90s and even if they have not been partners for very long, they have developed an apparently strong business relationship that involves a lot of people (cf. Ford 1980, Dwyer *et al.* 1987, Ford *et al.* 2003). Mekanotjänst explicitly describe how they put effort into becoming an 'ABB World Class Supplier' and that there have been several interpersonal contacts. The collaboration can also be measured in product exchanges and Mekanotjänst delivers hundreds of components to ABB Robotics – something that makes ABB Robotics Mekanotjänst's largest customer. This means that it is a business relationship worth investing in. One example of an idiosyncratic investment (Anderson & Weitz 1992) that Mekanotjänst has made is the newly developed workshop that is used for putting the robots balance suspension into its containers. Even if ABB Robotics is a partner with high demands, the business relationship is close as ABB Robotics keeps their word when they have 'shaken hands' on something, i.e. there seems to be a high degree of trust and commitment (Anderson & Narus 1990, Anderson & Weitz 1992, Morgan & Hunt 1994) in this business relationship.

The business relationship is supported respectively by the company's enterprise system where ABB Robotics uses SAP R/3 and Mekanotjänst uses Monitor (see figure 29). But even if both partner's enterprise systems have reached the onward and upward phase (Markus *et al.* 2000a) their interorganizational connections are moderate. Mekanotjänst receives their orders via ABB Robotics' SupplierWeb and then they transform the order data into an MS Excel application so their enterprise system Monitor accepts it. If Mekanotjänst took the data directly from the SupplyWeb it would result in an error in Monitor, i.e. they have to make specific adaptations based upon a complementary application (i.e. other information systems) to be able to utilize their enterprise system in the business relationship. Besides facilitating the business exchange, Mekanotjänst's Monitor is also integrated with a 'content management system' Lotus HyperDoc. The exchange of product information is thereby facilitated by this other information system. But even if the technical interorganizational connections are moderate, the business relationship has lead to an aspiration for remote access to product drawings and also EDI, technical solutions that can be added in the future. If these interorganizational information systems will be utilized in this business relationship, there is still no information system that represents or facilitates all the interpersonal contacts that take place in this business relationship, i.e. the existing enterprise systems are solely focused on the business (product vs. money) exchanges and future added functionalities seem to focus on the same form of exchanges.

6.13.5 Summarizing the ABB Robotics case

The focal company's enterprise system, ABB Robotics SAP R/3, is still in a phase where more functions will be added (a description that fits well with Davenport *et al.* 2004). The utilization of SAP R/3 has a clear production focus, i.e. other activities that are part of the business relationships (such as mutual development) are less facilitated. Following the reasoning of activity dependencies and enterprise system utilization (see figure 6), there are few activities beyond the order handling that are facilitated by the enterprise system. When studying ABB Robotics SAP R/3, the system features (see the analytical framework, figure 7) can be described in terms of operational, monitoring and control, and to some part also planning and decision (Markus 1984). Its interorganizational use is rather limited and, given the interest in all forms of exchanges, the enterprise system facilitates the product exchange to a high degree, but the other forms of exchanges are handled in other ways. When searching for the enacted use (Orlikowski & Iacono 2000) this is also rather a result of organizational considerations than of individual resistance (cf.

Markus 1984). Basically the enterprise system's scope was, after the Freja project, focused on the core processes (which were: product development, delivery and aftermarket) which means that the support processes (e.g. marketing and purchasing) were less affected, and thereby also less supported, by ABB Robotics enterprise system SAP R/3.

When following the concepts presented by Håkansson & Snehota (1995), the enterprise system can be described as facilitating the activity structure (i.e. the intra-organizational aspect) but is less apparent in the activity links (i.e. the interorganizational aspect). It is also worth mentioning that the exchanges are not only related to the business exchanges, others are social or information exchanges (Håkansson 1982, Johanson 1989) that lead to the development of new routines (such as YIT's test protocol), work as governing mechanisms for the business relationship's future (as Kablageproduktion that straighten things out over lunch) or that lead to a more knowledgeable supplier (such as Mekanotjänst who participate in supplier courses).

When reviewing the business relationships presented, the Volvo Cars, Specma Automation, SKF Mekan, YIT Kvänum, and Kablageproduktion exchanges are free from any predestined (i.e. structured) data formats. The only business relationship where the partners' enterprise systems are more utilized is between ABB Robotics and Mekanotjänst but they have made some adjustments to the order data even there. Even if several of the business relationship studied signal that the partners are committed (Anderson & Weitz 1992, Morgan & Hunt 1994) and even if many of the companies involved have enterprise systems in the onward and upward phase (Markus *et al.* 2000a), the utilization in the ongoing exchanges has been moderate or even absent.

The limited use of the enterprise system SAP R/3, seen from a business relationship perspective, is partly because of an initially limited scope (Markus *et al.* 2000c) but also based upon how the business relationships are organized. Given that most of the business relationships presented have shown a complex web of interpersonal contacts, having people filling different roles in the business relationships, the enterprise system's possibility of capturing more than quantitative information about the ongoing business activities is rather limited. As an example, even if the purchasers continuously evaluate the customers and get a good insight into how the suppliers act, they keep this information on complementary information systems (i.e. MS Office programmes and Lotus Notes databases). The enterprise system only holds information about the supplier's company name, cont-

act people, components delivered, and prices. The other information is something that the purchasers keep for themselves. Even if such information would be able to be handled in the enterprise system, it is based upon the purchasers' knowledge and experiences of the supplier; it is regarded as sensitive which means that it should not be shared with others.

When analysing the exchanges with customers, the Salesmen and Marketers (as well as Project Managers) are quite free from ABB Robotics SAP R/3's influence. This can be caused by two reasons. The first is ABB Group's organizing, i.e. a question about the company's infrastructure and 'production lattices' (cf. Kling & Scacchi 1982, Campbell 1985). Different units handle the sales and some of them use their own SAP R/3 instantiations for financial information (such as the Automotive sales) whilst others use the Robot Specification Forms in an MS Excel format together with other information systems. The general setting (organizational as well as technology wise) thereby sets the rules for how things are done. The second is the initial scope of the Freja project and the location of the enterprise system: the production related internal activities have been prioritised before the exchange activities. But there is a movement that can be seen in the continuous development of ABB Robotics SAP R/3. The Product Specification Tool, offering step-by-step support when selecting a robot, was developed in parallel with a search for a product configuration tool for ABB Robotics' enterprise system. This tool would affect the ongoing exchanges and how the business activities are performed.

THE VOLVO WHEEL LOADERS CASE

THE CASE STUDY IN THIS CHAPTER takes its starting point with *Volvo Wheel Loaders*^{*} as the focal company. As with the prior chapter, the case story starts with an overview of the case setting, followed by a description of the focal company Volvo Wheel Loaders and its enterprise system. When Volvo Wheel Loaders business is covered, the case story continues with one of their major customers, the dealer *Swecon*. Volvo Wheel Loaders only uses dealers for their sales activities in a European perspective and Swecon is selected as the only customer case. Finally this chapter deals with three of Volvo Wheel Loaders suppliers: (i) *Bridgestone*, (ii) *CH Industry*, and (iii) *DKI Form*. These companies can be seen as different representative suppliers regarding sales volume, number of articles, cooperation, and so forth. As with the prior case story it is important to stress that *the text reflects the situation as it was during the spring and summer 2005* (see Appendix C for exact dates).

*Towards the
consolidated,
integrated, and
extended
enterprise*

^{*} Volvo Wheel Loaders are a company within the *Volvo Group* which was placed as No 255 on the Fortune 500 list in 2003.

7.1 The case setting

The focal company Volvo Wheel Loaders has production facilities in Europe, USA, and South America. In this study, the case is delimited to Volvo Wheel Loaders' Swedish activities, involving the main office in Eskilstuna and the Arvika plant with approximately 280 respectively 1050 employees. To capture the business relationships that the focal company is involved in, one major customer (Swecon) and three suppliers (Bridgestone, CH Industry, and DKI Form) are described in an attempt to capture their business relationships (see figure below)

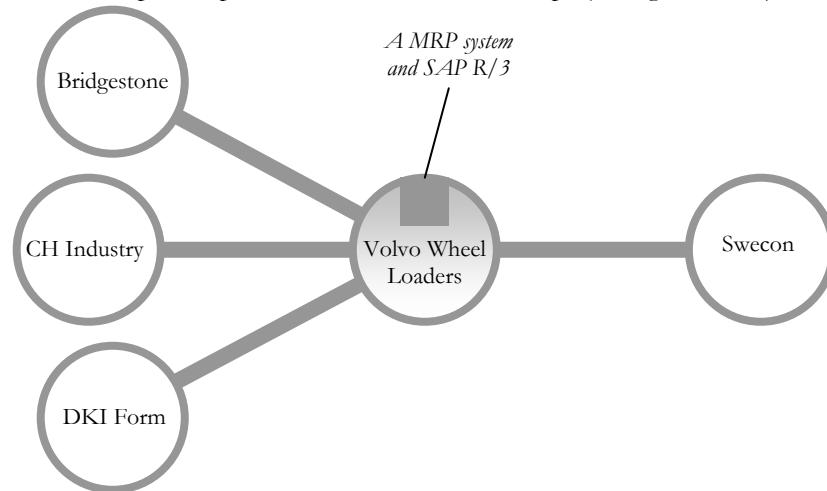


Figure 31 ► The companies in the Volvo Wheel Loaders case study.

This case differs from the empirical setting described that was set out in the research design based upon the reason that Volvo Wheel Loaders uses *dealers* to market and sell their products (from a European perspective). Swecon is a dealer that is selected as an exclusive vendor of Volvo Wheel Loaders machines in the Swedish market. This means that they and Volvo Wheel Loaders have a strong interest in developing their activities, and information systems, together to enhance their business. This also means that this business relationship is more formalized and in some sense complex, which is why, during the early stages of the investigation, it seemed reasonable to investigate this constellation further. From a research economics perspective, this within case seemed more important to capture with rich data than scanning several dealers. The selection of Swecon was also discussed with managers at Volvo Construction Equipment (Volvo CE), who described it as representative for the dealers they have in Europe.

7.2 Introducing Volvo Wheel Loaders

Volvo Wheel Loaders is a part of the Volvo Group that has 130 different markets worldwide. The wheel loaders that Volvo produces are basically: '[A modified] normal tractor [with] the loader unit over the big wheels' (own translation from a Volvo Wheel Loaders 50 year's jubilee pamphlet). Volvo Wheel Loaders is a part of the business area Volvo CE (see organizational chart below).

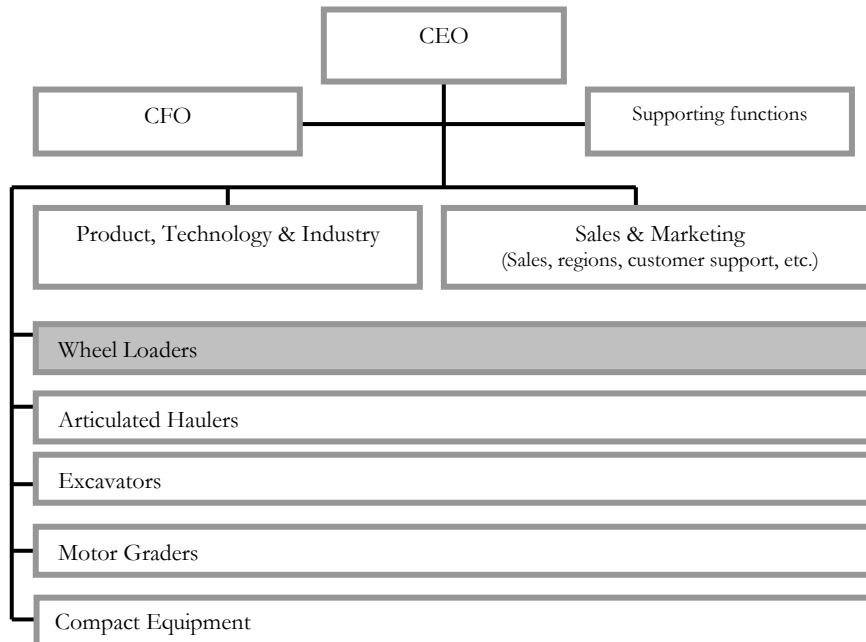


Figure 32 ► The Volvo CE organization [simplified organization chart based upon a Volvo Wheel Loaders slideshow, spring 2005]

Volvo CE produces and sells wheel loaders, articulated haulers, excavators, motor graders, and compact equipment. During 2004, Volvo CE sold nearly 30,000 machines and 7,800 of them (26%) were delivered from Volvo Wheel Loaders*, which thereby is a major actor within the Volvo Construction Equipment's business lines.

* During the later part of the case study two of the business lines (Volvo Wheel Loaders and Volvo Articulated Haulers) were pooled into one business line. The case story is based upon the organizational setting (presented in Appendix E) that prevailed at the start of the Volvo Wheel Loaders case study, though the changes could not be observed when the data was collected.

The information systems and the personnel that figure in this chapter are sometimes active both within Volvo Wheel Loaders business line and within the business area Volvo CE. This means that the individuals described can come from Volvo Wheel Loaders or Volvo CE.

7.2.1 The head office in Eskilstuna and the Arvika plant

Volvo Wheel Loaders have a main office in Eskilstuna, a town that also houses parts of other Volvo CE's companies. The factories that produce Volvo's wheel loaders are located in Arvika (Sweden), Ashville (USA), and Pedeneiras (Brazil). As has been mentioned, this case is delimited to cover the Arvika plant, which is the largest production plant and also considered a 'core plant'. Being a core plant means, among other things, that the Arvika plant is involved in Volvo's R&D and prototype processes. The MRP system they use has also been the role model for the other production plants. Until 2002, Volvo also had a wheel loader production plant in Eskilstuna, but nowadays the final assembly in Sweden is only carried out at the Arvika plant.

The production in Arvika is structured around three production lines and the plant is clearly manufacturing and assembly focused. Activities such as R&D, supply and purchase management, process development, information system infrastructure, and so forth, are managed at Volvo Wheel Loaders' main office in Eskilstuna. The reason for Volvo CE to locate their production of wheel loaders to Arvika (with a distance of 270 km to the Eskilstuna office) is that this region has a strong tradition in thick-metal welding.

7.2.2 The structuring of the Volvo Wheel Loaders description

As within the earlier case, the empirical material has been structured as a case story that involves both the researcher's depiction (in text and illustrations) and the respondents' verbal expressions (as quotations). The aim is to have a casual description of the business experienced that has appeared in the empirical investigation. The description of Volvo Wheel Loaders has been inspired by their own classification of core business processes called product portfolio development, order to delivery, sales to order, and delivery to purchase. Beside these processes, there are also a number of supporting processes, gathered under the description business administration. As with the earlier case, this case story is a simplification of the reality, aiming at offering an insight into the everyday business of the studied companies. The processes are also not described in an equality thorough

manor – the focus is instead on where the enterprise system is used and how each respondent has described their everyday work and their company's business.

7.3 Volvo Wheel Loaders products

A wheel loader is a machine that is constructed to transport large volumes and that may be running most days in a week. This means that what 'running costs' and 'productivity', i.e. carried volume or mass in a given time span, are important figures. Volvo Wheel Loaders' product line is named L50E to L330E and the wheel loaders are divided into small (L50E-L90E), midrange (L110E-L120E) and large (L150E-L330E) machines. Volvo Wheel Loaders' most sold wheel loader, the L120E model – this case study's focal product – is a midrange machine with a wide application area. As described in a product brochure (2004):

Volvo's 20 ton wheel loader is packed with loads of power to make your job easier everyday. The tyreless L120E represents yet another leap in the stride for higher productivity. The versatility of this Volvo Wheel Loaders makes it the obvious choice in a wide range of industries and applications, including moving material in sand and gravel pits, loading cargo vessels and rail cars, handling wood chips at paper mills and unloading timber trucks.

The text above indicates that an L120E is a part of a wider production facility. For some data on the wheel loader products, see the table below.

Table 3 ► Volvo Wheel Loaders' models [spring 2005]

Models	Operational weight	Max engine output	Bucket capacity
L50E	8.200-9.400 kg	101 hp (73.9 kW)	1.2-3.9 m ³
L60E	11.000-12.300 kg	139 hp (102.0 kW)	1.7-5.0 m ³
L70E	12.700-14.000 kg	152 hp (112.0 kW)	2.0-6.4 m ³
L90E	15.000-17.000 kg	165 hp (121.0 kW)	2.3-7.0 m ³
L110E	18.000-20.000 kg	209 hp (154.0 kW)	2.7-9.5 m ³
L120E	19.000-21.000 kg	223 hp (164.0 kW)	3.0-9.5 m ³
L150E	23.000-26.000 kg	284 hp (210.0 kW)	3.1-12.0 m ³
L180E ^(a)	26.000-29.000 kg	300 hp (221.0 kW)	3.7-14.0 m ³
L220E	31.000-33.000 kg	351 hp (258.0 kW)	4.5-14.0 m ³
L330E	50.000-53.000 kg	502 hp (369.0 kW)	6.1-13.5 m ³

^(a)A special wheel loader, L180E HL, is excluded from the table

When a customer orders a wheel loader, he or she will have a lot of functionalities included as standard. The wheel loader's equipment is based upon prevailing regulations and laws in the customer's country, the intended application, capacity needed, and so forth. At Volvo Wheel Loaders and at their dealers, the basic wheel loader configuration is labelled an *MRS machine* where the acronym stands for *Market Related Specification*. The MRP machine configuration is based upon each dealer's request and the MRP equipment is decided in collaboration between the dealer and Volvo Wheel Loaders. Beside the standard equipment that an MRS machine comes with, each dealer has an *option pricelist* where complementary equipment is listed.

When a customer specifies a wheel loader they want to purchase, he or she first has to choose the boom length needed, which bucket to attach, and what tires the machine shall have. All these selections affect both price and delivery time. To give an impression of how many options a wheel loader can have, Swecon's Salesmen's option pricelist includes more than 250 positions, where some positions exclude others. As an example, the driver's cabin can be equipped with features such as a radio and CD-player, air condition, adjustable steering wheel, and even a rear view camera and monitor. Besides the exemplified selections, there are a lot of other options that are available depending on the tasks that the wheel loader is supposed to perform, the degree of safety that is required, based upon the environmental (e.g. asbestosis or freezing environments) or work place circumstances (e.g. speed limiter), and so forth.



Figure 33 ► Volvo Wheel Loaders L120E [Published with courtesy of Volvo Wheel Loaders 2005]

Through the interviews it became apparent that the ‘average’ wheel loader is hard to find. Less than half of the machines follow basic specifications and the majority are, instead, wheel loaders that are adjusted according to different options.

7.4 Volvo Wheel Loaders’ enterprise system

To handle the production of the wheel loaders several information systems are utilized. Volvo Wheel Loaders lives with a mix of different information systems involving applications at mainframes as well as standard software that runs on PCs. But the information systems used are in a state of change. To capture the momentum in the change processes surrounding the prevailing information system, the following text both describes the information systems studied and the ‘systems to come’, as well as future plans and expressed intentions.

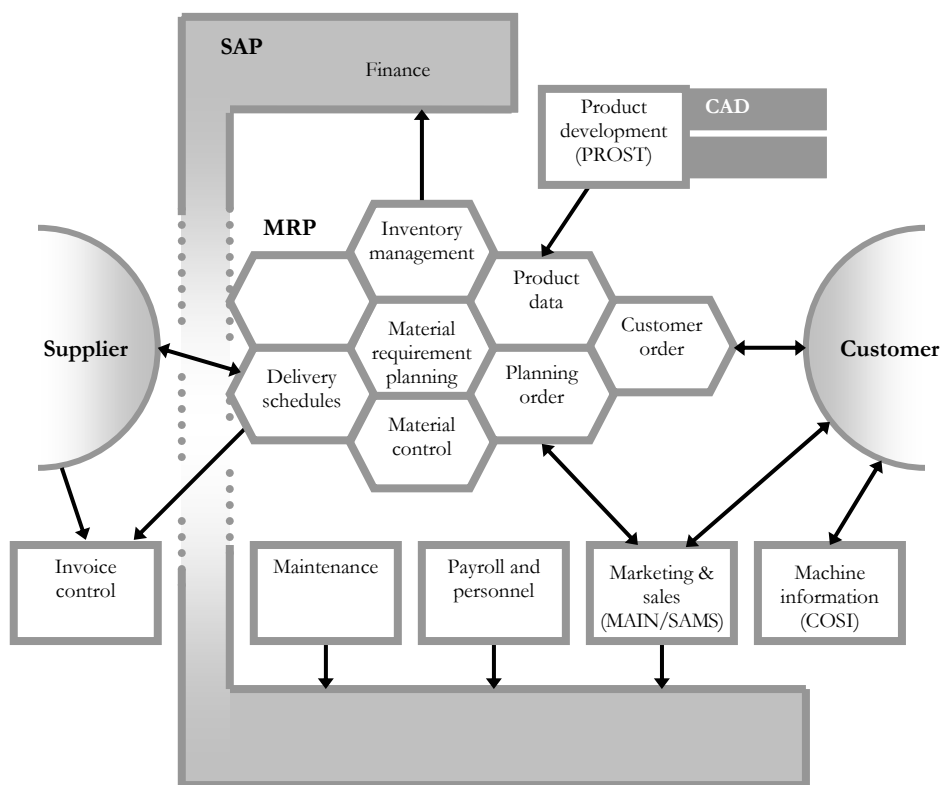


Figure 34 ► Central data processing at Volvo Wheel Loaders, referred to as their enterprise system in this thesis [modified from an OH-presentation, spring 2005]

Volvo Wheel Loaders' transaction handling backbone is a material- and resource planning (MRP) system that is more or less integrated with surrounding applications used for, e.g. order and invoice handling, product development, and market forecasts. Besides these information systems, Volvo Wheel Loaders uses SAP R/3 for accounting and other financial information (which they have in common with the other companies within the Volvo Group). The previous figure offers a brief overview of some central functions that are data processed by the systems. Together, these central information systems are regarded as Volvo Wheel Loaders' enterprise system. It is important to mention that the figure depicts the infrastructure when the case study started (in November 2004) and that a change was proceeding throughout the case study.

7.4.1 The present information systems

Volvo Wheel Loaders' core data processing is focused around the processes that are necessary to control and monitor the production of wheel loaders, i.e. what are labelled an MRP system in this thesis^{*}. The MRP system is clearly production-focused (as seen in the previous figure), which means that its functionality is best manifested at the production plant in Arvika. The MRP core handles more than 30,000 transactions each week and it is only partly customized, i.e. most of its functions follow the vendor's specifications. Other procedures such as R&D, marketing, and supply management are only partly supported by the MRP system. These processes are more dependent on other information systems that communicate with the MRP system. Many of these information systems are customized to fit Volvo Wheel Loaders' business and to communicate and share data with the MRP system. Examples of other information systems, and considered a part of Volvo Wheel Loaders' enterprise system, are:

- *PROST*: A kind of legacy PDM system used for Volvo Wheel loaders R&D. Holds information about product structures and product configuration possibilities.
- *MAIN*: A market and sales application holding information about the dealers, market and production forecasts, and so forth.

^{*} The naming 'MRP system' is used instead of the vendor name base upon a request from Volvo Wheel loaders. The MRP system studied has been used for more than a decade, and its functionality is basically what is considered to constitute an MRP system, even though the vendor describes it as an ERP system.

- *SAMS*: The order system that is experienced as a part of MAIN. It is this system that receives the orders sent from the dealers and that makes an order 'sharp'.
- *COSI*: An information system that offers information on sold wheel loaders. The dealer must access this system and specify the end-customer to activate the wheel loaders warranty.

The information systems above are all integrated to different degrees. MAIN and SAMS is used in parallel with the order booking in the MRP system. The PDM system PROST is used to download product structures into the MRP system, the MAIN and COSI systems can be used for a 'combined query' about customer segments (even if it requires some effort) and so forth.

Volvo Wheel Loaders also use SAP R/3 for the accounting and financial auditing of Volvo. SAP R/3 fetches its data from the MRP system as well as from MAIN and SAMS. The Volvo Group uses SAP R/3 for financial information, but as will be evident in the coming case story, it is less visible in the business activities that are related to the business relationships studied. Beside the information systems that have been presented, Volvo Wheel Loaders' employees utilize their Intranet *Violin*, the *Microsoft Office* package (such as MS Word and MS Excel), web solutions, CAD applications, and so forth.

7.4.1.1 EDI connections

Volvo Wheel Loaders interorganizational communication is handled in several ways. *EDI* following the Odette standard (used in the car industry) is a common ground for the order handling. Both customers (dealers) and suppliers are urged to use EDI, but if they do not have the information systems infrastructure needed to communicate with EDI they can access Volvo Wheel Loaders information systems via web interfaces called MAS-EDI (dealers) and Edionet (suppliers). The MAS-EDI will not be treated in this thesis (this case study's customer Swecon uses EDI) but the web-based solution Edionet will be depicted later on.

Edionet is a form of web based EDI that lets a supplier use whatever information system they prefer, as long as they can access the Internet with a PC that has a web browser. Edionet is developed by Viaduct*, which is a company that, among many other services, offers what can be referred to as a 'value added network' (VAN). Basically, Viaduct has designed an application that takes Volvo's EDI mes-

* Labeled a 'web service company' in this thesis.

sages and transforms them into a format that can be presented on a web page. The Edionet offers the same functionality as EDI involving; prognoses, ordering, notifications, goods labels, and invoices. From Volvo Wheel Loaders' perspective, they do not need to consider whether a supplier has EDI or Edionet, they are based upon the same data formats from and to Volvo Wheel Loaders' MRP system.

7.4.1.2 Dealer management system (DMS)

Volvo Wheel Loaders' dealers usually have an even tighter integration with their enterprise system than the suppliers. Swecon and the majority of dealers in the European countries use a *Dealer Management System* (DMS) when ordering wheel loaders from Volvo. The DMS can be seen as an information system that is developed to fit the marketing, selling, and ordering process of the dealer, and it is designed so it can be integrated with Volvo Wheel Loaders' enterprise system. The DMS is supplied by Volvo CE (i.e. Volvo has lead the DMS selection and development), which means that it is modified to fit Volvo Wheel Loaders' existing processes.

7.4.1.3 Office systems and Internet applications

Besides the use of EDI and DMS solutions, there is a frequent use of *email* and different attached documents such as MS Excel spreadsheets, pdf-files and dxf-files from CAD drawings, MS Word documents, and so forth, in the communication between the companies. Beside this, Volvo Wheel Loaders also has different web pages that their partners can access, as well as FTP servers used for file exchanges.

7.4.2 An information system's infrastructure in change

During the case study, Volvo Wheel Loaders was working with an application called MOM – *Master Order Management* – which is supposed to replace some of the applications (including parts of the existing DMS) that the dealers and customer contacts at the factories use to handle orders. The purpose of the MOM system is partly to replace some of the legacy systems used to access the MRP system (as SAMS) and also to replace some applications in the DMS (called MAS). Another reason is to separate the ordered wheel loader specification from the product structure presented in the MRP system. As it is now, the orders must match the product structure on a part level. If there is a change from one part to another the order must follow the new product specification in detail. With MOM, the dealer specifies a product (with for example air-condition) and when Volvo Wheel

Loaders receives it, it does not matter if they have changed from 'AC 123' to 'AC 456'^{*}, the order is translated to the prevailing model.

MOM allows web-based access; the dealer can access Volvo CE's business lines from one single interface and get guidance when selecting a product configuration, something that is missing in the present SAMS application. With the MOM project, every dealer will have the same functionality. From a European perspective, approximately 70 % have MAS and 30 % have Web-MAS connections with Volvo CE's companies. But from an international perspective, there are small dealers that still use manual systems and that send their orders via fax. With MOM, all dealers will use the same application to place and handle orders. During the study, several respondents mentioned that they had seen demos of MOM and that it seemed promising. The MOM project manager was interviewed in Volvo CE's magazine, where he declared: 'It is important to remember that we have refined the old system for 15 years. It will probably take a while until we get the new one exactly as we want it' (Volvo CE's magazine *Insikt* No. 2 2005, own translation).

The description of Volvo Wheel Loaders and Swecon and their mutual business will not offer any description of MOM in use, but the implementation efforts with this new application, affecting personnel at both Volvo Wheel Loaders and Swecon, is indicating the direction of the future information system infrastructure. Besides the MOM project, there were also parallel projects aiming at replacing the old DMS and also adding CRM functionality. Even this project could not be observed, but Volvo Wheel Loaders and Swecon respondents could describe the plans and aims. The IS/IT manager at Volvo Wheel Loaders summarizes the change that takes place:

I would say that three concepts describe the future information system direction. The first is *the extended enterprise* that means that our partners [dealers and suppliers] get closer to us. The second is *the integrated enterprise* that means that all the business data is stored together. Finally, *the consolidated enterprise* indicates that all business should be handled in a similar way [with a unified enterprise system] in real-time.

Volvo Wheel Loaders IT/IS manager (2005, own emphasis)

Throughout the descriptions of the ongoing information system projects, it is clear that the change has a process-oriented infrastructure as a goal. Both Volvo

^{*} The example is the researcher's own.

CE's IS/IT strategy and Volvo Wheel Loaders' IS/IT manager refer to business logic that follows a general description of the core processes when referring to the changes that are ahead. As described by the IS/IT manager, they are going from a 'spaghetti' situation to a more harmonized and integrated infrastructure. This movement is based upon a need for more common and efficient business processes. But this change is also a necessity as some of the legacy systems are based upon old programming languages. Beyond the business reasons there are, in other words, also purely technical factors, such as the ability to keep the legacy systems in operation, which Volvo Wheel Loaders must take into consideration.

To illustrate the use of the information systems and applications that have been mentioned, this chapter moves on to Volvo Wheel Loaders and their business activities, starting with how the wheel loaders are developed and sold.

7.5 Development and marketing

The development (R&D) and marketing of wheel loaders is carried out in collaboration with Volvo Wheel Loaders' dealers, but also, in some aspect, with their suppliers. To capture actors involved in this process, the descriptions will, rather, focus on the inputs from Volvo Wheel Loader's partners, rather than the engineers that carry out the development *per se*, starting with the dealer side and then moving over to how Volvo Wheel Loaders interacts with its suppliers.

7.5.1 R&D software

Volvo Wheel Loaders has a couple of hundred engineers that develop new products and features. The IS/IT manager describes that the R&D has a well developed portfolio of information systems that support their processes. The *PROST system*, which can be described as a PDM system, is used all the way through an R&D project. PROST deals with the product structures and it can signal different statuses. When a project is considered completed, the structure is 'released' which means that it can be downloaded into Volvo Wheel Loaders' MRP system by coordinators at the Arvika plant. When the product structures are downloaded into the MRP system, each wheel loader holds a product number to which several 'function groups' (i.e. motor, transmission, cabin, etc.) and their articles are connected. The drawings of wheel loaders and its parts are carried out in a CAD application that lets the engineers create dxf-files, which is a format that suppliers can download into their production equipment (for CAM functionality). The drawings that the engineers produce are stored in a CAD archive (a server) with a structure

based upon PROST's labelling and structure. Besides the systems mentioned, each project utilizes several other information systems and applications such as Lotus Notes for communicating and storing project information or Microsoft Project for creating time plans and scheduling project resources.

7.5.2 Activities in the marketing function

Volvo Wheel Loaders' research activities often start with some input from 'the market' and that is why the case story moves over to the marketing function. Volvo Wheel Loaders use *dealers* to market and sell their wheel loaders. These dealers, located all around the world, are supported by a regional *Vice President* (there are four regions: Europe, North America, Asia, and International.) from Volvo Wheel Loaders, but also by the organisation *Volvo Customer Support* that handles issues like guarantees, complaints, and spare parts, and by a *Business Director* (from Volvo CE) for the specific region. With such organized support, the dealers have supporting actors that solely focus on the interest of the business line (Volvo Wheel Loaders) and others that take the whole business area (Volvo CE) into consideration. At Volvo Wheel Loaders' marketing function, there are also *Product Managers* and *Market assistants* that support the vice president for the specific region (in this case region Europe, in which Swecon is the second largest dealer after Germany based upon their net sales).

The personnel that are involved in the marketing activities are both responsible for the everyday operations such as pricing, marketing activities in the different regions, and commercial contacts with the dealers. They also act in a supporting role when it comes to the continued development (R&D) of Volvo Wheel Loaders' products. When communicating R&D issues with the dealers, they usually interact with a *Dealer Representative* as the first contact person at the dealer company. The Dealer representative can be part of the market reference groups that Volvo Wheel Loaders use when they develop new products (see figure below). The description of the development and marketing of wheel loaders involves several individuals, something that is needed when selling products in the front-line. Volvo is a well-known brand name with core values such as quality, safety and environmental care,^{*} and during the interviews with employees at Volvo Wheel Loaders, it has been apparent that they are proud to be a part of this company. Producing a wheel loader with a clear quality profile affects how the development,

^{*} The core values were presented at Volvo Construction Equipment's homepage, see www.volvoce.com (visited 23 November 2005).

marketing and sales of the product are structured. There needs to be a 'win-win' situation that favours all parties, i.e. Volvo Wheel Loaders, their dealers and the end-customers. Both the advantages, but also the costs, with such a quality product must therefore be communicated to all these partners.

The Vice President's job is to have an overview of how the dealers perform and be attentive to market fluctuations from Volvo Wheel Loaders' perspective. It is also the Vice President who sets the levels that the Marketing assistants and Product Managers may follow regarding commercial activities i.e. price levels, campaign activities, and product allocation to the dealers. To decide what new features a wheel loader should have, to develop a new product, or to decide what to do in a market requires continuous communication with the Dealer representative. The Vice President mentions, as an example, that the Swedish dealer Swecon is a very competent partner that has sold wheel loaders for many years. He also describes that Swecon's Vice President is 'one of those who are professional in this branch, and he is also one member of our market reference group'.

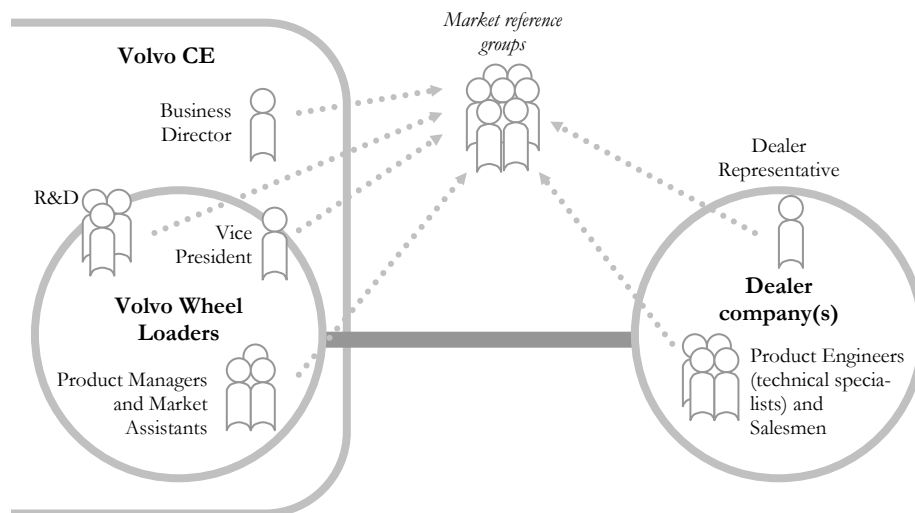


Figure 35 ► Example of individuals that may be involved in the market communication and R&D projects carried out by Volvo Wheel Loaders and their dealers [own illustration based upon interviews]

Besides the managerial contacts between the Vice President, the Business Director, and the Dealer representative, several more individuals can be involved in the process. As an example, the dealer company often has a *Product Engineer* and Volvo Wheel Loaders assigns people from the producing units or other business lines

(the latter to align the R&D to what goes on in the other business lines to gain synergy effects). There are also personal meetings and conferences with dealer representatives regarding the development of the products, market activities and so forth. All these activities can be seen as having a strategic significance for Volvo and their dealers. But there are also activities that are carried out even more frequently, dealing with issues that are operational and that leave 'fingerprints' in Volvo Wheel Loaders' enterprise system. One example is the application that supports the dealers with machine information (called COSI), another is the market prognosis and production prognosis.

7.5.3 The market and production prognoses

During the year, Volvo Wheel Loaders gathers information that is compiled into quarterly *market forecasts* and monthly *production prognoses*. These prognoses directly affect the MRP calculations that the production facilities (e.g. the Arvika plant) use to plan and execute their production, but it is also information that the dealers are offered via their DMS. The market forecasts indicate what level of sale the different dealers expect to reach, while the production prognoses are 'facts' that directly affect how the production is scheduled. The data that these forecasts and prognoses hold are based upon a continuous communication with the dealers and they report the forthcoming volumes. The data received are also signalled to important suppliers who signal if they will be able to produce the requested volumes. The plans gathered are consolidated and compared to the existing 'main planning' at the production facilities and they also result in a 'production programme' based upon the acceptance of Volvo Wheel Loaders' management.

The *global forecast* is entered to the market and sales application MAIN/SAMS, which means that Volvo Wheel Loaders' personnel may act upon the requested volumes. This information is also visible to the dealers who, via integration between their own DMS and the market and sales application, can access the present market forecast and production prognosis. The prognoses will be mentioned later in the chapter as they are a part of the data that is used in the MRP calculations. It is also worth mentioning that the requested volumes (in the market forecasts) are quantities that the dealers anticipate. Some of the dealers have difficulties in giving a precise prognosis; especially the dealers in the smaller market, and in such cases the Market Assistant can negotiate with other dealers if it is possible to take some wheel loaders from another dealer's requested quota. There is, in other words, some flexibility in this procedure, which absorbs the movements of different markets. The handling of prognoses involves a lot of communication with

the dealers, and SAMS and MAIN are supports in this work. The handling and adjustment of prognoses are, though, managed from the head office. The plants, such as Arvika, do not have the authority to make such changes.

7.6 The supply management

Volvo Wheel Loaders has approximately 40 people working within the supply chain function at the Eskilstuna office and even more when incorporating personnel at the production plants in Arvika, Ashville, and Pedeneiras. Volvo Wheel Loaders' supply management are important as approximately 50 % of the supply costs for a wheel loader originate from external suppliers. The supply management function is divided into two main groups. The *Purchasers* are involved in all commercial contacts with the suppliers, such as negotiations and price reduction activities. The purchasers are active with both the day-to-day purchase activities and supplier evaluations. Each purchaser works with a number of suppliers, which also means that this purchaser is fully responsible for these suppliers and their 'quality delivery cost'. The purchasers are working with both new and existing products as an interface between the suppliers and Volvo Wheel Loaders' personnel. Besides this, there is a group working with *Supplier Development* and these are active with the continuous evaluation of the suppliers' quality.

From the Supply Manager's perspective, the typical purchase cycle starts with some idea that is declared a project (see figure above). This project can result in sketches and descriptions of what kind of products that need to be purchased from a supplier. When this stage is reached, one of the purchasers contacts a number of potential suppliers and offers them the information produced (sketches and descriptions) for evaluation. The Supply Manager describes that this usually results in some kind of feedback from the suppliers, such as 'Sure, this looks interesting, but can't we do it like this instead? If we can do it like that the product will be cheaper and the time for delivery will be shortened'. Both the assigned purchase personnel and the R&D engineers consider this feedback, which usually result in a drawing. This new, and more detailed, information including drawings is sent to the suppliers again who then do their calculations and come up with a quotation. This is followed by negotiations which end with one supplier being selected. Thereafter, the supplier and product data are put into the MRP system. By now, the supplier's products can be ordered and delivered according to agreed procedures (e.g. via EDI or web based EDI).

7.6.1 The continuous quality work with suppliers

During the supply and purchase process described, the suppliers are evaluated according to the traditional criteria that the Volvo Group has. Volvo Wheel Loaders divides their suppliers in three categories: (i) preferred suppliers, (ii) 'question marks', and (iii) phase-out suppliers. A supplier that wants to do business with Volvo Wheel Loaders must be categorized as a preferred supplier, but a supplier that is considered a 'question mark' can take precautions to reach the preferred supplier level. A preferred supplier has to follow some 'key elements' that Volvo Wheel Loader has stipulated which on a (a) general level means that each supplier has to be approved to Volvo Wheel Loaders' supplier evaluation model (a form of check list), use EDI-communication in its whole supply chain and also value Volvo as a preferred customer. The supplier must also have a (b) quality management system, i.e. they must fulfil ISO 9001 or TS 16949 standard (a quality standard for the automobile industry). The (c) Production and engineering must involve 'in-house' prototype production, explicit process and capacity management as well as manuals for drawing and service handling. An important part is also the (d) *cost*, which involves warranty cost responsible, continuous quality and production improvements and so forth. Finally, aspects of (e) environment (ISO 14000), social responsibility and logistics have to be fulfilled.

Table 4 ► The Volvo group's supplier demands [information from a presentation, summer 2005]

The Strategy	Global partners, but supplying locally, including local content markets Considering Volvo as a preferred customer when giving access to innovation Transparency in terms of cost and strategy
Development	Complete system suppliers where it adds value Technical skills / innovation skills Resident engineers when required
Relationship	Long-term relationship Pro-active in reducing cost and improving performance (proposing new features)
Quality	Highest quality standards Good management of your lower tier suppliers (low cost countries)

The Volvo Group's description of a 'preferred supplier' clearly indicates that a supplier is expected to follow Volvo's core values (quality, safety, and environm-

ent) and there is also a clear economic dimension in the supplier 'key elements' and supplier demands. The requirements in the table above are presented as important to fulfil for any supplier and contractor that aims at doing business with Volvo Group's companies. The Supplier Development personnel at the Purchasing and Supply Management Department perform their continuous work with the suppliers based upon this requirements and 'key elements', among some protocols. The next section describes some of the information systems that are used by the purchasers and supplier developers.

7.6.2 Information systems for purchase and supply management

In Volvo CE's continuous quality and price reduction efforts, their supply and purchase personnel use a *Purchasing Information System* (PINS), a web based information system. PINS is used to coordinate Volvo's purchases, so that all business lines can benefit from deals and partnerships with suppliers. The figure below gives a brief overview of the information systems used in the purchase activities.

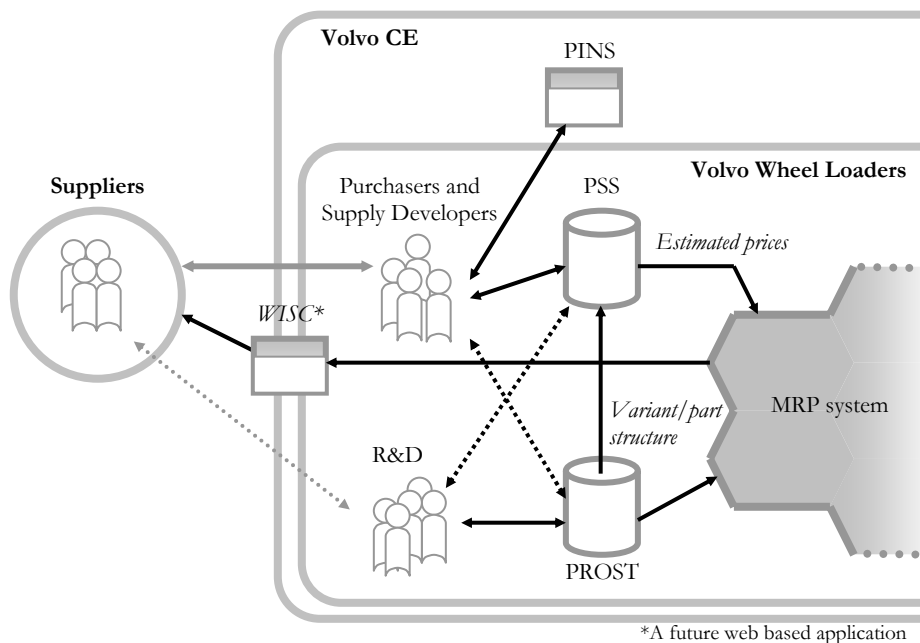


Figure 36 ► Information systems used by the supply management [own illustration based upon interviews]

If there is a product that interests more than one product line, the business lines can assign one Purchaser or Supply Manager to attend to that product in terms of supplier development (including price, product features, logistics, and so forth).

This means that the assigned Purchaser is marked as responsible for that purchased product in PINS, and that he or she can be contacted if others need that product. PINS also helps a Purchaser to find supplier agreements that other business lines have negotiated, something that means that negotiation and agreement arrangements can be used once again. PINS also hinders that different business lines act differently against a supplier, i.e. PINS is a tool to make each business line act as a common company and to develop the supplier relations.

An accepted supplier is put into the *MRP system* via a supply and purchase module. This application is web based and, according to the Supply Manager, it is a compromise regarding the application's functionality. The purchasers had another module in the past, and the present MRP module is less appropriate for the purchasers. But even if the prior application was more fitted for the purchasers, they use the information system that is offered them via Volvo Wheel Loaders' central IT/IS function. After the supplier data is put into the MRP system, along with the products they are supposed to deliver and the business conditions that they have agreed upon, the production plants can order them. After a supplier, and their products, have been stored in the MRP system, the personnel at the plants can place orders.

The Purchasing and Supply Management Department has hired a person working with supply chain IS/IT development. This person is supposed to support the Purchasers and Supply Developers, helping them with *ad hoc* questions that the purchasers cannot acquire from the different information systems they use. This IT/IS person has also developed an application that is used at Volvo Wheel Loaders. The application, called *Project Support System* (PSS), is created as a tool to keep track of purchased articles and engaged suppliers. PSS is developed as a Microsoft SQL server application and it can, among other things, help the Purchasers to evaluate articles that are still not constructed.

Even before the article is drawn, it is possible to describe the article's structure [in PSS]. It is possible to describe the product, estimate lead times, risks, and such types of questions. [...] When the developer is drawing the product, the purchaser may already search for suppliers. The developer may also contact the purchaser that is assigned the specific article. [...] Once the article structure is described in PROST it is possible to import it to the Project Support System.

Supply Chain IS/IT Developer (2005)

Besides being able to 'simulate' articles that have not been constructed, PSS also offers information about the present articles, letting the Purchasers and Supplier Developers evaluate each product through its whole lifecycle. The functions handled by the PSS were carried out earlier as MS Excel spreadsheets, but this was a less adequate solution. It was risky and troublesome to send Excel documents to the different business units, waiting for each unit to fill in their data. With the SQL server solution PSS, the different offices and plants may access the server via a client and update their data in real-time. PSS retrieves variant and part (i.e. product) structures from the PROST system on a daily basis and it is also used for feeding the MRP system with estimated prices. PSS also displays divergence in lead times at the plants, which may initiate discussions between the plants, and in the end leads to more effective purchase routines.

Finally, the Purchasers use a web based information system called *Wheel Loader Interactive Supplier Communication* (WISC) that was under development during the case study. WISC gets its data from the MRP system and it is supposed to offer suppliers information about their status as a Volvo Wheel Loaders' supplier. It will also display order history, present orders, prognoses, and delivery plans. Due to WISC's novelty, it was only in a test phase during this case study, it does not figure in the supplier descriptions. Despite this, it is mentioned in this chapter to indicate a direction of the information system solutions that the Purchasers and Supplier Developers use.

It is adequate to highlight how some of the information systems described are developed and used with the purchasers' activities, and their work with suppliers, as a main objective (PSS and WISC). Others are developed for including in other personnel categories (PROST) or as a general application for Purchasers at all the Volvo CE's business lines (PINS). With this in mind, we move over to the production and delivery of wheel loaders. Now, the purchase and supply management personnel has entered the selected suppliers and specified articles into the MRP system. It has also been described that the dealers indicate future sales (which becomes a market forecast) and that there are wheel loaders ordered or described as 'in the pipeline', which forms the basis for the production prognosis. Via the R&D personnel's PROST system, the wheel loaders structure is also available, downloaded into the MRP system. The next section describes the continued activities leading to the production and delivery of wheel loaders.

7.7 The Arvika plant – producing wheel loaders

Whilst most managerial and administrative functions are placed at the Eskilstuna head office, the day-to-day planning and production is executed at the Arvika plant. The production at Arvika is divided into three production lines, one for the smaller models, one for the medium models, and one for the larger wheel loader models. The following section offers a description of some of the main activities that are carried out, leading to a produced wheel loader, and the information systems used in this process.

7.7.1 The market contacts

When a dealer (such as Swecon) orders a wheel loader, they will come into contact with the *Market Contact* personnel that handle and initiate the orders in Volvo Wheel Loaders' enterprise system. The dealer's Market Assistants and the Market Contacts at the Arvika plant communicate on a daily basis, via telephone, fax or email. The Market Contact's communication with dealers and the use of information systems are illustrated in the figure below.

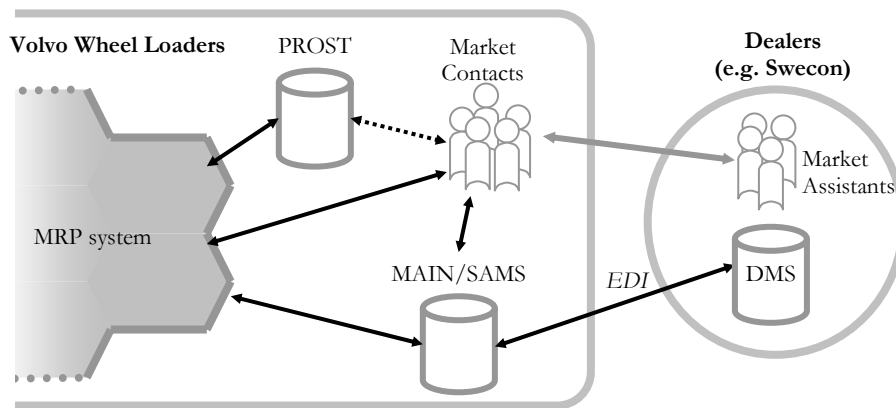


Figure 37 ► The Market contact's and the use of information systems the order activities carried out with dealers [own illustration based upon the interviews]

When an order is placed in the dealer's *DMS* it is also visible in Volvo Wheel Loaders' marketing and sales system *SAMS*. At this point, the order is 'placed' and it thereby needs attendance. This means that a Market Contact first controls when it is possible to produce the ordered wheel loader by checking the assembly schedule and the article status in the MRP system. The final production and delivery time is also checked and compared with the market and production prognoses in *MAIN* (also a part of the Volvo Wheel Loaders marketing and sales sys-

tem). If the order specification seems to include options that are incompatible, the Market Contact usually also checks the product structure in *PROST* to avoid ordering a wheel loader that cannot be produced. When production schedules, article statuses and the machine configuration ordered are checked, the Market contact activates the order in *SAMS*. By this time, the Market assistant at the dealer company will get a confirmation in the DMS. Thereafter, the Market contact uses the *MRP system* to enter the order data (i.e. information about the wheel loader that shall be produced) and update the production schedule. The order is thereby a part of the data that the MRP system processes, and it will also be a part of the MRP runs that are used for scheduling the wheel loader assembly in Arvika. Finally, when a wheel loader is produced, *SAMS* is used to create the invoice for the wheel loader produced and also to produce adequate information to Volvo Logistics that handles the transport to the dealers and end-customers.

As the description of the Market Contact's work indicates, the market and sales systems (*MAIN/SAMS*) and the MRP system are the main supporting systems together with *PROST*. The use of these systems is 'mature', i.e. they have been used for a long time and the respondent describes how she and her colleagues 'know their way around', i.e. the Market Contacts have good knowledge about the enterprise system's features. Usually, the systems work well, but sometimes they are slow and it is sometimes problematic to get access to the functions needed. As an example, the MRP system usually slows down when many people are accessing it:

[The MRP system] has been improved, but it is sometimes slow. When we do queries and suborders it is usually extra slow. [...] Another problem is the 'double booking' [off orders] that sometimes happens. Then we get a warning [from the MRP system], and one has to change his order.

Market Contact at the Arvika plant (2005)

The Market Contacts, in addition to executing the dealer's orders, also offer other services to the dealers. As an example, they can access the market forecasts that are stored in the market and sales system *MAIN* and offer the dealers information on how they are performing according to the present prognosis. Another, often repeated, service to the dealers is to search in *PROST* for information regarding possible wheel loader configurations. All these information systems are accessed on a daily basis, as a part of the business activities that the Market Contact personnel carries out in their contacts with the dealer companies.

7.7.2 The MRP supported production

All of Volvo Wheel Loaders' production plants use the MRP system and it holds all the basic data that is needed to produce a wheel loader. Once an order is written into the MRP system, it is ready to be scheduled at one production line as well as it signals its material need (i.e. articles delivered by suppliers). The basic representation of a wheel loader, the 'product structure', is quite 'naked' in the MRP system. Before a wheel loader is equipped according to an order, there is a possibility to select and combine between 700 and 900 options (where every option results in even more articles). This puts a specific demand on how to plan and assembly a machine. There are also different dependencies between the options. Volvo Wheel Loaders' Arvika plant has almost 6.000 'articles' in their MRP system and many of them are dependent on other options/articles. This means that each selection of an option can require assembly of many different articles.

To be able to handle the production, where some articles are used intermittently, the personnel that carry out the material supply use 'selective control' of the articles and parts.

The [wheel loader] cabins from Halsberg can be used as an example. [Halsberg] is located only 2.5 hours from Arvika. We are 'sequence controlling' them which means that, at 1.00 PM today, we put a sub-order on those cabins that shall be mounted onto wheel loaders tomorrow. And the sub-orders [that are sent to Halsberg] are based upon customer orders. [...] And these cabins will be mounted on to the wheel loaders that will produce tomorrow!

Acting Material Supply Manager at the Arvika plant (2005)

But the sub-ordering of essential parts, such as cabins, does not happen *ad hoc* according to customer orders. The use of Volvo Wheel Loaders' production prognoses also plays a part when communicating supply demands with suppliers. A process that 'breaks down' the production prognosis and customer orders is carried out for each of the three production lines and this also results in order-information that is sent to the suppliers.

The MRP system that is used for this procedure has not followed the growth of the Arvika plant. The factory has gone from a semi-large production plant to a high-capacity production facility in just a couple of years. Today, many of the activities that are carried out to create the production sequence are carried out manually, with support of other applications than the MRP system. Instead, the production planning personnel use different spreadsheets in MS Excel to support

the creation of the supply needs and assembly schedules. In the future, the planning will be carried out even more often, due to the increased production and the growth of Volvo Wheel Loaders' order stocks. As described by the Acting Material Supply Manager (2005):

Today we have a 'once-a-week' planning frequency but, during the spring, we will move over to a 'once-a-day' frequency. I usually say: 'to manage a factory as [the Arvika plant], with its demand on delivery time, measurements have to be taken'. I usually make an analogy with this factory 3-4 years ago and the ships that cross the Atlantic Ocean. 100 years ago, the sailing ships used a sextant maybe once a day and that was enough to correct their travel direction. But now, when high-speed ships are crossing the Atlantic Ocean, they use GPS that gives them their exact position plus/minus 0.5 meters! That is similar to managing a factory such as ours. We are used to controlling the processes with a low frequency, and now we have to modernize it to the new needs.

According to the Acting Supply manager, the increased MRP requirements will be arranged by a continued development of the existing MRP modules. It will all come down to the development costs; changes will be made if it is economically reasonable.

7.7.3 Acquiring material – getting articles from suppliers

When a wheel loader is up for production (i.e. appearing in the MRP system) the *Material Control* personnel, working with the acquisition of articles and parts, sends out sub-orders to the suppliers. The wheel loader production structures are represented in the MRP system and it thereby gives the Material Controllers information about articles needed. The Material Controllers use different methods when handling the material supply and sub-ordering, depending on which supplier they are ordering from. The preferred method is to use (1) *EDI*, i.e. Volvo Wheel Loaders' MRP system automatically generates a request in the supplier's information system through EDI when it is time for the supplier to send their articles. If the supplier does not have the possibility to communicate through EDI, Volvo Wheel Loaders' offers their web based EDI application (2) *Edionet*. This solution is arranged via different web service companies which support Volvo Wheel Loaders with both web server facilities and the creation of the web application needed. A supplier that uses Edionet has to pay a yearly fee to the web service company, where after they receive a login and a supplier identity in the web service. As seen in the figure below Edionet shows delivery dates, ordered articles, quantities, and order numbers. Other Edionet views offer the supplier their order history, deliv-

ery plans, and invoice information. The data that are presented via Edionet is updated when a new delivery schedule is sent. It is, therefore, not naturally updated when the MRP system is updated. The supplier can also return order information via Edionet, information that the MRP system receives.

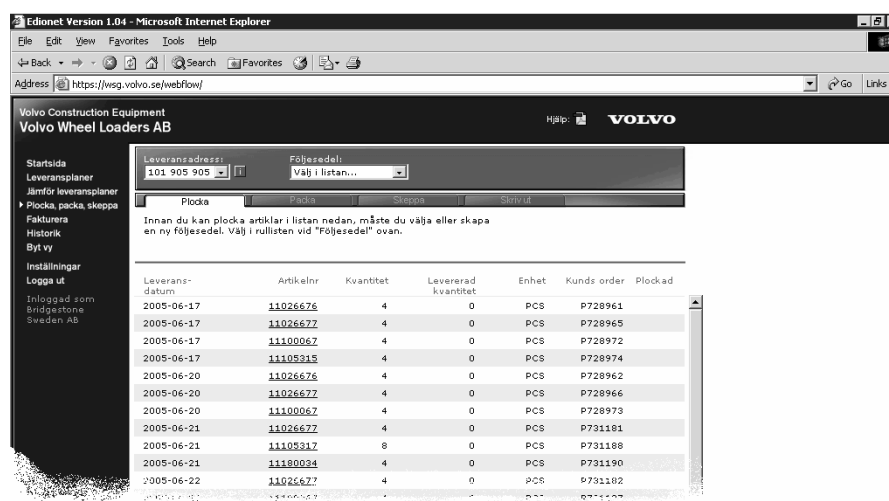


Figure 38 ► Edionet [modified screen picture from Volvo Wheel Loaders supplier Bridgestone, 2005]

Despite the formal (electronic) communication methods described, the Material Controllers also frequently use (3) *Office programs* (as MS Excel spreadsheets) *and email*, besides telephone calls. The Excel documents are created based upon what is needed in the communication with each supplier, i.e. there is no template or dedicated server involved. It is, instead, up to each Market Controller's capability and interest.

Depending on if the supplied products are seen as scarce or standard, the contacts with a supplier are more or less frequent. The business carried out between the Market Controllers and a supplier is generally described as 'cooperative' and 'supportive'. One Market Controller describes that 'it is about give and take!' Each week, the Material Controllers check their suppliers' delivery schedules. This information can be found in the MRP system that has three different order statuses: 'Status 1' for orders with delivery dates, 'Status 3' for preliminary delivery dates, and 'Status 4' for long time prognoses. This order information is also communicated to the suppliers via one of the communication means presented earlier (the information systems used for the business activities described is illustrated in the next figure). The actual order statuses are checked by the Material Controllers

every week, and the suppliers know that all orders in Status 1 or 3 will be ordered (Volvo takes financial responsibility for these) while all orders with Status 4 are considered indications for future needs.

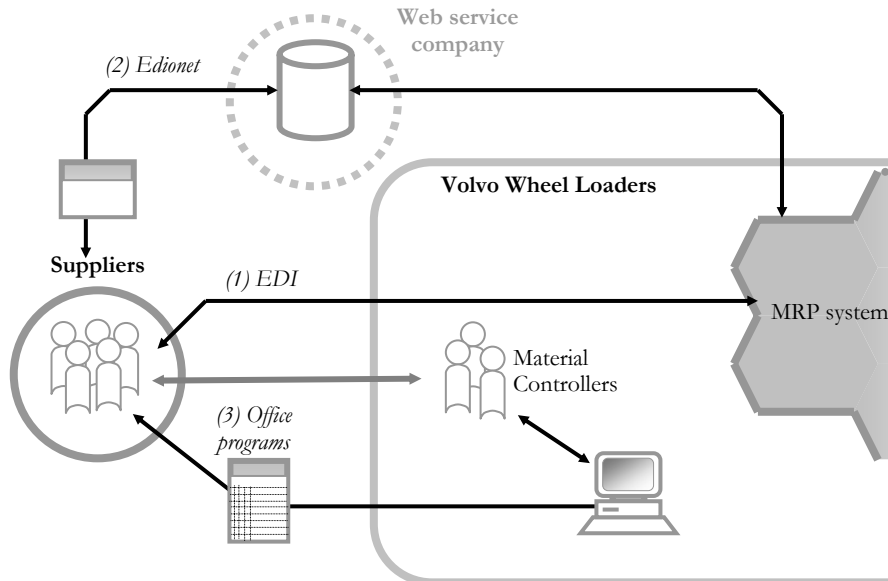


Figure 39 ► The Material controllers at the Arvika plant information systems and supplier contacts [own illustration based upon interviews]

Volvo Wheel Loaders' Material Controllers receive feedback from each supplier, based upon the orders and the order prognoses that have been sent.

7.7.4 Evaluating the supplier logistics

Each Material Controller also, besides the continuous order handling with the suppliers (which can be from several times per day to once or twice a month), give the suppliers feedback on their performance. During spring 2005, some of the Material Controllers have been evaluating the WISC system, which means that they have used this application to evaluate their suppliers. The Material Controllers can get a performance indicator on each supplier via WISC, and they think that WISC works very well. Until now, WISC has mainly been an internal application, but the intention is to let the suppliers access it themselves. When (and if) the WISC system is in full use, the suppliers will also be able to give feedback in the system if, e.g. they think their performance indicator is wrong. By that time, WISC can be regarded as the supplier's web portal to Volvo Wheel Loaders.

There are also three Material Controllers that are assigned to carry out investigations striving to increase the suppliers' performance. This is done by letting each supplier carry out a global logistic evaluation (GLE): a general global document (i.e. not a Volvo specific requirement) used for 'world class performance' evaluations. The result of a GLE assessment results in that the supplier becomes an A, B or C supplier. As an example of a technology aspect in the GLE: to become an A or B supplier the supplier must have EDI, otherwise they automatically become a C supplier. The difference between the evaluations described in the section about supplier evaluation at Volvo Wheel Loaders' Supply Management Department and the GLE evaluation is that the prior focuses on the whole supplier company whilst the latter focuses their logistics.

After this description of Volvo Wheel Loaders and their business the case story moves on to one of their major business partners, the Swedish dealer Swecon.

7.8 The Swedish dealer Swecon

Swecon Anläggningsmaskiner AB is an exclusive retailer of Volvo CE's products. Swecon was established in 1999, but its history goes back to the 1880's as a part of the organization Lantmannaföreningen in Sweden. Swecon has incorporated former Volvo employees with a good insight in Volvo CE's procedures and products. Through history, Swecon (as Lantmannaföreningen) have had Volvo as their main supplier and, with the employment of Volvo personnel, the ties to Volvo CE (and hence Volvo Wheel Loader) is described overall as close. Swecon has approximately 380 employees at 38 service workshops and sales offices in Sweden and it is one of Volvo CE's largest dealers at the European market. In addition to the Swedish market, Swecon also has business in Estonia, Latvia, Lithuania, and parts of Germany. Swecon's headquarters is located in Eskilstuna and they are housed in a part of Volvo CE's Promotion Centre. The continued description focuses on Swecon's business in the Swedish market.

7.8.1 How to sell entrepreneurial machines*

More than 30 Salesmen that manage different regions cover the Swedish market. The Salesmen are supposed to sell all products from Volvo CE, i.e. not only wheel loaders. The machines from Volvo Wheel Loaders are, though, one of Swecon's

* Entrepreneurial machines are the researcher's translation of the Swedish expression 'entreprenörsmaskiner'.

most sold products. One salesman describes that 'It is gratifying to sell Volvo's wheel loaders in Sweden, because the market is very loyal to the famous Swedish brand'. But even if a customer has not even checked the competitors' products and prices when ordering a wheel loader, most customers have a reasonably good overview of the market. When visiting the Salesman that is responsible for Västmanland county and the Eskilstuna district, he describes that he has a loyal customer base. He has two offices, one in Västerås and one in Eskilstuna, to be available to his customers. He describes that the Eskilstuna office fills its function, even if he only spends one day a week there:

People know where this place is. The customers [in Eskilstuna] have got used to; [...] just dropping in if there is something they want to talk about.

Salesman at Swecon (2005)

Swecon offers, besides Volvo CE's products, other equipment that can be fitted to the entrepreneurial machines or used together with them. Swecon also offers financial solutions and insurances for the machines, services that they have developed and offered in collaboration with a financial company and an insurance company.

The figure below illustrates the described day-to-day interaction carried out by Swecon's personnel that are directly involved in the sales of a wheel loader. The activities that are carried out, before and after a wheel loader is sold, involve both manual routines and the use of information systems and computer-based applications. Swecon's organizing is also divided into different tasks. The *Salesmen* that carry out the sales activities; write quotations, negotiate conditions and prices, and finally sign the contract of sale, are the front-line facing the customers. When a wheel loader is sold, a *Market Assistant* (located at Swecon's headquarter) collects all the sales data from the Salesman and executes the sale so it becomes an order at Volvo Wheel Loaders' Arvika plant. Besides these two actors, Swecon also has Product Engineers that support the Salesmen with technical expertise regarding the products features.

From the Salesman's point of view, an (1) *MS Excel spreadsheet template*, created at Swecon's head office, is a major support in the everyday activities. The spreadsheet is used as a tool when calculating wheel loader prices, but it is also an application that gives the Salesman an equipment list that he or she may give to the customer (i.e. it offers support with production selections, prices and margin calculations).

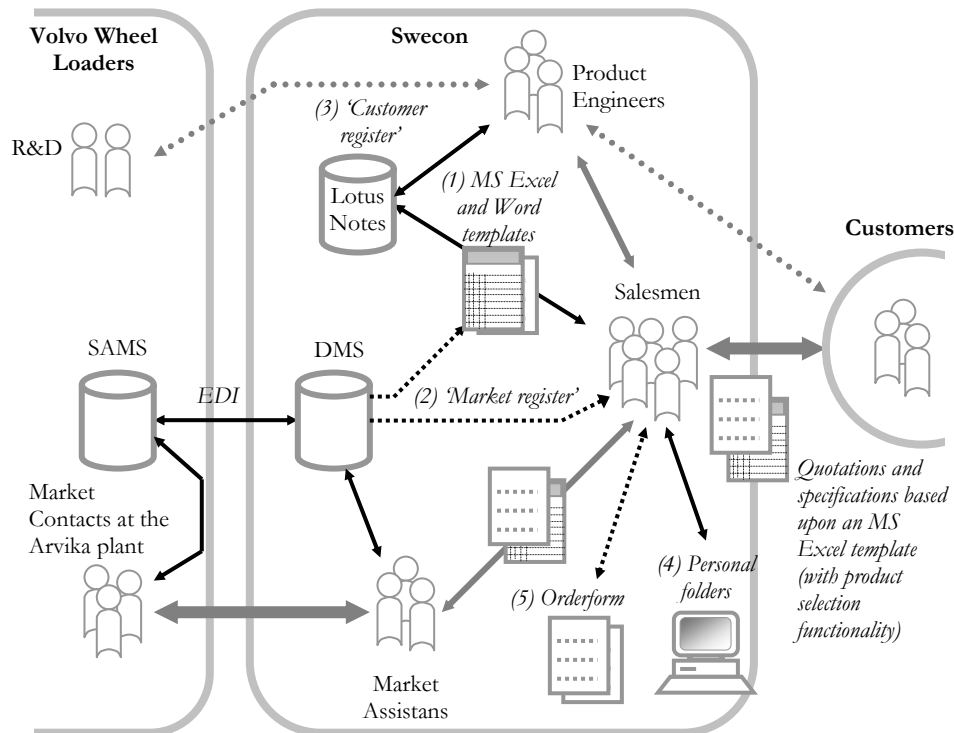


Figure 40 ► Swecon's wheel loader sale activities and the information systems [used own illustration based upon interviews and observations]

The typical end-customer, which means approximately 80 % of the customers, is a company with 1-5 entrepreneurial machines running. Each machine use to be replaced every 5-6 years and by then, the used machine has 2-3 more 'lives' at other companies such as sub-contractors, farms, and similar settings. In the continuous contacts that a Salesman has with these customers, he or she uses several information systems. The Salesman interviewed describes a problem with the existing information systems and applications:

We have tools for everything, but they are not connected to each other. I have [as an example] a market register that I use as a customer register. [...] But that is another system than the customer register that is used for repairs etc. That is another database and the two [registers] do not share information with each other. As an example; if a customer moves, then Swecon may change the information in the market register, but the Salesman will not see it!

Salesman at Swecon (2005)

What the Salesman refers to as the (2) *market register* is a function within the dealer management system (DMS) that holds customer information (including customer numbers that is used to identify each customer) whilst the (3) *customer register* is an application within Swecon's Lotus Notes database. The DMS is handled and updated at Swecon's headquarter and the customer registers are handled by each district's Salesman. The Salesmen are equipped with a personal PC and a login in to both the DMS and to Swecon's Intranet (i.e. a Lotus Notes environment). The MS Excel application described is also available through Swecon's servers, but the Salesman interviewed had it downloaded on his laptop's hard drive.

Before a sale, the Salesman from Swecon discusses what type of product the customer needs, trying to find out what kind of product to suggest. When the Salesman has a good picture of what the customer needs, he or she moves into the (1) MS Excel spreadsheet to calculate prices. The spreadsheet offers product and price information and it gets its figures from the DMS. A *Product Engineer* at Swecon's head office is responsible for accepting new products and product modifications in the DMS, and those that have been accepted are periodically transferred to the spreadsheet. When a Salesman opens the spreadsheet, each option that is considered an MRS machine is marked. By using the MS Excel application (with approximately 250 posts for the L120E model) and marking each option that the customer needs, a 'product specification' and a 'customer price' are created. Besides the MS Excel spreadsheet, each Salesman also has a *MS Word template* for their quotations. At this point, a (4) '*quotation folder*' is created on the Salesman's laptop, holding a Salesman number, the actual date, and a quotation number. The quotation created in MS Word, the calculation from MS Excel, and possible other documents, will be stored in that folder. The quotation is then sent to the customer via email, together with a specification list printed from the MS Excel spreadsheet. At this point, the Salesman also has a calculation of the gross price and the margins, information that will be stored in the quotation folder.

If the customer accepts the quotation, the Salesman uses a printed and numbered (5) *order form* to manually write down the purchase conditions. Usually, this order form is too limited to fit all the specification data, which is why the Salesman usually refers to the earlier quotation and specification list. When this is done, the customer receives a copy of the order form. Once a sale is 'closed', the Salesman will order workshop time at one of Swecon's workshops and complementary equipment that Volvo does not sell (e.g. a fire extinguisher or a weighing-machine to be placed on the bucket). After these tasks are done, all the sales documents are sent to the Market Assistant at Swecon's head office. The document package for

each sale thereby includes: the order form, the calculation, the specification list, and orders placed at other suppliers than Volvo CE.

7.8.2 The ordering of wheel loaders

At this point in time, the Market Assistant writes all order data into the DMS. The part of the order that shall be produced at Volvo Wheel Loaders is automatically transferred through EDI and immediately seen at Volvo Wheel Loaders' Arvika plant. Thereafter, the Market Assistant accesses Swecon's financial system so the order is registered on the proper account and so that the wheel loader, later on, can result in an invoice to the end-customer. The DMS that the Market assistants use has three 'modules': the *Machine Administration System* (MAS) that communicates with Volvo's MAIN and MAS systems, the *Service Administration System* (SAS) that handles workshop orders and finally the *[Management] Order Parts System* (MOPS) that are used for the after sales market. Whilst MAS communicates in real-time, SAS and MOPS have batch transfers during at night. *MAS* is the main system for orders, storing the information about sold wheel loaders, and *SAS* is a supporting system where workshop costs are stored. *MOPS* holds after sales functionality such as spare parts or other products that are sold to the wheel loaders. When the Market Assistant uses the DMS modules, they 'communicate' with Volvo Wheel Loaders' enterprise system – e.g. for reporting sales, and once a machine is sold, activate the product warranty. As illustrated in the previous figure, whilst the Salesman deals with the customers, the Market Assistant is responsible for communicating with the production plants (as Arvika). The Market Assistant is in contact with the Market Contacts at the production plants several times a day regarding delivery dates, how the status for tires is, or other order and delivery specific topics. The communication that takes place is also initiated from Volvo Wheel Loaders' Arvika plant, discussing potential order changes (e.g. is it possible for Swecon to delay a machine), notifications about production changes, and so forth. The collaboration between Swecon's Market Assistants and Volvo Wheel Loaders' Market Contacts are close, and Swecon's Salesmen are requested not to contact Volvo directly, but to go via the Market Assistants or the Product Engineers.

7.8.3 Swecon's intranet

Besides the templates in MS Word, MS Excel, and the order execution in the DMS modules, Swecon's personnel have access to a Lotus Notes Intranet. This Intranet is e.g. used for the sale of used entrepreneurial machines. The sale of used machines is supported by a Lotus Notes application that allows the Salesmen

to store information about used wheel loaders in a database, including product descriptions and digital photos. Each Salesman in Sweden has access to this database, which means that they can see what kind of used wheel loaders (and other entrepreneurial machines) that the other offices or workshops have. A part of the information that this Lotus Notes application holds is also presented on Swecon's web portal. This means that potential customers can search for used Swecon/Volvo products themselves via a regular web browser.

7.8.4 The product engineer – a technical specialist

The Intranet also works as a *bulletin board* and a knowledge repository regarding Volvo CE's products. This service is partly handled by Swecon's *Product Engineers* that update and handle the information presented. But the Product Engineers, expected to have deep knowledge of their product series, have to be careful when selecting what to communicate with the Salesmen: 'If you put out too much information [on Lotus Notes], no one will read it!'. The Product Engineers are responsible for being the technical specialists regarding the products that Swecon sells. The Product Engineer is responsible for the MRS machine specification and it is also he who handles the acceptance of new products in the MAS system.

A large part of the Product Engineer's daily operations is to modify products (such as buckets) according to customers' requests, but they also carry out administrative tasks regarding Volvo CE's products. The Product Engineers are also Volvo CE's 'ears out in the market', i.e. they give feedback on how the products are accepted and how they perform according to the end-customers. The Product Engineers also participate in local activities arranged by the Salesmen (e.g. trades) and visit high schools, informing about Volvo CE's and Swecon's business and their products.

The Product Engineer that is responsible for the wheel loader product line was an employee at Volvo Wheel Loaders for eight years before he came to Swecon. He can thereby discuss how the work at Swecon is handled with consideration as to how Volvo Wheel Loaders usually act. As an example, he mentions that he misses the possibility to access the PROST system that offers information about possible wheel loader configurations. Nowadays, as a Swecon employee, he is guided to the web service Volvo Dealer Network. The information presented at the Volvo Dealer Network is presented as a bulletin board with news, product information, competitor analyses and other information regarding Volvo CE's products and the entrepreneurial machine market. There is also a 'sales engineering manual' available at the Volvo Dealer Network.

In the description of the difference between Swecon's Salesmen and the Product Engineers, the first category is responsible for everything about the sale whilst the latter focuses on the products. As described by a Product Engineer:

I gladly discuss economy, but never prices. That is the Salesman's business.

Product Engineer at Swecon (2005)

Basically, the Product Engineers set the basic specifications on what to sell (by administrating Volvo CE's products in MAS), but they shall not be involved in any commercial issues. The administration of MAS includes setting legal and technical requirements or environmental remarks (marked with different acronyms in the DMS). The Product Engineers also approve or delete products and options in MAS, something that affects the data presented in the MS Excel spreadsheet that the Salesmen use for quotations. MAS also has a setting that results in the information being 'seen' or 'invisible'. As an example, the option of 120 voltages is directed to the US market, which is why this is marked as invincible and thereby not transferred to the MS Excel application. By administrating these settings, the Product Engineers hinder a sale and ordering of an impossible or improper wheel loader configuration. Beyond the activities mentioned, the Product Engineers use several other applications in their work. Volvo Site Simulation is one example. This software simulates the use of Volvo CE's machines and even other machines (if the customer wants to compare with competitor's machines). The result presents selected machines, their routes, average production per year, cash flow, and other data that can be interesting for the customer. The simulator may also present 'total cost to move target' if a certain task is programmed. But the simulation is used conservatively, due to the effort needed and it is even the case that the customer sometimes has to pay for the simulation.

7.8.5 The IS/IT function at Swecon

Two *IS/IT coordinators* at Swecon's head office support all the information systems that are used for Swecon's business. The IT/IS Controllers are responsible for the maintenance of Swecon's information systems. Swecon's present DMS is focused on order handling, which means that some information needs cannot be fulfilled. A problem is also that the functions are scattered on different systems, even if the users do not experience it so: 'There are connections [between the systems used] but they could be more obvious and simpler' (IT/IS Coordinator at Swecon 2005). An IT/IS Coordinator describes that they do not have any proper data mining or data warehouse system for the customer and machine management.

Even if the present information systems offer such information, it is badly used and hard to structure. Recently, Swecon evaluated their present and future IT/IS needs and formed an IT requirement analysis. This analysis has resulted in a list of some problems that must be attended to, such as: a need for CRM functionality and a better integration between the information systems used. The major issue addressed by Swecon's financial manager is, of course, also good control over the economic status and transactions. Besides the factors mentioned, the future information system infrastructure also needs to meet standard requirements such as usability etc.

7.8.5.1 CRM functionality

A better *CRM functionality* would allow Swecon to have a better insight into their customers' behaviour and needs, and the present information systems do not perform sufficiently in this area. The DMS is created from Volvo's perspective, that is, Swecon is seen as the customer. This means that the end-customer, who is the one that uses the wheel loader, is to a large extent missed. One of the IS/IT Controllers mentions that the German office uses Microsoft's enterprise system Navision and that system has a better CRM functionality. In the continued collaboration with Volvo CE, they see different standardized solutions as possible, even though SAP R/3 is too extensive for a business like Swecon. Selecting another solution than the one Volvo uses would have its disadvantages:

From Volvo's point-of view, we can choose whatever [enterprise system] we want as long as we also account for the interface. The alternative is to follow Volvo's selection of information system which also means that they arrange the interface [between Volvo CE and Swecon].

IT/IS Coordinator at Swecon (2005)

Swecon's Vice President gives a similar description. Being a dealer to Volvo CE brings many synergy effects, such as being offered a DMS that is well fitted to their business. He also mentions that the new DMS also involves a standard CRM application that may be implemented soon. If Volvo CE presents a DMS and CRM solution with the needed functionality, and full integration towards Volvo CE, that solution is preferred. Even the present DMS holds functions that can be used for CRM purposes, such as being able to mark what products customers are interested in the customer register, but these functions are frankly seldom used.

7.8.5.2 Better integration

The factor *better integration* means that the employees will not experience the modules in the DMS as different systems. The structure of the DMS can briefly be illustrated as made up of three modules. As has been described, the modules are used for different purposes (*MAS*, orders to Volvo Wheel Loaders; *SAS*, service administration; and *MOPS*, after market) and they are also connected to different information systems at Volvo CE's different business lines. The figure below is simplified showing some of the functions of these modules and their connections with Volvo CE's and Volvo Wheel Loaders' information systems.

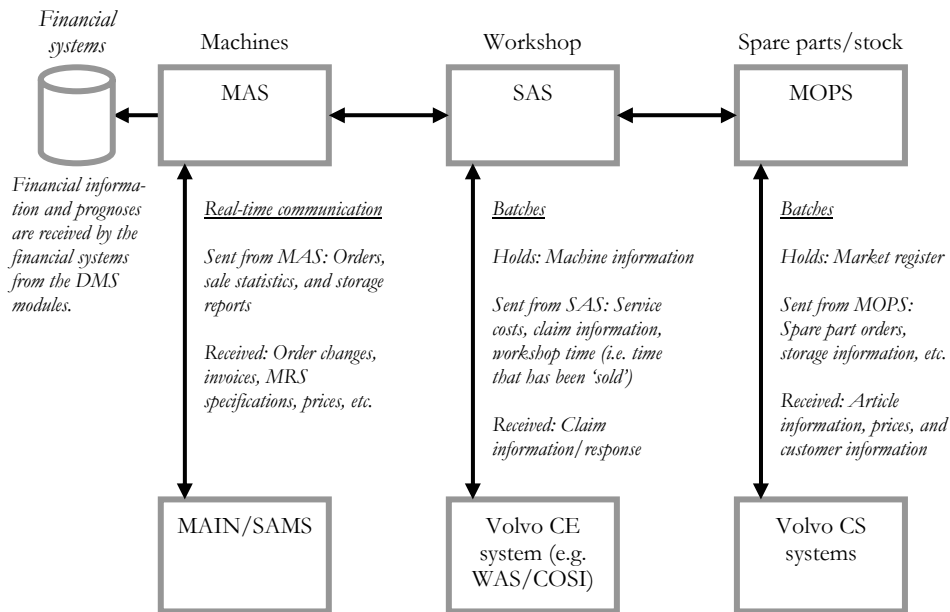


Figure 41 ► Swecon's DMS structure and its connections to information systems at Volvo CE and Wheel Loaders [own simplified illustration based upon the IT/IS Controllers' presentation and sketches]

From a Salesman's or a Market Assistant's perspective, these three systems are experienced as different systems, even if they communicate with each other. The modules are used from when a machine is ordered, through its lifetime involving service and repairs.

Thereby the description of Swecon is ended and the case story moves over to the suppliers.

7.9 Bridgestone – the tyre supplier

Bridgestone^{*}, a Japanese company acting in a global market, is one of Volvo Wheel Loaders' major suppliers of tyres. Bridgestone's main products are tyres to most that runs on wheels like cars, buses, entrepreneurial machines, and Formel-1 racing cars. Bridgestone's head office is located in Tokyo and their business is spread around the world with a sale organization that is divided into three business areas: (1) Europe, (2) Asia, and (3) America. *Bridgestone Sweden AB* (which will be referred to as 'Bridgestone' in the continued description) manages the marketing and sales activities in Sweden. The Swedish head office, located in Sundsvall, has 26 employees and besides that there are 22 Salesmen 'on the road' responsible for the Swedish districts.



Figure 42 ► [On the right side.] A tread tyre, suitable for rocky and abrasive conditions, used on the L120E model [published with courtesy of Bridgestone]

When discussing Bridgestone's strategy for how to handle customers, the Product Manager, that also acts like a marketer, describes that they are aiming at having 'some big customers and many small' in a 30/70 relation. This means that the major customer base is made up of minor customers (regarding order sums and the quantity of tyres), something that can guarantee a stable customer base. The Product Manager also reflects upon that the manufacturer of entrepreneurial machines also seems to apply the same strategy: 'They do not want to put all their eggs in the same basket'. Bridgestone's Product Manager describes how there are three big actors in the tyre world market: Bridgestone, Michelin, and Goodyear. He believes that Volvo Wheel Loaders have spread their orders among these three actors quite similarly, and that they also have some other minor tyre suppliers when equipping their wheel loaders.

7.9.1 Bridgestone's and Volvo Wheel Loaders' business

Today, the whole tyre industry is in a special situation that has not appeared before. Due to increased raw material prices and a growing demand for off-the-road tyres, companies like Volvo CE have covered themselves by formulating 'basic agreements' with the tyre manufacturers. In this case, the initial purchase

^{*} No 250 on the Fortune 500 list (2003).

process has been carried out on a global level, where the main actors were Volvo CE and Bridgestone Europe. These two actors have agreed upon the price levels, possible price adjustments according to changes in the currency or raw material prices, and so forth. Based upon what is stipulated in the agreement between Volvo CE and Bridgestone Europe, purchasers at Volvo Wheel Loaders and sales personnel at Bridgestone Sweden carry out the operational business. At Bridgestone in Sundsvall, a *Product Manager* is assigned the Volvo Wheel Loaders' contacts. The Product Manager deals with Volvo's purchasers regarding the buying conditions and the development and evaluation of new products. The collaboration between Bridgestone and Volvo CE goes way back – even before Bridgestone's Swedish office was established in 1988, Bridgestone Japan supplied Volvo CE with tyres directly. The Product Manager at Bridgestone describes a close collaboration between the two companies, and a high frequency of encounters, involving many people from both companies. To get a picture of the magnitude of Volvo Wheel Loaders and Bridgestone's business, the quantity of tyres sold may give an indication. Due to commercial issues, there are not any quantitative measures given, but the deliveries of tyres add up to several trucks per week (i.e. many thousands of tyres per year).

7.9.2 Joint activities

Bridgestone values the business that is carried out with Volvo Wheel Loaders, due to Volvo's recognition on the market. This means that there is a close collaboration between the two partners. Volvo Wheel Loaders is, for example, a selected partner when it comes to developing and testing new tyres:

If it works for Volvo, it works for others. [The collaboration with Volvo] is also an advantage for Bridgestone's R&D – Volvo is respected in the world!

Product Manager at Bridgestone (2005)

Bridgestone's Product Manager is, besides the R&D collaboration, mainly involved in activities that can be seen as strategic, such as buying conditions and joint product development, and there is another organizing the operational activities that end with the truck transportation of tyres. For an overview of the contacts described between Bridgestone (Sweden) and Volvo Wheel loaders, see the figure below. The figure offers a simplified picture of all the business activities that take place, but it also works as an elucidation of the partnership described.

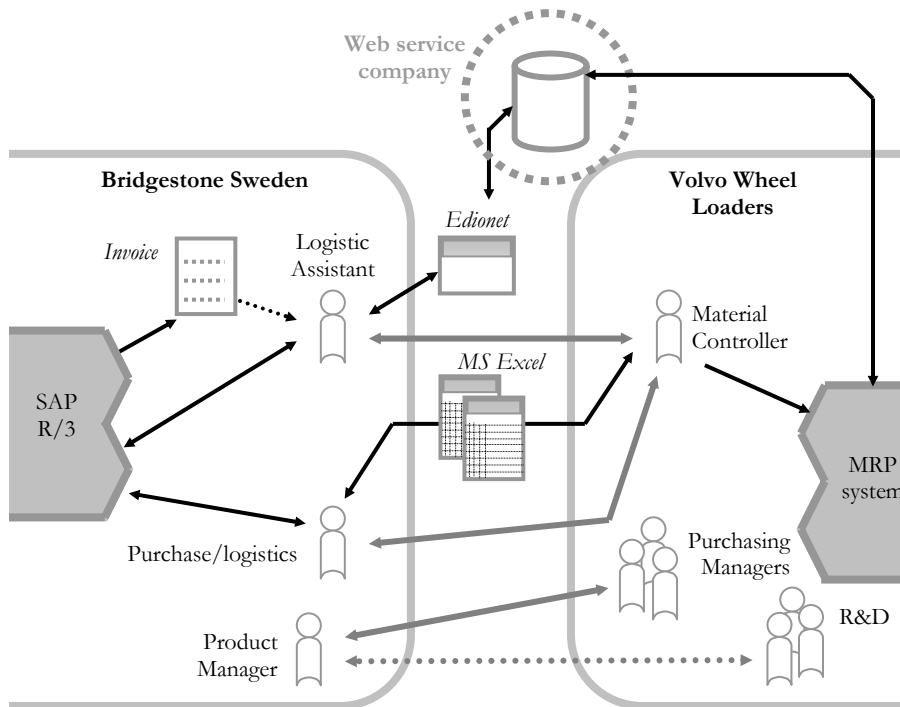


Figure 43 ► Bridgestone's business activities with Volvo Wheel Loaders and the use of information systems [own illustration based upon the interviews]

The day-to-day activities at Bridgestone involve a constant updating of prognoses of how many tyres Volvo Wheel Loaders need forthcoming, as an average delivery time for tyres is more than three months. Volvo Wheel Loaders' Edionet offers Bridgestone access to such prognoses. At Bridgestone, an order and Logistic Assistant continuously checks Edionet and manually transforms the order information sent from Volvo Wheel Loaders to orders in Bridgestone's SAP R/3 system. The prognoses from Volvo contain information about tyre quantities, dimensions, treads, and so forth.

7.9.3 Information systems used

Bridgestone's business activities are supported by an SAP R/3 installation at their European office with a server outside Paris. Bridgestone's Swedish MIS Manager mentions that the SAP R/3 client performs well, but sometimes the personnel experiences that the systems are slow due to problems in the connections between Bridgestone's WAN and the Swedish agency's LAN (this was corrected after the case study through the installation of another, redundant, server).

Bridgestone uses different means when they communicate with their customers such as (a) *EDI* for handling orders from replacement customers (i.e. smaller tyre dealers). Lately, they have also established (b) *web based EDI* with a major customer, something that the Product Manager thinks will be more common in the future. Besides this, other customers can get product information and place orders through what the respondent describes as (c) *Bridgestone's e-commerce*, i.e. a website offering where the customers can place and check orders. Depending on which kind of customer Bridgestone has, they let the customer use their e-commerce solution (as with all the smaller car and tyre companies) or they themselves use the customer's web-service as in the Volvo Wheel Loaders' case (with the Edionet solution).

An EDI connection between Volvo CE and Bridgestone would make the order handling easier, but the two IT Managers at Bridgestone Europe have issues that are seen as more important on their agenda. An EDI connection to suppliers is, though, a part of Bridgestone's 'MIS plan', but their Swedish MIS Manager does not think this will be realized in the near future. There are factors that affect why an EDI connection between Volvo Wheel Loaders and Bridgestone has not been installed, besides the resource mentioned and time factors. As it has been until now, the delivery plans presented by Edionet have had faults, and Bridgestone do not want these faults into their own enterprise system. As a result of these flaws in the prognoses presented by Edionet, Bridgestone's Logistic Assistant and Volvo Wheel Loaders' Material Controller have agreed on exchanging their prognoses as *MS Excel spreadsheets*. Due to the tyre market situation, Volvo Wheel Loaders buys everything they can and, until now, they have not had any problems with using them:

Because the delivery time on tyres is 14 weeks and the production scope of wheel loaders is 15 days, there are estimations and taking chances involved. [...] The figures in the [MRP system] are 'sharp' and the numbers in the Excel prognoses are based upon experience. [...] But there is almost a one-to-one relationship between the prognoses and the outcome, and still we have not been standing with any tyres left.

Volvo Wheel Loaders Material Controller at the Arvika plant (2005)

In the business with Volvo Wheel Loaders, Bridgestone has accepted using Edionet for order administration. This means that Bridgestone pay a yearly fee to one assigned web service company and they use Edionet for order communication. But there is also an advantage in getting the prognoses in Excel-format, as Edio-

net presents the prognoses per article whilst the Excel spreadsheet gives a better overview of the articles.

Bridgestone uses several different information systems in the business with Volvo Wheel Loaders. Edionet offers daily information about what tyres they need, and it is also Edionet that initiates the ordering process carried out by the Logistic Assistant. But Volvo Wheel Loaders' Edionet does not communicate directly with Bridgestone's SAP R/3, which is why the logistic personnel at Bridgestone constantly checks Edionet and transfers its data to orders that can be produced and delivered by Bridgestone. The Edionet also offers complementary documents such as the delivery slip with Volvo Wheel Loaders' order number. When the order is expatiated, i.e. on its way to the Arvika plant, Bridgestone notifies Volvo Wheel Loader via Edionet. At this point, Bridgestone also creates the invoice in their SAP R/3, something that results in a paper document. These paper invoices are picked aside because Volvo does not accept invoices as paper documents, whereafter the invoice is written into Edionet (which holds agreed prices and so forth). The positive effects of having separated information systems (which this solution is) are that fault EDI orders do not affect Bridgestone's SAP R/3, but on the downside come: the risks with manual treatment of orders, the Edionet are slower [to use than SAP R/3], and there is no possibility to correct errors or to credit orders. The latter has to be done manually by contacting supply personnel at the Arvika plant.

7.10 CH Industry supplies metal details

CH Industry AB is a company that have been offering metal (tin-sheet) products since 1948, and Volvo was their only customer at the beginning. Relatives to one of the founders are still active within CH Industry, but nowadays an employed CEO manages the company. CH Industry profiles themselves as a 'supplier of sheet metal components for heavy vehicle and telecom industry' and they describe themselves as a subcontractor within the metal and tinplate market; offering services such as, e.g. welding, laser cutting, punching, and assembly, on their home-page^{*}. The company has 55 employees, whereof the majority are blue-collar employees. CH Industry serves all the companies within Volvo CE including the plants in other countries, and their customer base also includes other international companies such as ABB and Ericsson.

^{*} www.chindustry.se, visited 27 September 2005.

7.10.1 CH Industry's business with Volvo Wheel Loaders

CH Industry supplies Volvo Wheel Loaders with more than 400 articles, of which most of them are metal details such as holders and brackets. Each article can also involve several other articles, which means that there are a great number of parts manufactured for Volvo Wheel Loaders. The articles that Volvo Wheel Loaders orders thereby involve most production processes that CH Industry carries out, such as laser cutting, punching, bending, and welding. The business with Volvo Wheel Loaders works well from CH Industry's perspective:

They are good to have to do with! [...] They are on the same track – they are a part of the game.

Customer Contact at CH Industry (2005)

Some of the characteristics that the Customer Contact at CH Industry assigns to Volvo Wheel Loaders are good routines, honesty, and good order specifications. Even though Volvo is a big company, they do not act like a 'big brother'. The extensive deliveries to Volvo Wheel Loaders also means that CH Industry has had a good base when it comes to investing in production equipment.

The quality demands Volvo puts on its suppliers, such as ISO 9000 and ISO 14000, is not any problem for CH Industry. These standards are, on the contrary, an important support to CH Industry's business in general. In fact, CH Industry is in the progress of obtaining the ISO/TS 16949 (ISO TS), which is a necessity when they act on the international market. Even if they have not got any demands or requests for an ISO TS certificate from Volvo Wheel Loaders yet, it is just a matter of time. Overall, the business with Volvo Wheel Loaders can be seen as beneficial as it has been a foundation for investment into modern production equipment. The production capacity that CH Industry can offer today is, thereby, a result of their business with large actors such as Volvo Wheel Loaders. Being a supplier to large companies is a ground foundation when aiming at growth and new markets.

The products and services that CH Industry offers Volvo Wheel Loaders involves subcontract and prototype manufacturing. The most frequent communication regarding orders is carried out as EDI messages, but for information about prototypes or other article specifics that cannot be handled by EDI, personal meetings and telephone calls as well as email are used.

7.10.2 Information systems used

CH Industry implemented the enterprise system *Movex* (from the vendor Intenia) back in 2000-2001 and they included all the modules needed for managing the order handling, production, and logistics. During 2002 they also involved HR functionality into *Movex* and since then, the use of the enterprise system has been gradually refined. *Movex* has been 'a great support' in CH Industry's manufacturing process and it also offers delivery and cassation statistics, information that they can compare with the delivery precision statistics (i.e. feedback) they get from Volvo Wheel Loaders and other customers. As explained by the Production Manager who was responsible for the implementation of *Movex*:

[I sometimes say that] *Movex* is the most important machine we have!

CH Industry's Production Manager (2005)

The business process between the two partners is, on a strategic level, based upon CH Industry's CEO who negotiates, and sets the basic business condition, with purchase and supply management personnel from Volvo Wheel Loaders. When CH Industry has been accepted as a supplier for an article, the operational personnel take over. The continued business process then involves repeated sub-ordering, continuous quality checking and article adjustments. The typical ordering also involves 100's of articles rather than 1000's – i.e. CH industry focuses on producing articles in medium size batches, an area where they can compete with low income countries that have their best advantage in large series production.

A dynamic aspect of having Volvo Wheel Loaders as a partner is the prototype manufacturing. CH Industry offers Volvo Wheel Loaders support when it comes to producing prototypes, products that later will be produced in a larger scale. As a base for the prototypes, and also for the articles that are produced on a continuous basis, Volvo Wheel loaders send their drawings via *email* as *dxf*-files. These files contain all the data that CH Industry's production equipment needs to produce a prototype or a product.

For an overview of the information systems used in the business activities that are carried out in the business with Volvo Wheel Loader, see the figure below.

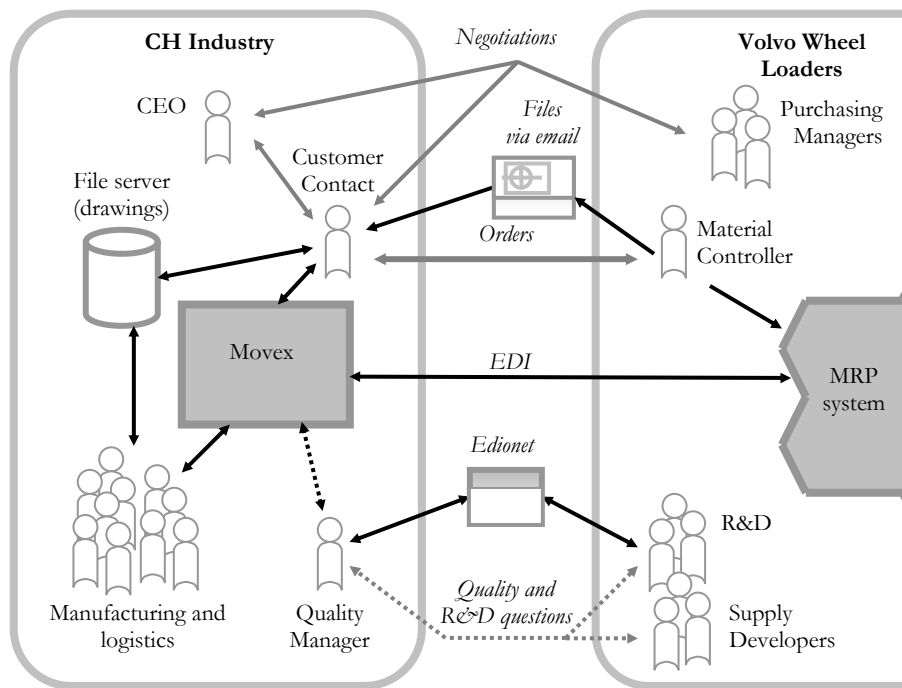


Figure 44 ► The business activities and information systems used in the business between CH Industry and Volvo Wheel Loaders [own illustration based upon interviews]

CH Industry uses *EDI* as the standard communication method in the business with most of their customers. The EDI connection has its advantage such as reducing the administrative tasks, CH industry handles approximately 2000-3000 order lines per week, and it is also a tool for increased flexibility. Today, the production teams are getting their production schedules presented electronically by Movex, which means that there are no papers lying around with old information. The production teams are, instead, constantly feed with production schedules that are updated 4 times per day. This means that the production is very flexible and adaptive to customers' changes. The use of EDI works very well and, based upon a Movex modular structure, it is easy to adjust an EDI format to new customer requirements. But the use of Movex and EDI connections still render the need for manual work between CH Industry and Volvo Wheel Loaders. If Volvo Wheel Loaders sends an order that has a shorter delivery time than stated in the contract, CH Industry might not be able to deliver it in time even though the fault is initiated by an incorrect delivery time from Volvo Wheel Loaders. Movex identifies short delivery times (i.e. if the stated delivery time is shorter than the con-

tracted delivery time) and gives the Customer Contact at CH Industry a warning. To avoid getting bad delivery statistics, the Customer Contact usually contacts Volvo Wheel loaders, via email or telephone, and asks them to correct the incorrect delivery statistics that resulted from the fault.

In the continued work with different articles, the business between Volvo Wheel Loaders and CH Industry is often initiated with CH Industry receiving drawings over the parts that they shall produce. To handle all these drawings that CH Industry receives from their customers, a *file server* with a specific structure (that binds each drawing to a specific article) is used. All employees can access this file server to get drawings for their work (e.g. for producing an article). The files, which can be the result of scanned drawings, CAD-files, Amada-files (used for 3D pictures) or dxf-files, are viewed through the application *Microsoft Imagine*.

The routines for receiving and storing drawings (files) works well, but despite this, CH Industry is in the process of installing *Lotus Domino Document Manager*, a document management programme that will enhance their possibility to handle different versions of drawings. The contract that CH Industry has with Volvo Wheel Loaders means that they must be able to offer spare parts for 20 years after a delivery. This means that CH Industry is obligated to deliver an 'article version A' even if the prevailing production is producing 'article version F'. Another advantage with the document management system is that it allows CH Industry to offer their suppliers (i.e. second tyre suppliers) the access to drawings via a web based interface.

Even if the use of dxf-files makes the activities with the new articles easier, which means that the production equipment does not need to be manually programmed, there are times when the dxf-files contain measures that cannot be produced. One of CH Industry's production technicians describes that the dxf-files from Volvo Wheel Loaders as well as other customers sometimes contain errors in the form of too tight tolerances or other dimension faults. In such cases, CH Industry may correct the fault dxf-file and then give Volvo Wheel Loaders feedback regarding the tolerance or dimension problem and the changes made.

CH Industry has also invested in expensive *measuring equipment* that optically measures the produced articles. Volvo Wheel Loaders requests measuring protocols for the articles that CH Industry produces and the measuring machine prints the tolerances needed. But Volvo requires a measuring report protocol with a structure that differs from the protocol that CH Industry's measuring equipment creates. This means that a measuring technician has to, manually, transfer the output data

from the measuring machine's protocol to Volvo Wheel Loaders' protocol. Another transfer that is not handled by the EDI connection is the *package instructions* that Volvo Wheel Loaders send out. The package instructions contain information on how different articles should be packed. The package instructions are a part of Volvo Wheel Loaders' striving for an effective production and they are produced as regular MS Word documents, involving package instructions and digital photos. Today, these documents are sent to the Customer Contact (or the warehouse and logistic personnel) via email and then stored in regular binders in CH Industry's warehouse.

7.10.3 CH Industry's quality work

CH Industry is in a phase of growth, and the description of their production equipment and their enterprise system is a result of this growth. Movex has been a huge investment for CH Industry, but it seems to be worth it:

Quality is 'A and O' [and] Movex is a part of the quality work. [Movex] was expensive, not to mention the yearly fees, but it has made the production more effective.

Customer Contact at CH Industry (2005)

The Production Manager mentions that the Movex implementation was not aiming at the state that CH Industry was in back in the year 2000 – Movex is implemented for the state that CH Industry strives to be in:

You don't want to implement a new system like that after five years!

Production Manager at CH Industry (2005)

With Movex, CH Industry has a system with the potential to match the customers' future needs. The Production Manager thinks that a coming trend will be that the customers' require direct access to their suppliers' enterprise systems, with the possibility to see the ongoing production from their own enterprise systems. Movex has this functionality built-in, which means that CH Industry may accept such demands. Movex has also been valuable in CH Industry's continuous quality work. As an example, in the process of gaining ISO TS, Movex has a function that involves monitoring the production equipment. If a puncher has punched 5000 thin-plates it needs to be replaced. By letting Movex count the articles produced it can signal when a Production Technician must change a tool or service a machine. Such aspects, as managing the production equipment, are a part of the quality work that Movex can handle. Movex may even be included in the docu-

ment management, but as it is today, CH Industry will let this be handled separately by Lotus Domino Document Management. And the reason for this [does not seem to be the technical possibility, but it rather] is the cost inherent in letting Movex manage these tasks.

7.11 DKI Form supplies plastic details

The last supplier involved in this case study is the Danish company *DKI Form* which has produced different plastic products since 1946. The company has approximately 200 employees today active within 4 production plants. DKI Form is also a subcontractor, as CH Industry, but they have not been a supplier as long. As described on their homepage^{*}, DKI has a specific business idea:

Instead of being a traditional subcontract supplier, DKI offers a productive partnership in which a long-term working relationship with frequent exchanges of know-how, high production efficiency and quality together with a reliable delivery, ensures maximum benefits for the customers.

From the DKI Homepage (2005)

DKI Form has been doing business with Volvo Wheel Loaders, and other companies within the Volvo group, since 2001. To be accepted as a supplier to Volvo, three criteria had to be fulfilled. DKI Form had to be certified according to the quality standard ISO 9000 and environmental standard ISO 14000. They also have to handle the orders via EDI, through a connection to their own enterprise system or via Edionet. As they are using an older MRP system, the use of a direct EDI connection was not possible, so DKI Form chose to use Volvo Wheel Loaders' *Edionet* solution. This means that DKI Form pays Volvo Wheel Loaders' selected web service provider a yearly fee for the possibility to handle Volvo Wheel Loaders' orders.



Figure 45 ► [On the right side.] A cabin part delivered by DKI Form [with courtesy of Volvo Wheel Loaders]

^{*} www.dkiform.dk, visited 18 October 2005.

7.11.1 The business with Volvo Wheel Loaders

As has been mentioned, DKI Form is involved in both the design and production of plastic parts to Volvo Wheel Loaders. When the interviews were carried out, DKI Form delivered to 14 addresses belonging to the Volvo Group. Volvo Wheel Loaders is clearly a customer that is interesting to do business with. Volvo Wheel Loaders orders seven different plastic details (articles), but this number will be doubled during the next year according to the Factory Manager.

7.11.2 Information systems used

DKI Form gets CAD drawings or dxf-files from Volvo Wheel Loaders, files that they store on a *SolidWorks* workstation. With these drawings, they can programme their CNC-machines that are used to produce the details to Volvo Wheel Loaders. Sometimes, the drawings are on several megabytes (which would be problematic to handle via traditional email) which is why DKI Form accesses Volvo Wheel Loaders' files through a FTP-server. With this solution, DKI Form can download the drawings they need to produce the requested products.

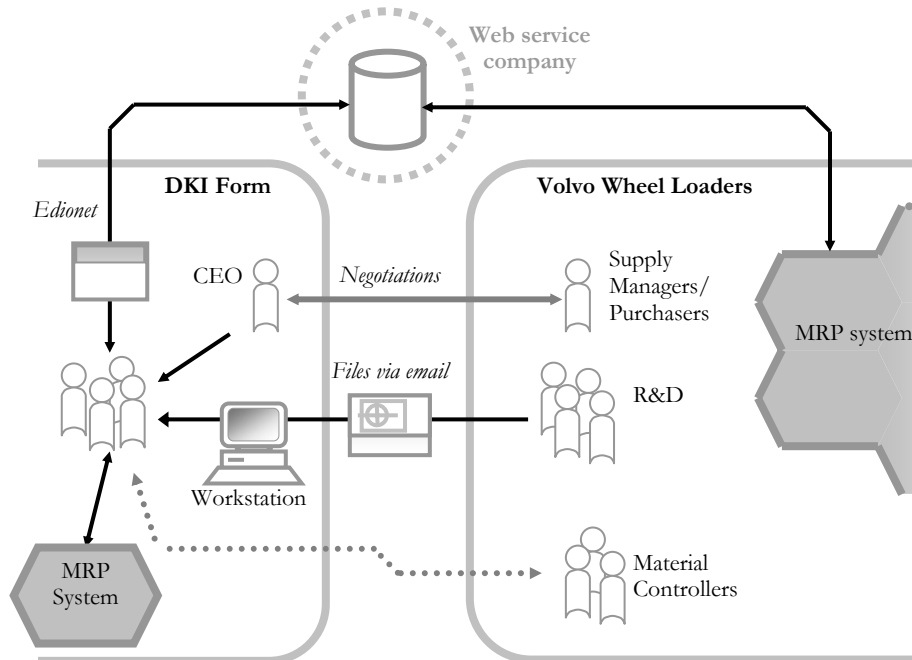


Figure 46 ► DKI Form's Business with Volvo Wheel Loaders and information systems used [own illustration based upon interviews]

As illustrated in the previous figure, the continuous ordering is handled via *Edionet* that Volvo Wheel Loaders offers through the web service company. The only downside with Edionet was that the logistic personnel had to apply 'learning by doing' at the start. They did not get any prior training: the instructions only came as an email. It would have been an advantage if the personnel that use Edionet could have seen it in action before they started working with it. Even though the introduction of Edionet could have been better, the present opinion is that it is a system that works splendidly. All the order and logistic handling is handled via Edionet such as forecasts, orders, notifications, and finally invoices. In parallel with the order treatment, DKI Forms personnel use their own information systems such as the accounting system, PC software and MS Excel for prognoses, email for communication and so forth. But due to Edionet, Volvo Wheel Loaders receives the information they need according to their own specification.

7.12 Analysing the Volvo Wheel Loader case

As with the ABB Robotics single case analysis, the respondents have not checked the following text, i.e. it is solely the researcher's analysis. This single case analysis also starts by scrutinizing the focal enterprise system, followed by a discussion about the focal product's characteristics and the wheel loader industry. Thereafter, each business relationship is analysed one by one.

As chapter 7 has illustrated, wheel loaders are machines that are valued in terms of production capacity, which also indicates that their field of application is professional. It has also been apparent that each wheel loader has standard attributes described in an MRS list, but that the common machine also has some unique features based upon what is available in an option list. As with the robots, this is a rather complex product that puts demands on the information systems that are used to support the supply, production and sales activities. This is a part of the general setting for the Volvo Wheel Loaders case.

7.12.1 Volvo Wheel Loaders' enterprise system

The central hub in Volvo Wheel Loaders' enterprise system is the MRP core that has been 'refined [...] for 15 years'. According to the empirical data, this MRP system is a central production system that facilitates the wheel loader assembly and it is still under constant improvement. The MRP functionality means that its application is limited besides planning and facilitating the production. For other activities such as ordering and R&D, other information systems as MAIN/SAMS and PROST are used. All these information systems that are the foundation for

Volvo Wheel Loaders' enterprise system have been around for quite some time, which means that they are in the onward and upward phase (Markus *et al.* 2000a).

As a business unit within Volvo CE, Volvo Wheel Loaders also utilizes SAP R/3 for financial information, but this system has been absent in the interviews performed (which is interpreted as it having a limited role in the business exchanges with the partners). Volvo Wheel Loaders has also other information systems handling the information about sold wheel loaders (COSI) and by carrying out a query in some of these systems (as MAIN/SAMS and COSI) representations of Volvo Wheel Loaders' business customers (and hence business relationships) can be found on aggregate level. Given the age of some of these systems, such queries are not easy to do. There are also other reasons for Volvo Wheel Loaders to evaluate and migrate their information systems to a newer environment. The status of the present enterprise system is thereby expected to change and the aim is a consolidated, extended, and integrated enterprise.

A project that indicates Volvo Wheel Loaders' striving is the 'MOM system'. With this upcoming order system, Volvo CE (and thereby Volvo Wheel Loaders) unifies the different dealers' technical infrastructure (cf. Kling & Scacchi 1982, Kling & Lamb 2000). The general setting holds different exchange patterns and with MOM, all dealers are supposed to communicate with Volvo Wheel Loaders' plants in a uniform way. Another feature of the MOM system is that it will 'disconnect' the product's detail level, i.e. it is not important what specific combination of parts the wheel loader is built of. If there is a change of some parts, the order specification created in MOM is still valid. MOM also has similar functioning as the PROST system, i.e. it holds information about the product structures (configuration possibilities). This means that the customer (dealer) orders a wheel loader model with the desired equipment in MOM, which signals the possible combinations, and when Volvo Wheel Loader receives the order it will be 'translated' into the MRP system's prevailing product structure. With MOM, the partners can reduce information exchanges that require interpersonal contact. The MOM system can also be seen as a part of the future activity links (Håkansson & Snehota 1995) Volvo Wheel Loader has with its customers (dealers).

7.12.2 The wheel loader product

Volvo Wheel Loaders produces wheel loaders for a variety of tasks. Its use must be considered professional and it is a production unit in settings such as, e.g. mills and forestry industries. The development, sales, and manufacturing of such a product is surrounded by engineering and technical know-how; something that is

manifested in a organizing that also affects the suppliers' and customers' (dealers') business activities. Besides the input from suppliers and customers, it is also important that the purchase activities give synergy effects within Volvo CE. This means that all business activities that Volvo Wheel Loaders, and their partners, carry out also involve engagements on a company group level.

The wheel loaders are equipped according to the customers' specifications and a majority of the machines are unique. As an example of selection possibilities, the focal product Volvo Wheel Loader L120E can be equipped with a bucket from 3.0 m³ to 9.5 m³. There are also hundreds of other choices that make each wheel loader customer specific. The product can thereby be seen as a heterogeneous resource (cf. Alderson 1965, Penrose 1995), i.e. its configuration and application can vary. There are several actors involved in the marketing and sales of this product. Besides the dealer's Salesmen needing technical knowledge, they also have Product Engineers assigned that are supposed to have a deeper technical knowledge. Some of the complementary information systems (PROST) are also used for showing possible equipment combinations. The nature of the wheel loaders thereby affects the internal activities (production) as well as the exchange activities (Dubois 1998). A product that is not 'fixed' (i.e. heterogeneous) requires systems that have flexibility and that can function with all the representations that the product can take. We might also expect that the routines to handle the product require adaptations as well as continuous information and social exchanges (Johanson & Mattsson 1987, Hadjikhani & Thilenius 2005). As with the ABB robotics case, the product studied is complex and multi-faced and this must be considered in the following analysis.

7.12.3 The wheel loader branch*

Volvo CE had a 20 % increase in their sales and a 36 % increase in their revenues during 2004, but even if Volvo CE made an 'all time high', so did the whole market for entrepreneurial machines. As described in the internal magazine *Volvo CE News* there are few global actors but many 'specialist' companies and small companies with only one product. The largest actor on the market is Caterpillar followed by Komatsu, Deere, Hitachi, and Volvo CE (the last three have a market share of approximately 6 % each). Volvo CE had almost half of their sales in Europe, with USA as the second largest market during 2004, and by focusing

* This section is primarily based upon Volvo CE's internal magazines during 2005 and the Swedish business newspaper *Dagens Industri's* and its website (www.di.se) during 2004.

organizational growth and by penetrating new markets they expect to take market shares. Even if the market of entrepreneurial machines, thereby, has been in a state of growth, Volvo CE and hence their business line wheel loaders aims at taking market shares. Some of the challenges that Volvo Wheel Loaders faced during the case study were the deliveries and prices of steel and tyres. This affected their products cost, but this also affected their competitors.

7.12.4 Volvo Wheel Loaders' business relationships

As with the ABB Robotics case, the following business relationships are of different characteristics, e.g. some are old and some are new, meaning there are differences in the number of exchanges that have taken place. The analysis starts with Volvo Wheel Loaders customers (dealers) and moves over to their suppliers. After the business relationships have been analysed there is a summarizing of the case.

7.12.4.1 *The dealer Swecon*

The business relationship between Volvo Wheel Loaders and Swecon is the one in this study that signals the highest degree of trust and commitment (Anderson & Narus 1984, Anderson & Narus 1990, Morgan & Hunt 1994) and all the respondents have indicated that there is a very close cooperation. Given that Swecon is Volvo Wheel Loaders' exclusive sales organization in the Swedish market and that Swecon only sell the Volvo brand, the partners are interdependent (Cunningham & Homse 1986, Håkansson & Snehota 1995, Ford *et al.* 2002). The business relationship has roots even before Swecon was established in 1999 (then as Lantmanaföreningen) and some of Swecon's employees are former Volvo CE employees.

Swecon, that is an important and large dealer from a European perspective, has a formalized organizing (i.e. a infrastructure that affects the use, cf. Kling & Scacchi 1982) that supports their exchange activities in sales and marketing. This formalized structure is also apparent in the exchanges that Swecon has with Volvo Wheel Loaders (see figure 40). The salesmen are scattered around Sweden and the Salesman interviewed described that he works closely with the end-customers that 'just drop in if there is something they want to talk about'. With more than 30 salesmen and 38 service workshops there is usually a local actor that supports a Swedish wheel loader customer. There is also a Product Engineer assigned to handle all the technical issues with the wheel loaders and Market Assistants to take care of the order administration and communicate with Volvo Wheel Loaders' production plants. The organizing is thereby holding several roles, where the salesmen's business activities are separated from Volvo Wheel Loaders' personnel

(i.e. a clear front-office function) whilst others are performing a large part of their duties together with Volvo Wheel Loaders' personnel. The organizing is also formal which can be illustrated by the Product Engineer's description of his and respectively the salesmen's duties: 'I gladly discuss economy, but never prices. That is the Salesman's business'.

The description of Swecon's sales activities illustrate Swecon's quantity of information systems: (i) a quotation and specification application in MS Excel, (ii) a quotation template in MS Word (iii) the Salesmen's folder structure on their personal laptops (iv) the order forms (paper format), (v) the DMS with views for Salesmen (limited access), Product Engineers (administrating what product configurations to be sold), respectively Market Assistants (full access as they execute orders), and (vi) the Lotus Notes Intranet, with each Salesman's own customer register. Whilst the DMS are interorganizational, connected with Volvo Wheel Loaders' enterprise system (even if not all data is transferred in real-time, see figure 41), many other information systems are solely used within Swecon. These other information systems, with a Lotus Notes Intranet as a central hub, are used in the business activities that are carried out when Swecon deals with end-customers. Some of these other information systems are also the Salesman's personal information whilst others are common for the whole company.

During the case study, Volvo CE's MOM project was proceeding in parallel with that Swecon made an IT requirement analysis for forthcoming information systems. Whilst the use of the DMS and Volvo Wheel Loaders' enterprise system (i.e. the MAS and MAIN/SAM connection) can be considered mature (Markus *et al.* 2000a), the prevailing systems lack CRM functionality. Swecon's IS/IT Coordinators described how the DMS is designed from Volvo CE's perspective, which means that it lacks Swecon's CRM needs. But being a dealer involves dependencies (Campell 1985) and there is a clear advantage with selecting the supplying company's suggested DMS. The future CRM system is therefore probably the one that Volvo CE suggests. The present DMS 'modules' could be better integrated; the three parts of the DMS (MAS, SAS and MOPS) are not experienced as a homogenous system but rather as separate parts that are used in parallel. The same goes for Volvo Wheel Loaders' enterprise system that Swecon sends their data to. As an example, Volvo Wheel Loaders MAIN and COSI's data, which are fed by Swecon's MAS and SAS systems, can be integrated to get end-customer information, but it requires some effort. The integration, and the data transferred between the partners, could therefore be enhanced, which also would lead to that Swecon's business with the end-customers would be better facilitated (cf. Baraldi &

Waluszewski 2005), i.e. Swecon's possibilities to 'read' and act in its business network is affected by the present IT infrastructure which could informate (Zuboff 1988) Swecon's personnel better. How, and with what information systems, the forthcoming end-customers will be handled are affected by Volvo Wheel Loaders and Swecon's focal business relationship, something that can be described in terms of interdependency (cf. Cunningham & Homse 1986) and connectedness (cf. Blankenburg & Johanson 1992).

7.12.4.2 *The tyre supplier Bridgestone*

The business between Volvo Wheel Loaders and Bridgestone has had tyre deliveries for decades and the business relationship shows two committed partners (Morgan & Hunt 1994). Bridgestone has specific employees assigned to the business with manufacturers, which means that the organizing is quite formal (a form of infrastructure, cf. Kling & Scacchi 1982, Walsham 1993), and the same goes for Volvo Wheel Loaders. Given that the market for off-road tyres has suffered scarcity and given that Volvo Wheel Loaders is one of the largest producers of entrepreneurial machines, the business partners are interdependent (Cunningham & Homse 1986, Ford *et al.* 2002). But even if Bridgestone describes the business with Volvo Wheel Loaders as positive overall, leading to cooperation as with the R&D ('if it works for Volvo, it works for others [...] Volvo is respected in the world!'), this business relationship lives side by side with other business relationships with other similar companies. Bridgestone's Product Manager mentions that: 'They do not want to put all their eggs in the same basket'. Despite the close collaboration, it is, in other words, best to ensure deliveries and sales by having more similar business relationships (from both Volvo Wheel Loaders and Bridgestone's perspective).

Whilst the Product Manager is the one who handles the purchase conditions and R&D collaboration on a national level (the general agreements are on a company group level), there are also logistic personnel involved in the order administration. A Logistic Assistant who uses Bridgestone's enterprise system SAP R/3 to handle the day-to-day exchange activities. Even if Volvo Wheel Loaders and Bridgestone could use EDI, there have been more important things on the agenda. But there is also a precautionary measure taken as some order data have contained faults, errors that Bridgestone does not want into their enterprise system. To handle the prevailing lack of off-road tyres (and the perceived insufficient support of Edionet) the information is complemented with MS Excel spreadsheets that Volvo Wheel Loaders' Material Controller has created (see figure 43). Thereby other

information systems (e.g. an MS office application) are used in parallel with Edionet. The business exchange is thereby moderately facilitated by an interorganizational connection, which has led to an 'augmented use' (Markus 1984) of Edionet. The semi-integrated business also involves many manual activities. As an example, Bridgestone's SAP R/3 generates invoices on paper, documents that are put aside in parallel with that the invoice information is manually written into the Edionet solution (i.e. a form of self-billing). The companies' activity structures (Håkansson & Snehota 1995) are thereby facilitated by each respective enterprise system, but the activity links (Ibid.) are based upon both a formalized connection (the Edionet) and a non-formalized communication based upon the exchange of MS Excel spreadsheets that are created for the exchange activities. But the augmented use of the enterprise systems (and the interorganizational connections) can be seen as a behavioural adaptation (Johanson & Mattsson 1987).

7.12.4.3 The subcontractor CH Industry

CH Industry's and Volvo Wheel Loaders' business relationship goes back to 1948, when CH Industry was established. The two companies thereby have a long history that, according to the empirical description, has resulted in a close business relationship. Even if the companies have uneven sizes, Volvo Wheel Loaders do not act like 'a big brother'. Instead, the business interaction has led to 'good routines' that CH Industry has adapted. From CH Industry's side, the CEO and an assigned Customer Contact deals with both strategic and day-to-day business activities and, when necessary, several employees from CH Industry get involved (see figure 44). There are many business exchanges (Johanson 1989) between CH Industry and Volvo Wheel Loaders, but there are also social and information exchanges (Ibid.) during the production and evaluation of prototypes. The close business relationship between the two partners thereby holds several types of exchanges on a continuous basis, exchanges that have had time to be institutionalized and organized into a mutual social and technical infrastructure (Kling & Scacchi 1982) through the long-lasting business relationship. We can, thereby, find most of the aspects that we have addressed as 'exchange' and 'behaviours' in the analytical framework (see figure 7) in this business relationship.

When studying the information systems that are used for these exchanges, CH Industry has invested in the enterprise system Movex as a part of their quality work and to be able to act as their large customers require. Even if the Movex implementation was a huge cost, the Product Manager describes its positive effect regarding how many orders they can handle and how it admits a continuous up-

dating of production orders in the workshop. CH Industry's enterprise system has reached the onward and upward phase (Markus *et al.* 2000a) and Movex has supported CH Industry to increase both their flexibility and efficiency. The Product Manager also described how such an implementation is an immense effort ('You don't want to implement a new system like that after five years!'), an effort interpreted as possible through the stability that business relationships like the one with Volvo Wheel Loaders offer.

CH Industry's Movex and Volvo Wheel Loaders' enterprise system are interorganizationally connected via EDI. This means that CH Industry, despite being a medium size company, can handle thousands of order posts each week. The use of EDI also eliminates the need for invoices – it is automatically handled through the EDI solution once an article is sent. The only time the Customer Contact has to act is when Volvo Wheel Loaders has sent an order with too short a delivery date. Then it is necessary to contact a Purchaser at Volvo Wheel Loaders so he or she can redraw the order to avoid bad delivery statistics. Beside EDI, CH Industry stores Volvo Wheel Loaders' drawings on a file server. There are also other information systems used in the business relationship, such as a web based supplier portal where CH Industry's Quality Manager can report if there has been any delivery or article problems.

CH Industry was also implementing a document management system, Lotus Domino, during the case study. Lotus Domino enables CH Industry to fulfil Volvo Wheel Loaders requirements for spare parts 20 years after a delivery. The purchase of this other information system can thereby be seen as a relationship investment (but not an idiosyncratic one – it can be used in other business relationships as well). Even if CH Industry's enterprise system Movex can be equipped with a similar functionality as Lotus Domino, it was too expensive. The selection of another information system than Movex for the document management function was, in other words, not a question of functioning but rather an economic one.

When discussing the documents that are exchanged between Volvo Wheel Loaders and CH Industry it is also worth mentioning the dxf-files that let CH Industry produce prototypes and components based upon Volvo Wheel Loaders' product structures in 3D. Sometimes these drawings contain faulty measures that CH Industry corrects and then informs Volvo Wheel Loader about the needed adjustments. Another information exchange is the measuring of the products – data that Volvo Wheel Loader requires in a specified format. This means that CH

Industry's measuring equipment, which reports its data in another format, has to be manually written into Volvo Wheel Loaders' protocols (i.e. an administrative adaptation).

7.12.4.4 The recent supplier DKI Form

The final business relationship is the one between Volvo Wheel Loaders and DKI Form – a more recent supplier of plastic details. The novelty of this business relationship is shown as few types of articles (only seven) and that the business activities carried out and information systems used are much the one that Volvo Wheel Loaders stipulates. This means that the exchanges, to a large extent, take place based upon Volvo Wheel Loaders' premises and that DKI Form make adaptations based upon these requirements. So far, this business relationship is too novel for any deeper interdependencies or far developed institutionalized behaviour. Volvo Wheel Loaders are, though, planning to increase their purchases from DKI Form, which means that the business relationship is moving into a stage of fewer uncertainties with an increased commitment (cf. Ford *et al.* 2003).

The newness of this business relationship can also be seen in the information systems that are used for the business exchanges. DKI Form does not have the proper technological infrastructure for EDI, which is why they get their orders via Volvo Wheel Loaders' Edionet (see figure 46). Besides the use of Edionet, DKI Form uses their workstations to store the drawings that Volvo Wheel Loaders sends. The interorganizational connections are thereby moderate.

7.12.5 Summarizing the Volvo Wheel Loaders case

The focal company's enterprise system, Volvo Wheel Loaders' MRP system with surrounding applications, is clearly focused on the internal activities and the interorganizational connections are primarily used for the business (i.e. product vs. money) exchanges (Johanson 1989). The other information systems used for administrating the business activities that are carried out together with Volvo Wheel Loaders' partners is though not primary related to the manufacturing and assembly of wheel loaders.

From the customer side, a close business relationship has involved development of a DMS that is interorganizational connected, and designed to be used in parallel with, Volvo Wheel Loaders' enterprise system. Much of the information is handled by different application packages that surround Volvo Wheel Loaders' MRP core, such as MAIN/SAMS, PROST, COSI, and so forth. These applications are not fully integrated, which can be seen as caused by their legacy. This

means that information about the business exchanges, and also about the end-customers, is sometimes not attainable without some efforts. The same description is valid for the dealer who describes how the integration between the DMS modules could be more obvious. Even if Volvo Wheel Loaders' enterprise system and Swecon's DMS is based upon common (and hence structured data) it could be easier to combine and use the different sub-systems data.

The information used in the business exchanges with the dealer are spread on different information systems and modules which make some information, which could offer knowledge about different aspects of the ongoing business exchanges, hard to get. As with the ABB Robotics case, the focus on the production – where the system features can be described in terms of automate (Zuboff 1988), operational, monitoring and control, as well as planning and decision (cf. Markus 1984) – means that the exchange activities could be better facilitated. This will, though, change in the future. The MOM system will, as an example, replace some functions that both the dealers and Volvo Wheel Loaders' systems have today. One aspect is conformity between dealers; another is to disconnect the 'article number' level when ordering a wheel loader. The dealer, thereby, does not have to mind the wheel loader's specific parts – they got the requested wheel loader no matter what changes Volvo Wheel Loaders has made on a component level.

When studying the supplier relationships, CH Industry 'stood out' with a well developed interorganizational connection through EDI and complementary document management system. Bridgestone seems to have the technical possibility to have such solution, but other priorities and some faulty data transfers have put such a solution on hold. Finally, DKI Form is a recent supplier with an information system that does not support such integration between the companies. This business relationship's novelty may also contribute to the quite low technological integration between the companies. From Volvo Wheel Loaders' side, the development of a web-based supplier system (WISC) indicates the need for communicating the business exchanges but also to offer the suppliers a gateway for mutual information exchange (Johanson 1989). The other supplier system (PSS) is also supporting the exchanges with suppliers, helping Volvo Wheel Loaders' purchasers to act in a uniform way and to keep track of the suppliers. But this system is also an 'other information system', i.e. its data is only used by the purchase/supply management personnel and not manifested in the enterprise system. Even if the enterprise system is, thereby, used as intended, it is not fully integrated with the other information systems that facilitate the purchase activities.

CROSS-CASE ANALYSIS

AS A STEP TO STRENGTHENING THIS study's conclusions each case is brought together in a *cross-case analysis*. If more than one case study's data points in the same direction, the findings will be even more robust (Yin 2003), and if they do not the discrepancies may draw the investigator's attention to flaws in the findings. As discussed in the methodological chapter, there will also be a comparison between the within cases, meaning that four *focal company vs. customer* and six *focal company vs. supplier* dyadic business relationships will be reviewed (ten relationships altogether). This chapter starts with an analysis of the focal companies' similarities and differences, their products, and their enterprise systems. Thereafter, the findings in the single-case analyses are rendered, leading to a synthesis of the findings. The cross-case analysis uses the analytical framework's components and inherent concepts as a support to understand and scrutinize the business and the enterprise system studied, ending up with lessons that stand for themselves but that can be related to the ensemble view of technology and business relationship theories. The lessons are gathered and discussed pinpointing how the flaws in the enterprise system's functionality is completed with other information systems. The analysis ends with a discussion on how an enterprise system that is meant to handle more of the exchanges that takes place between two business partners could be (conceptually) designed.

Quinta
essentia

8.1. The focal companies

The focal companies studied are business units/areas within two *Fortune 500* company groups (the ABB Group and the Volvo Group), and both ABB Robotics and Volvo Wheel Loaders are well performing companies within their respective industries. Another similarity is that both companies sold at an 'all time high' during 2004 and that their sales success continued during 2005. To handle the empirical material the data collection was delimited to capture the major Swedish production plants, which in both cases were the respective company's largest and most important production unit. Whilst the ABB plant and offices studied holds approximately 640 employees, Volvo Wheel Loaders Arvika plant and the Eskilstuna head office has more than 1,300 employees. ABB Robotics had a production capacity over 12,000 robots during 2005 and Volvo Wheel Loaders produced 7,800 wheel loaders during 2004. From a Swedish perspective both companies are well-known and, as seen in the empirical descriptions, have a good reputation. The significant difference between the two cases (from a Swedish perspective) is that ABB Robotics uses several ways to sell their robots while Volvo Wheel Loaders uses dealers. The latter thereby has a more formal business relationship, even if the ongoing exchanges and the partners' behaviours involve the same dynamics that can be found in a business relationship without any formal contracts.

8.1.1 The products

Both ABB Robotics and Volvo Wheel Loaders' products can be considered 'heterogeneous resources' (cf. Alderson 1965, Penrose 1995), i.e. their final manifestation is not given and the customer can choose in what setting to use them and how to equip them. When comparing the two products, both are 'professional' products; purchased by other companies (i.e. not consumers) and used in a 'system', e.g. some production facility. Even if the robot's final use is more diverse than the wheel loader's, both products are equipped uniquely which means that it is hard to find the general robot or wheel loader. Still, both products have their basic equipment described as a Robot Specification Form or as an MRS machine specification. This means that there are some configurations that are more common than others and that this equipping is put forth as a starting point when ordering the products. The complexity of these products also means that the organizing around their sale needs to involve several competencies both regarding an economic and technical nature. This is apparent in the figures that illustrate the business exchanges and the information systems (IS) used, in chapters 6 and 7. To govern all the exchanges that take place, we might also expect a mutually oriented

behaviour involving adaptations and institutionalized routines as well as interdependencies. The treatment of the business exchanges also requires exchanges that are not focused on the prevailing products but on future products or components. These activities are also a part of the ongoing business carried out by the participants and, hence, interesting to capture to get an overview of the business relationship's status.

8.1.2 The enterprise systems studied

Whilst ABB Robotics has a recently implemented enterprise system from SAP, Volvo Wheel Loaders has an older MRP system as the core of their information system's architecture. Both companies are though living with a mix of new and old systems, which are integrated to different degrees. In the cases studied, it is not a question of a unique enterprise system from just one vendor. Instead, the enterprise systems are made up of both new standardized, in-house developed, as well as legacy systems. It is also evident that the focal companies' internal activities, i.e. their activity structure (Håkansson & Snehota 1995), are those which are mainly supported by the enterprise system. As an example; even if ABB Robotics' Freja project had a limited scope, the internal (production) activities (Dubois 1998) are highly supported by SAP R/3 and even if Volvo Wheel Loaders' MRP system is more than 15 years old, its functioning is still enhanced as described by the Material Supply Manager (metaphorically the MRP system's functioning was going from a sextant's precision to a GPS's). The focus of this production oriented core are primary operational/automating (cf. Markus 1984, Zuboff 1988), i.e. it sets the agenda for how things are done.

To be able to produce the products smoothly, the enterprise system has indicated that it needs to be based upon structured data and a configuration application to avoid the selection of impossible product combinations. Whilst ABB Robotics have included most of the activities needed to do this – such as setting the proper robot product structure as well as configuration possibilities – in SAP R/3, Volvo Wheel Loaders utilizes their PROST system to deal with this. PROST holds the wheel loader structures and ones completed, it is downloaded into Volvo Wheel Loaders' MRP system at the production plant. The principles are though the same, even if Volvo Wheel Loaders' personnel needs to access two information systems to get the same information (something that may be integrated into the MOM system in the future). Other information systems that have been displayed have had functions needed to smooth the production but they have also been involved in some of the exchanges that the companies studied have had.

8.2 The within-cases

The analytical framework's elements are applied to all the within-cases (that were presented in chapters 6 and 7) in the following section. The aim is to gather all the empirical data as a fundament before drawing any conclusions on the enterprise system's role seen from a business relationship perspective.

When reviewing the *business relationships characteristics* studied there have been different degrees of interaction with frequent or intermittent exchanges. By the applied approach, these companies' business activities have been described from both an intraorganizational (capturing activity structures) as well as an interorganizational perspective (capturing activity links) (Håkansson & Snehota 1995). In fact, the study has also touched upon network effects (i.e. a question of activity patterns) (Ibid.). The business relationships that have been depicted have also illustrated different degrees of trust, commitment, adaptations as well as interdependencies as well as connectedness to the wider business network. Depending on the complexity of the business exchanges, the interpersonal contacts have involved numerous different people (involved in business as well as information and social exchanges) and a variety of arranged business activities. Many of the studied companies' interpersonal contacts have also been described as characterized by an atmosphere of closeness, but there have also been conflicting interests.

The *enterprise system utilization* has differed depending on what business activities have been studied. As seen in the case stories (chapters 6 and 7), the internal (production) activities have been much more supported by the enterprise systems (cf. Payne 2002, Sumner 2005) than the exchange activities (Dubois 1998). The within cases also present both well-developed interorganizational connections as well as exchanges that are mainly supported by manual routines. Whilst studying the involved users, both intended use, augmented use (Markus 1984) and non-use has been found. But when the enterprise system fails to support the user, which can basically be caused by its functioning not being arranged for that specific personal category, there have often been other information systems used. The system features of the enterprise system can mainly be described in terms of; operational, monitoring, controlling (Markus 1984) and automating (Zuboff 1988), something that may not be adequate in the exchanges that takes place (this is a result that also was seen in the pilot study, see Ekman 2004 and Ekman & Revay 2004). Given that the partners' tries to act as expected of each other, the situation may instead need a more flexible solution that is focused on the interorganizational and communicational functionalities (cf. Markus 1984).

Finally, the *contextual aspects* are, in the within cases, both characterized by a general setting that has evolved to facilitate the partner's business exchanges during decades as well as holding generic solutions that are not business relationship specific. Many of the cases' going concerns have also had a 'momentum' indicating the direction of the business relationship and the potential development of the enterprise system or other information systems. In some cases the focal net has also been seen as influential (Alajoutsijärvi *et al.* 1999), i.e. a question of connectedness (Blankenburg & Johanson 1992), which means that there is a company beyond the studied ones that sets the agenda for how things are done.

The following table (page 220-224) presents a synthesis of all the within cases and their characteristics according to the analytical framework's three components (based upon the single case analysis in chapters 6 and 7). This synthesis of the analysed business relationships and enterprise system utilization is the fundament for the coming theorizing about the enterprise system's role in business relationships. When analysing the ten business relationships studied, eight of them [1, 2, 4, 5, 6, 7, 8, and 9] can be considered complex and close. These business partners have also been having different forms of exchanges for a while. The other two cases were of different characteristics; i.e. the business relationship between ABB Robotics and SKF Mekan [3], which was characterised by intermittent exchanges and where SKF Mekan drifted towards robot deliveries by third parties (i.e. they want to purchase 'systems'), and Volvo Wheel Loaders' business relationship with DKI Form [10] that was quite novel. (cf. Ford 1980, Ford *et al.* 2003)

When comparing the enterprise system utilization and the business relationship characteristics, more frequent or complex exchanges (Ford 1980, Håkansson 1982, Johanson 1989) means that the need for mutual coordination increases, which also means that the activity links multiply (Håkansson & Snehota 1995). In parallel with the activities during the negotiations of products and prices, issues that deal with prototyping, product features, and other activities that require adaptations, take place. When such exchange activities (Dubois 1998) are not supported by the enterprise system, it is complemented with other information systems alternatively not facilitated by any technology at all. This discussion is continued in the next section where business relationship aspects of the enterprise systems utilization are put forth.



Table 5 ► [On page 220-224] An overview of the within-cases analysed from the customer's and supplier's perspective.

Business relationship	Business relationship characteristics	Enterprise system (ES) utilization	Contextual aspects
ABB Robotics/ Volvo Cars	<i>Large purchases (projects), many interpersonal contacts (functions) in the sales and purchase activities, agreements on company group level which can be considered a form of formalized commitment. Product adaptations according to Volvo Cars requirements. Business exchanges are carried out 'strictly professionally'. Besides the product, Volvo Cars require 3D models for their RobCAD system, something ABB Robotics fulfil (i.e. also a form of adaptation).</i>	Both partners have enterprise systems. <i>Product adaptations</i> results in 'Volvo specific' Robot Specification Forms in SAP R/3. Order input is manually made. The focal ES thereby <i>facilitates the exchange activities moderately</i> . The binders with robot specifications are made in ordinary office applications and Volvo Cars use Ford's purchase system, i.e. a <i>moderate degree of interorganizational connections</i> and a <i>frequent use of other information systems</i> (IS) based upon the general setting where SAP R/3 is rather absent.	The car market is a 'mature customer', i.e. <i>the business network and the going concerns seem favourable for the buyer</i> . Orders come intermittently but the <i>agreement indicates interdependence</i> based upon the wider business network (caused by agreements on company group level). Given the competition on the robot market <i>ABB Robotics is highly engaged (illustrated by their 'capture teams')</i> . Both ABB and Volvo are well-known companies (cf. Anderson & Weitz 1992) in Sweden, something that may govern their business relationship.
ABB Robotics/ Specma Automation	<i>Committed business partners through a formal partnership. Formalized business exchanges via an assigned salesmen. The customer (partner) has high product knowledge which is a base for knowledge dependence, but the arrangement involves interdependence as Specma is a part of ABB Robotics' sales interface. The customer has invested in RobotStudio, i.e. an idiosyncratic investment.</i>	Specma is offered Robot Specification Forms in MS Excel format (<i>other IS</i>) where they can specify their robot orders directly, but the order booking is left to the partner salesman, i.e. it is a question of <i>non-use</i> from Specma's point of view. Beside the Robot Specification Form, Specma are given access to servers (<i>other IS</i>) that hold production and partner information, i.e. a <i>moderate inter-organizational connection</i> .	An <i>increasing robot demand</i> from the market means that it is interesting to be a partner. The customer (Specma) indicates a need for other exchange forms (i.e. <i>the general setting has limitations</i>). The business relationship with ABB Robotics also excludes the customer for businesses where the potential customer has e.g. 'yellow robots', i.e. a <i>connected effect</i> manifested in Specma's <i>focal net</i> .

Business relationship	Business relationship characteristics	Enterprise system (ES) utilization	Contextual aspects
ABB Robotics/ SKF Mekan	<p><i>Less frequent interpersonal contacts between ABB Robotics salesman and the customer. The customer is more interested in getting a production system than in the product 'robot'. A low degree of adaptations and few exchanges (and hence no clear interdependencies). This exchange also requires few involved actors and less formalized procedures. This also means that the mutually oriented business activities are quite few.</i></p> <p>[3]</p>	<p><i>The ES is absent in this business relationship. The customer can choose to use SKF Mekan's enterprise system Movex as he pleases, i.e. there are no interorganizational connections. The salesmen also send the order to the ABB Robotics plant via email. The salesman has developed an application for project management, i.e. there is other IS used that facilitates the exchanges between the business partners.</i></p>	<p>The situation's momentum reveals that robots are more and more used for such production that the customer SKF has. <i>The customer has increased the number of robots during the last 10 years and moves towards more complex solutions, preferably 'turn key' solutions from engineering companies. The Industrial setting thereby means that the focal business relationship will involve more partners, i.e. it will affect the surrounding business network.</i></p>
YTT Kvänum/ ABB Robotics	<p>A business relationship inherited from ABB Flexible Automation where the organizing can be interpreted as a sign of adaptation and institutionalized routines. A highly committed supplier: 'This is what they want, and this is what they get'. Some projects also involve demands for customer specific components (<i>i.e. a question of connectedness</i>). There are also adaptations made to the test protocol that is used for the application cabinets that are mutually designed.</p> <p>[4]</p>	<p>ABB Robotics sends their orders via fax and YTT handles this information in their information systems (an in-house developed 'MRP' application, an administrative system and a financial system), i.e. no interorganizational connections. Besides the order exchange, YTT receives drawings as pdf-files via email. The exchange is, in other words, not facilitated or represented by the information systems involved. There are instead several other IS used.</p>	<p>ABB Robotics is, during the last year, YTT Kvänum's largest customer, which has lead to continuous business exchanges (involving more or less unique products). Even though YTT is a large company group, the branch office seems to act quite independently. Even so, being a part of YTT means that there can be directives about new IS (<i>a form of dependency</i> on the YTT Groups infrastructure, i.e. in an effect that can be found in the organizational setting and the wider business network).</p>

Business relationship	Business relationship characteristics	Enterprise system (ES) utilization	Contextual aspects
Kablageproduktion/ ABB Robotics	From Kablageproduktion's perspective, <i>the business relationship is very close</i> . Kablageproduktion has 'open sales calculations', i.e. a high degree of <i>trust and commitment</i> . There are <i>several adaptations</i> made (cables are custom-made and parts are specified by ABB Robotics). <i>ABB Robotics also invests in this business relationship</i> manifested by the continuous visits of engineers at Kablageproduktion's workshop (i.e. <i>many interpersonal contacts</i>). <i>A frequent business exchange</i> also requires the handling of product information and revisions.	ABB Robotics sends their orders (generated in SAP R/3) via email, i.e. <i>there are weak interorganizational connections</i> . There are also drawings sent, information that is stored on dedicated file servers (i.e. <i>other IS for product data</i>). Kablageproduktion also has access to SupplierWeb but they have just recently started to take advantage of that possibility (probably because of a low 'IT maturity'), i.e. <i>the interorganizational connections will increase when their ES (Navision Axapta) utilization has reached a mature stage</i> .	Kablageproduktion has many former ABB (and ASE/A) employees and their growth is to a large extent a result of their business relationship with ABB companies (where ABB Robotics is the single most buying company). <i>The historical setting thereby facilitates this business relationship</i> . Kablageproduktion has also implemented a new ES that is in the <i>shake-down phase</i> (Markus <i>et al.</i> 2000a) which means that they will utilize even more ES functionalities in the future.
Mekanojärnt/ ABB Robotics	Mekanojärnt consider themselves an ABB Robotics 'partner' and they thereby signal <i>a high degree of commitment</i> . Mekanojärnt has also designed a new workshop (<i>an idiosyncratic investment</i>). There are <i>continuous exchanges</i> of products (300-400 articles) and there are <i>many interpersonal contacts</i> , indicating that this is a close business relationship with numerous activity links.	Despite having a rather well developed ES that facilitates Mekanojärnt internal activities they only have a <i>moderate interorganizational connection</i> with ABB Robotics. Mekanojärnt use an MS Excel application (<i>other IS</i>) to modify the SupplierWeb's data (i.e. <i>the data structure needs to be manipulated</i>) before using it (i.e. a form of administrative adaptation).	Mekanojärnt ES Monitor is in the <i>on- and up-going phase</i> and they see the ES as a part of their business development process (i.e. a clear IT strategy). <i>ABB Robotics is Mekanojärnt's single largest customer</i> and they deliver 300-400 robot components. The business relationship started in the mid 90s and they have already reached a stable stage (Ford <i>et al.</i> 2003).

Business relationship	Business relationship characteristics	Enterprise system (ES) utilization	Contextual aspects
Volvo Wheel Loaders/Swecon	<p><i>A close and strong business relationship: Formalized business activities, i.e. many exchanges, product (MRS) and procedure adaptations; institutionalized routines (i.e. given functions/roles). Formal interpersonal contacts (i.e. salesmen, product engineers, market assistants, market contacts, and so forth). Swecon is the exclusive sales organization in Sweden and they only sell Volvo CE's products, which signals a high degree of interdependency.</i></p> <p>[7]</p>	<p>Volvo Wheel Loaders ES(s) and Swecon's DMS are developed together, i.e. <i>well developed interorganizational connections</i>. The salesmen are though not using the DMS but an in-house developed MS Excel application and Lotus Notes databases (<i>other IS</i>). The order handling (and DMS use) thereby follow the formalized activities (<i>indented use</i>) whilst the DMS, and hence ES(s), are invisible in the salesmen's work (<i>non-use</i>).</p>	<p>Volvo Wheel Loaders and Swecon have a <i>long history</i> (before Swecon's present company structure) that has lead to that the general setting follows a <i>formalized infrastructure</i> and it also involves a close collaboration involving product and dealer databases. Swecon is even housed within Volvo CE's promotion center. During the study, the going concerns involved a <i>new order system</i> (MOM) and the <i>investigation of CRM functionalities</i>.</p>
Bridgestone/Volvo Wheel Loaders	<p><i>A close but well considered business relationship</i> ('not...put all eggs in the same basket'). <i>Many business exchanges</i> but also continuous information and social exchanges (<i>interpersonal contacts</i>). Joint product development. Few large tyre companies as well as entrepreneurial machine manufacturers (<i>interdependencies</i>). An atmosphere of cooperation. The order activities are based upon mutual oriented <i>adaptations and institutionalized routines</i>.</p> <p>[8]</p>	<p>Bridgestone use Volvo Wheel Loaders' Edionet (<i>moderate interorganizational connections</i>) even if they have a modern ES that allows EDI. They also have complementary manual routines to deal with the received data-formats. Beside this, Bridgestone's Order administrator and Volvo Wheel Loaders' Material Controller use MS Excel spreadsheets (<i>other IS</i>) to inform about the upcoming orders (i.e. a form of <i>augmented use</i> and <i>workarounds</i>).</p>	<p>Bridgestone's S-AP R/3 is in the <i>on- and up-going phase</i>. The <i>off-road tyre market has a shortage of tyres</i>, i.e. Volvo Wheel Loaders purchases all the tyres that Bridgestone can offer. Both Bridgestone and Volvo Wheel Loaders are well known, and well considered, brands – i.e. a mutual interest in doing business. The sales to manufactures make up the largest customer base, i.e. there is a <i>formal organizational infrastructure</i> for such business.</p>

Business relationship	Business relationship characteristics	Enterprise system (ES) utilization	Contextual aspects
CH Industry/Volvo Wheel Loaders	<p>This is a <i>long-lasting (close and important) business relationship</i>. CH Industry describes, e.g. that ‘They are good to have to do with’, which signals <i>trust</i> and also <i>commitment</i>. Volvo Wheel Loaders have routines that CH Industry complies with (<i>adaptations</i>). There are more than 400 articles involved in the <i>frequent business exchanges</i> and there is also information and social exchanges when working with prototypes (<i>many interpersonal contacts</i>).</p>	Volvo Wheel Loaders and CH Industry communicate via EDI, i.e. a <i>close inter-organizational connection</i> . When there are flaws in the EDI orders, CH Industry contacts Volvo Wheel Loaders via telephone to correct it. <i>CH Industry’s ES clearly facilitate their business activities</i> (mainly the internal ones). Product and prototype information are stored in a Lotus Domino Document Manager system (<i>other IS</i>). The measuring protocol has to be transferred manually.	CH Industry’s ES Movex is designed for tomorrow’s customer demands, i.e. they are <i>in the on- and up-going phase</i> . CH Industry has been a subcontractor to Volvo CE since 1948 and the Volvo CE companies are a large part of their customer base. CH Industry has invested heavily in an ES (Movex) to be prepared for future demands and to increase their performance and quality. <i>The long lasting business relationship has facilitated the development of the present infrastructure.</i>
DKI Form/Volvo Wheel Loaders	<p>DKI Form is a quite new supplier to Volvo Wheel Loader and the business relationship is still quite novel, i.e. there are <i>not that many interdependencies</i> developed yet and the partners still evaluate each other (cf. Ford 1980). The business exchanges are carried out according to Volvo Wheel Loaders’ stipulated routines (<i>DKI Form has to make adaptations</i>). Volvo Wheel Loaders have though signalled for more articles, i.e. this business relationship will grow.</p>	<p>DKI Form’s systems portfolio does not fulfil the demands for order handling via EDI (i.e. the system’s state is considered ‘legacy’) which is why they use Volvo Wheel Loaders’ Edionet, i.e. a <i>moderate interorganizational connection</i>. There are also <i>other IS</i> that are used for the handling of product information such as drawings. DKI Form thereby has an <i>IS that facilitates their internal activities</i> but it is used quite free from Volvo Wheel Loaders’ influence.</p>	<p>DKI Form is a subcontractor within the plastic industry that strives for ‘partnership’ with their partners. Volvo Wheel Loaders has more suppliers such as DKI Form and the <i>general setting</i> for such business is coloured by <i>Volvo Wheel Loaders’ supplier routines and required order handling via EDI or Edionet</i>.</p>

8.3 Enterprise system utilization from a business relationship perspective

Even if most of the studied companies have shown the utilization of different information systems, many forms of exchanges (especially those which hold social elements) are not captured and handled by any formal information system. Besides the transfer of order and delivery information between the business partners, there have been other information systems that hold information about the customers. ABB Robotics has basic information about the products sold and their equipment in their Config database and Volvo Wheel Loaders uses their COSI system for handling such information. But the systems mentioned are not fully integrated with the enterprise system, but rather semi-integrated applications that require some 'efforts' to be used in parallel with other information that can illuminate the companies' business relationships. There are also business exchanges with customers that can signal their importance for the focal company, but this is not captured system-wise either. As has been described in the empirical chapters 6 and 7, some salesmen have developed their own ways of handling the sales activities, which can involve memorandums, personal notes, their own developed applications in Lotus Notes, files structures on the laptop, MS Excel and MS Access applications, web based databases, personal customer registers, and so forth. All these solutions are often directed to a specific and narrow use by one individual or a group/function (such as the sales organization or a marketing department). The consequence with individual or group-oriented applications (e.g. as MS Excel spreadsheets) is that this data is not available for others and that it is difficult to evaluate its importance on an aggregate level; they become 'information silos' (cf. Sandoe *et al.* 2001, Luftman 2004), which means that the information is not available on a company level.

When moving over to the supplier relationships, other information systems that help the Purchasers and Supply Managers with evaluating and keeping track of the suppliers are used. Both ABB Robotics and Volvo Wheel Loaders have illustrated examples of how 'general' self-evaluations are given to the suppliers and there have also been examples of routines for 'grading' each supplier. The exchanges with the suppliers also involve several interpersonal contacts – there is usually a Purchaser or a Supply Manager that negotiates the component's features and price and that evaluates the supplier whilst the daily routine of ordering is handled by the production or material handling personnel. As in the ABB Robotics case where the Purchaser uses in-house applications (stored in Lotus Notes) when working with agreements and when selecting the supplier. When this is done, the

SAP R/3 only holds information about the supplier company and the purchased component, information that the Material and Production Planners order according to the agreement. Even the Volvo Wheel Loaders case shows a similar routine; the Purchasers and Supply Developers interact with the potential supplier companies using several 'purchase applications' (see figure 36) and when a supplier and a component is selected and agreed upon, the Material Controllers that plan the production handle the continuous orders from the supplier. The two different functions at Volvo Wheel Loaders also involve two separate evaluations; the Supply Developers evaluate the suppliers on a general level (does the supplier conform to Volvo supplier standards) whilst the Material Controller evaluates the logistic routines and delivery precisions. Both the ABB Robotics and Volvo Wheel Loaders cases also show how the central purchase function interacts with R&D, and how it supports the business and information exchanges (Johanson 1989) that involve the products and components' technical features. The purchase department thereby has tentacles into the other departments.

8.3.1 Network aspects

The case studies have also illustrated network connections (Blankenburg & Johanson 1992), i.e. effects that have transcended a focal business relationship. An example is the supplier YIT which had to conform to a certain CAD application based upon ABB Robotics' obligation to a customer. Another is how ABB Robotics had to purchase Bosch or Matuschek inverters based upon Volvo Cars request, i.e. a supplier may have to do adaptations based upon that the customer has an agreement with another company. Besides such networked (connected) effects many of the companies studied are a part of a larger company group, i.e. they are dependent on agreements, routines, and information systems controlled at company group level. The general setting, holding technological, organizational (social), as well as business network aspects can thereby to a large extent be seen as originating from a company group. Some of the behaviours in business relations, such as adaptations, are thereby hindered when the company belongs to a larger company group (as ABB Robotics within the ABB Group, Volvo Wheel Loaders within Volvo CE, Volvo Cars within Ford Motor Company, Specma Automation within Investment AB Latour, and so forth). The behaviours (see the analytical framework, figure 7), manifested in the company's business network, can thereby both be based upon belonging to a company group or the business relationships with other companies (i.e. suppliers and customers). Frankly, when studying the ten business relationships, the general setting in terms of being a part of a company

group seems to have a stronger influence on the enterprise system's scope and functionality rather than influences from the respective business relationship. This can from a business relationship perspective be described as it being difficult to make adaptations in the enterprise system based upon a specific customer's or supplier's requests. This is easier to do in other, often individually made, applications.

8.3.2 Invisible business interaction

Besides the business activities that precede and follow a sale or purchase, many of the business relationships studied have shown examples of an interpersonal closeness and a commitment that governs the business exchanges [as the within cases 4, 5, 6, 7, 8, and 9]. One example is the ABB Robotics and Kablageproduktion business relationship, where casual lunches are all that is needed for sorting out problems or the Volvo Wheel Loaders and CH Industry business where a common history has paved an infrastructure that allows a close collaboration, a highly committed supplier, and the use of EDI. Information about such business relationships – that also hold multiple interpersonal contacts with participatory R&D, repeated workshop visits, and so forth – are not caught by any enterprise system but they can be noted in the purchase personnel's own made applications. The business relationships studied thereby hold so many more exchanges than the ones that solely focus on the orders (and hence production) of the product. Some of these exchanges are caught in other information systems with a specific category of users (e.g. purchasers and salesmen), others are created by the individual. Many exchanges, besides the product exchanges, are thereby not available in any information system and hence not facilitated – nor represented (cf. Baraldi & Waluszewski 2005) – by the enterprise system seen from a company and managerial level.

8.3.3 Interorganizational connections and other information systems

When analysing how these companies utilize interorganizational connections for their information exchange we find the following distribution (see the table below): two business relationships characterized by highly integrated enterprise systems and other information systems [7 and 9], four with moderate connections [5, 6, 8, 10], and four with a low degree of interorganizational connections [1, 2, 3, 4]. By analysing the two highly interorganizational connected business partners we see that one [7] is governed by a supplier-dealer relationship (i.e. a formal and stable setting) and one [9] is characterised by the supplier's history that has lead to a strongly committed supplier. On the other side, we see that the business relation-

ships where there are few interorganizational connections are characterised by; few large quite specific purchases [1], a partnership relationship with an assigned sales organization and rather few purchases [2], seldom purchases [3], and continuous customer-specific orders and a small but technically specialized supplier [4].

Table 6 ► The utilization of information systems in the business relationships studied.

Business relationship	Interorganizational connections	Other information systems used in the exchanges	Note ^(c)
[1] ABB Robotics/ Volvo Cars	<i>Moderate</i> : Ford Motor Companies purchase system ^(a)	Specific <i>project binders</i> (i.e. a manual system)	→
[2] ABB Robotics/ Specma Automation	<i>Low</i>	Web based access to <i>product information</i> and <i>RobotStudio</i> ^(b)	↑
[3] ABB Robotics/ SKF Mekan	<i>Low</i> (orders via email)	-	→
[4] YTT (Kvånum)/ ABB Robotics	<i>Non</i> (orders via fax)	Drawings via <i>email</i> (and mutual designed test protocol)	→
[5] Kablageproduktion/ ABB Robotics	<i>Low</i> (orders via email)	Prognoses via ABB Robotics <i>SupplierWeb</i> ^(a) , drawings via <i>email</i> stored on a <i>file server</i>	↑
[6] Mekanotjänst/ ABB Robotics	<i>Moderate</i> : Orders via ABB Robotics <i>SupplierWeb</i> ^(a)	<i>MS Excel application</i> that rearranges orders, Drawings stored in <i>HyperDoc</i>	↑
[7] Volvo Wheel Loaders/Swecon	<i>High</i> : DMS and EDI messages	<i>Product and dealer databases</i> (incl. a dealer 'bulletin board')	↑
[8] Bridgestone/ Volvo Wheel Loaders	<i>Moderate</i> : Orders via Edionet ^(a)	Complementary order information in <i>MS Excel spreadsheets</i>	↑
[9] CH Industry/ Volvo Wheel Loaders	<i>High</i> : Order information with EDI	Reports via a <i>supplier portal</i> , drawings via <i>email</i> (stored at a <i>file server</i>)	→
[10] DKI Form/ Volvo Wheel Loaders	<i>Moderate</i> : Orders via Edionet ^(a)	Access to <i>product databases</i>	→

^(a) Is considered as equivalent to web based EDI.

^(b) RobotStudio cannot be considered an information system but rather an application used for designing and programming the robot cells. Even so, it can be used for creating information that facilitates the information exchange between ABB Robotics and the partner company, which is why it is included in this list.

^(c) Interpretation of how the interorganizational connections will develop, i.e. 'the situation's momentum' (→: no change in the nearest future. ↑: Signs that indicate an increased use).

The characteristics of each business relationship indicate to what degree the companies utilize, and connect, each other's enterprise systems and other information systems. When studying the 'in-between' cases [5, 6, 8, 10] there are several reasons why the interorganizational connections are not stronger. In one case there is an unequal IT maturity between the partners and the utilization of interorganizational information systems is supposed to increase [5]. Two business relationships, categorized by many exchanges, were about to get better interorganizational connections as EDI was investigated [6 and 8]. Finally, one business relationship was novel [10], which means that the partners have not had the chance to develop tight technical connections.

Having each business relationship's characteristics in mind, the utilization of interorganizational connections and the mutual use of the respective partners' enterprise systems follow the intensity and complexity of the performed exchanges as well as the degree of mutual oriented behaviours. Even if table 7 only presents a fraction of all the information systems that have figured in the business relationships studied, many others has been used by one of the business partners to facilitate activities carried out in the business with the other company.

The enterprise systems studied, both at the focal companies and their business partners (ten companies altogether), have mainly been used as *advanced production systems*, i.e. a utilization that lies in line with its production focused legacy (Markus 2000, Payne 2002). Another way of describing the enterprise system is mainly as a part of the prevailing activity structure (Håkansson & Snehota 1995), i.e. a mainly intraorganizational information system. But enterprise systems are supposed to have moved beyond that use and offer more features that help the company in all its business activities, including those carried out with business partners (cf. Davenport 2000, Shanks *et al.* 2003). Viewed from a business relationship perspective, this is achieved to a low degree. Even if the order information that has been transported via EDI or web based EDI indicates important figures as order quantities and delivery precision, a business relationship is so much more.

One example of measures that are taken to facilitate the companies exchange activities are what we can describe as the *complementary information systems* that they develop such as: product databases or websites where suppliers can report in problems and give feedback. Usually these information systems have been used to complement the information that the enterprise system handles (i.e. whilst the enterprise systems have handled the commercial information the complementary

information systems have handled technical information that is needed to fulfil an exchange).

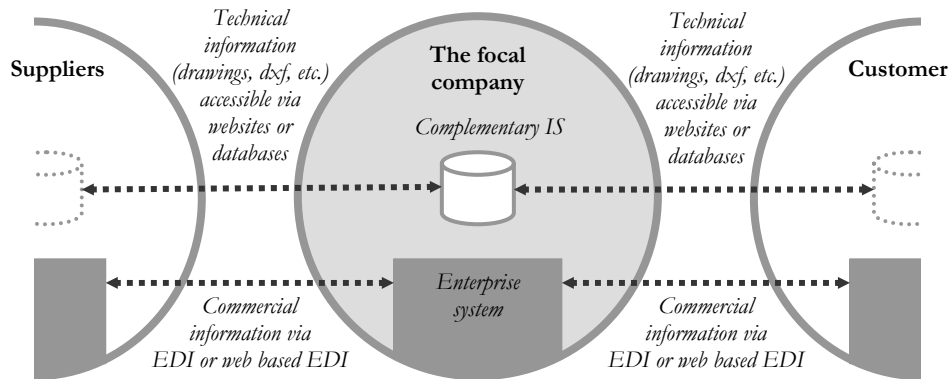


Figure 47 ► A conceptual illustration of the enterprise system's utilization in business relationships

The figure above is a synthesis of how the focal company's enterprise system has been manifested (see table 6) in parallel with a display of the complementary information systems as well as the business partners' information systems. The synthesis is a combination of the analysis carried out so far in parallel with a reviewing of all the figures that have been presented in each within case's interactions. But even if the enterprise system is complemented with other information systems, there are also business activities that are left aside. Section 8.4 will address why it may be so and also present a conceptual enterprise system that captures more of the business relationship characteristics.

8.3.4 Aspects that influence the utilization

When reviewing how the enterprise system and complementary information systems have been used in the business relationships studied, different aspects that point towards use or non-use have been seen. As has been evident, even the business relationships that are close and seemingly stable [as 1, 2, 4, 5, 6, 7, 8 and 9] differ when it comes to the enterprise systems' utilization. When reviewing the limitations in use, several factors including technical and organizational, as well as interorganizational, aspects can be found. Some of the less developed interorganizational connections can be described as a result of the involved companies' behaviours. When focusing on the large companies the dominant customer (buyer) may stipulate how the ordering and information exchange shall be handled [as 1, 3

and 8]. As an example, ABB Robotics gets their orders via Volvo Cars' purchase system, even if their SAP R/3 would allow tighter integration. The powerful actors (in this study highlighted by some *Fortune 500* companies) have also web based EDI as a potential solution when the supplier has an inadequate infrastructure. Such solutions, offered by the customer are also suitable when the business relationship is more novel, i.e. it reduces the need for costly adaptations, e.g. as DKI Form that has starting doing business with Volvo Wheel Loader and that can get their orders via web based EDI that do not require any expensive infrastructure.

Limited utilization can also originate in other causes related to the companies' business relationship. As an example, (i) when the products that are exchanged are custom-specific (i.e. hard to describe with a general data structure) [4], (ii) if the exchanged information is difficult for the business partner to handle [2], (iii) when the IT maturity differs between the partners [5], (iv) if the data exchanged does not fit [6 and 8], (v) if the exchange frequency is intermittent or low [1 and 3], and (vi) when the enterprise system's perspective is inadequate [7] the result might be non-use or augmented use (cf. Markus 1984). The last cause needs a comment. As seen in the Volvo Wheel Loaders/Swecon [7] within-case, the prevailing DMS has its main functioning based upon the continuous exchanges between the manufacturer and the dealer, i.e. the business with the end-customer is less facilitated. Today, Swecon handles this flaw with Lotus Notes applications but there are new solutions, including CRM functionality, up ahead (see section 7.8). The future solutions may also result in Volvo Wheel Loaders getting a better possibility to follow the end-customers (given that the business relationship with Swecon allows information exchange about Swecon's wheel loader customers). Such a solution can both automate (Zuboff 1988) some of the tasks between Volvo Wheel Loaders and Swecon at the same time as it may informate (Ibid.) both partners better than the prevailing solution does. By adding and sharing end-customer information as well as automating some of the procedures that require access in several information systems today, the partners can focus on other activities that may enhance their mutual business.

Finally, the enterprise system's scope (Markus *et al.* 2000c) has not incorporated all of a company's business units in the case studies. Given the research results, we can see that the production focused enterprise systems have been based upon the production plant's needs. This also means that the sales oriented business units use complementary information systems that offer output data structures that can easily be translated to a production structure in the production plant's enterprise

system. It is also interesting that an exact fit between the product specification that the sales organization is offered (in the Volvo Wheel Loader case, a dealer, and in the ABB Robotics case, the sales offices) and the product structures at the production plants can be a disadvantage. Instead, it is better to release the product selection application from the product structure (such as Volvo Wheel Loaders' MOM application) or to create a tool that hinders the salesmen from ordering improper product combinations and that results in a specification that the production plant can easily transfer to a producible order (as with the Product Specification Tool at ABB Robotics). Another aspect is how the enterprise systems are implemented. As described by Davenport *et al.* (2004), the emergence of the enterprise system's functionality is 'ongoing' and as seen in the cases it also follows the logic of process phasing (Davenport 2000). Practically, this means that some business processes are supported first, such as the core functioning that follows the inherent production focus, whilst the functions used in the business exchanges are added later on.

8.4 Enterprise systems for business relationships

As has been evident in the analysis so far, the enterprise systems are production based and to a very low degree business relationship based. A reason for this discrepancy in functionality is that *enterprise systems are focusing transactions* (Davenport 2000) which, from a business relationship perspective, is a too discrete approach. When studying the information that the focal companies have gathered in their business exchanges, some information does seemingly not belong in an enterprise system and some types of information are not even considered. Whilst the enterprise system's core is used as the prior MRP systems, but with more interorganizational functionalities, other forms of exchanges are less facilitated or represented in any information system.

The enterprise system's core functioning is undoubtedly to support the production of the focal product, i.e. to automate the material and resource deployment, support the production activities, handle product configuration, supervise transport and logistics, and so forth. Basically, the enterprise system becomes a facilitating entity for the focal company's activity structure (cf. Dubois 1998). As seen in the empirical data, we might also address the information that is interorganizationally exchanged for these processes such as order data (practically, often handled via EDI or web based EDI). This information can be considered 'hard facts', they are quantitative figures about components or products, delivery precision, prices, and so forth.

The data exchanged also follow the logic of the enterprise system, based upon fixed structures (materials) with properties (prices, quantities, etc.) and relations (to other materials), i.e. a form of structured data.

Even if the production focused information is the central issue for enterprise systems, *other forms of information are needed to facilitate the company's exchanges with the partner companies*. As described in the within cases, many of the companies studied have had complementary information systems, something that involves the risk that information that can facilitate the business is missed. Seen from the customer side, information about the customer's prevailing infrastructure, their knowledge about the product, the managerial structure, willingness to purchase, and so forth, are often the tacit knowledge of the people involved. Some of these 'soft facts' about the customers are written in personal notes and handled in individual's MS Excel spreadsheets and so forth, a location where they are not available for others. Moving over to the supplier side, the same scenario is valid. The purchasers and supply managers often have a good overview of the supplier, information that are handled at department level and that is impossible to incorporate when doing queries on a company level. Examples can be supplier gradings, the degree of participatory R&D, willingness to adapt and conform to the focal company's standards, etc.

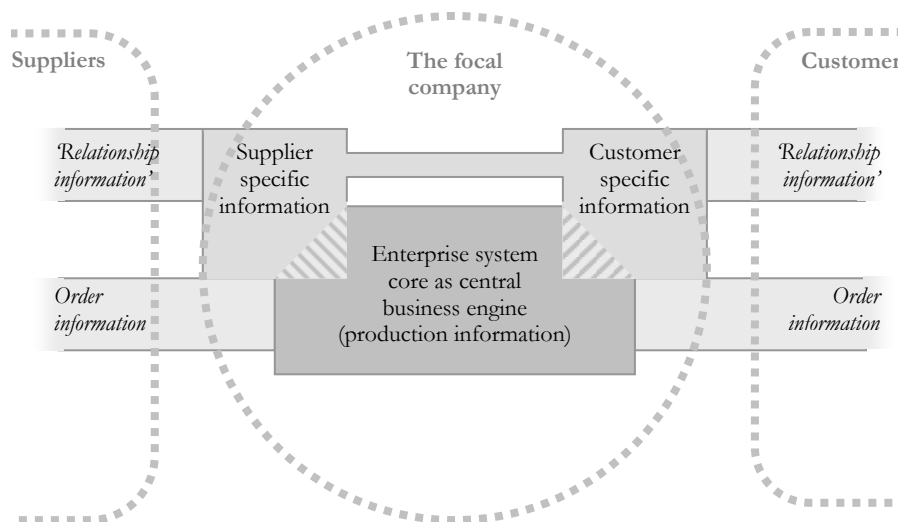


Figure 48 ► A conceptual illustration of a business relationship based enterprise system

All the forms of 'soft' information mentioned would make the focal company better aware of the status and value of its business relationships. The information

in such enterprise system would also have different origins (not only a 'buyer' and a 'seller'), which means that *such enterprise system must accept relational information from many sources* (such as purchasers, production planners, R&D, marketers, salesmen, and so forth). All the business interactions that have been described in the cases are hard to arrange in the prevailing enterprise system functioning, based upon the fixed data structures and the limitations when it comes to who is giving input. An enterprise system that would incorporate more of the business relationship characteristics into its functioning and logic would need complementary features and also be better in handling unstructured data. The conceptual illustration in the figure above shows how such an enterprise system could be structured.

By complementing the production focused information with information that highlights all the exchanges that take place in a company's business relationships, the company can get insights regarding its situation beyond the productivity aspects. If the traditional enterprise system has been a tool for efficiency (i.e. doing things right) (Davenport & Prusak 2003, Newell *et al.* 2003) the conceptual enterprise system would also incorporate functionality that enhanced the effectiveness (i.e. doing the right things). Some of the information that is supplier and customer specific is also suitable to offer to the partners (i.e. what can be described as *relationship information*). The typical complementary information in the case studies supplier relationships is technical information about the products (drawings), but other forms of information could be previous evaluations, the involvement in participatory R&D, an interface for supplier feedback, and so forth. With such information, the focal company can get a better picture of its business relationships with suppliers and, hence, its possibilities and its limitations to act (are other suppliers needed in the relationship portfolio?). Parts of this information would also be possible to exchange with the suppliers.

On the customer side, information about the sold product's use, after market information, the sales force estimated prognoses, historical landmarks (such as episodes of intensive interaction), as well as advertising information would enhance the knowledge about each customer. Ideally, the customer specific information also holds a product configurator that is released from the product's detail level (i.e. not directly connected to the enterprise system's material structure that is used for production), but that supports the salesmen and customer representatives to select the proper product. Traditionally, a large part of the functioning described is attributes that a CRM system usually has. The CRM acronym is, though, often focused on the customer from the focal company's point of view, and it is important to open up the functionality to support a dyadic (and even network)

perspective. Another important functioning is that the supplier and customer specific information needs to be connected, both information and feature wise, to be able to handle interconnected requests and direct customer requirements (and possibly also general agreements) to suppliers, as well as indicating competencies that the focal company's suppliers have to the customers.

As has been mentioned, some of this information is most useful for the focal company, but some supplier and customer specific information is suitable to share. The typical example is the product information, self-evaluation protocols, general supplier evaluations, notes about previous projects, and so forth. Much of this information is scattered on separate web based applications and stored on intranets, places where it cannot be collected and used on an aggregate level. Additionally, some information that is exchanged between two business partners originate elsewhere, i.e. they originate in the wider business network. As well as discussing information about a business relationship, it is also possible to address information from connected relationships, i.e. business network information. To be able to capture all this information, input needs to come from more users than the sales, market and purchase function, i.e. to be able to capture more information about customers and suppliers, all the interacting personnel needs to be able to feed the enterprise system with 'business relationship information'.

A delicate problem when aiming at capturing information beyond the focal business relationship, e.g. if the manufacturing company wants information about the end-customer, is the mediator's willingness to share information. As has been described in the ABB Robotics case, an opportunity to get information about how the product 'lives on' is through input from the service organization. Another way is, as in the Volvo Wheel Loaders case, to demand some input regarding the end customer to get a valid warranty. Both these ways may increase the knowledge about the end-customers preferences, i.e. the second-hand information that the immediate customer (such as a dealer, a partner, or an 'integrator') offers are complemented with first-hand information that exists in the focal company's wider business network.

Given that the enterprise systems features expand and cover the information and functionalities mentioned, its utilization will not only facilitate the production but also the business as a whole. 'No business is an island' (Håkansson & Snehota 1998), and to navigate purely based upon production statistics means that certain important aspects that highlight the focal company's present positioning are missed. To deserve the 'enterprise system' label, it needs to consider and integrate

much more information than what is achieved at this point in time. A question that has not been addressed in this final discussion is whether it is suitable to handle all the information in an enterprise system or not. A possibility to arrange and evaluate such rich and complex information about a specific customer and supplier raises new and interesting questions of security and integrity – issues that are beyond this thesis' scope.

CONCLUSIONS

AS THIS STUDY HAS SHOWN, THE business relationship perspective has exposed other aspects of enterprise systems' utilization than what a traditional organisation and strategy perspective would have done. Whilst the latter perspectives would signal how an enterprise system rearranges an organization's structure or its capability to give the focal company a competitive advantage, this study has analysed how the enterprise system is utilized in all those exchanges that constitute a business relationship (i.e. not only discrete financial and product transactions). The enterprise systems studied have had a clear production focus, something that is caused by their legacy. Another way of describing this finding is that enterprise systems are transaction focused, not relationship focused. Even if the *raison d'être* for business relationships is a business partner's need for a product (or service), i.e. a transaction, the business relationships will involve many more exchanges. Within business-to-business relationships the product is seldom fixed (following the logic of heterogeneous recourses), instead its form and application can vary, which means that it needs other forms of exchanges (such as transfer of know-how, adjustment of administrative routines, logistic arrangements and social meetings) to facilitate the product exchange between the supplier and the customer. A business relationship, therefore, often involves several people with different functions and posi-

*Lessons
learned...*

tions such as purchasers, salesmen, engineers, technicians, and so forth to deal with this complexity. Given the description of an enterprise system as offering 'seamless integration of all information flowing through a company' (Davenport 1998 page 121), this study provides some scepticism. Enterprise systems clearly integrate a large part of the production related information, but much other information is left out. This study is also in line with the study presented by Davenport *et al.* (2004), i.e. the enterprise systems studied have not been completely implemented and some functionalities are still to come. But even if the enterprise systems will continue to expand, both organizational and feature-wise, many of the exchanges carried out in the business relationships are not met by the enterprise systems' construction and logic. This final chapter presents the study's result and answers those questions that were put forth in the introduction. After the result, a presentation follows reasoning about this study's analytical framework. There is also a discussion regarding managerial challenges, i.e. issues that have been exposed in the empirical studies and through the analysis, and that have a practical relevance. Finally, the chapter ends with recommendations for further studies.

9.1 The companies studied

Before presenting the results there will be a brief discussion about the companies studied. The starting point for the case studies was two companies, ABB Robotics and Volvo Wheel Loaders, within two *Fortune 500* company groups. Both of the selected companies have a stronghold within Sweden and the industrialized Mälardalen region. Whilst ABB Robotics has gone through a phase of change by migrating from a legacy system to an SAP R/3 solution, Volvo Wheel Loaders' enterprise system is made up of a refined MRP system core with added features through complementary information systems as well as SAP R/3 modules. But even if ABB Robotics has utilized SAP R/3 to a larger extent (i.e. a more homogenous system core), both companies have complemented their enterprise systems with other information systems that increase the enterprise system's functionality. It is, therefore, hard to address an enterprise system; it is more a question of 'enterprise systems' i.e. a portfolio of information systems used in the companies' business.

The suppliers and customers studied have been of different kinds, from *Fortune 500* companies as Bridgestone and Volvo Cars (a part of Ford Motor Company) to local subcontractors such as Mekanotjänst, Kablageproduktion and CH Industry. Even if the size of the companies, and the sold or purchased quantities, has

differed, the interorganizational information exchanges have had similarities. The order and notification information has mainly been exchanged by EDI or web based EDI but this has been complemented by a frequent use of email and attached files. Besides these exchanges, the business relationships holds several other kinds of exchanges that are not captured by any information system.

It is also worth mentioning the products that have been studied. Both ABB Robotics and Volvo Wheel Loaders have products that are modified, equipped and part of a wider production system once sold. Whilst a dealer further equips the wheel loader, a robot can be sold 'naked' and (after putting in a robot cell by an integrator) the setting can differ widely. The characteristics of these products, further modified by the focal company's customer, means that the end-customer does not necessarily see the producing company as the supplier. As an example, the studies have offered descriptions of dealer (Swecon) specific wheel loaders (MRS machines) and another example where end-customers have turned to an engineering company (Specma Automation) for after sales support, seeing them as a robot supplier. The products studied are thereby not static entities, but on the contrary modifiable where their origin, the manufacturing company, can be overshadowed by the company that puts it into a system or equips it for its final use. This also affects how the producing company can act and what business activities their enterprise system needs to facilitate, something that will be discussed under section 9.3 Managerial challenges.

9.2 The results

To present the results each research question will be answered. After the answers there will be a discussion about the result's implications, managerial challenges and an evaluation of the analytical framework applied.

9.2.1 Answer to the first research question

The first research question put forth in the introduction was *what ongoing business activities do the enterprise systems support and what business activities are excluded?* All the companies studied (including customers and supplier) have shown enterprise systems (or other types of information systems) with well developed and refined production-handling capabilities. The enterprise system's legacy, as a production focused system (Markus 2000, Payne 2002, Sumner 2005), is thereby evident even in this study. By 'production focus', activities that practically would be addressed as supply management, production planning, order administration, logistic manage-

ment and other activities that are performed to produce a product are well supported by the enterprise system. Even during a migration from a legacy system to a new enterprise system, these processes are prioritized, which is reasonable as they often are also a part of what the companies' describe as their core processes. As a runner up, the R&D activities are supported, especially when it comes to handle and translate product structures into a data format that the enterprise system uses when supporting the production.

But when taking an interest in business relationships, which are a result of *all* the exchanges that take place between two business partners, other activities are not facilitated nor captured. Examples of exchanges that are an important part of a business relationship may be mutually oriented work during product development, the increased efficiency of administrative routines originate from adaptations made in a business relationship, customer interaction that cannot be traced to a specific purchase (e.g. feedback pinpointing flaws in the focal company's business), or continuous information exchange regarding new component revisions or product features needed. For such exchanges, the enterprise system is less apparent. As described in the case studies, these exchanges are, instead, supported by other means such as; MS Excel spreadsheets, email, FTP servers, personal meetings, and so forth. And even if such business activities take place prior to and after a product exchange, and hence are a part of the business relationship, they are not supported and displayed in the enterprise system. This means that the enterprise system excludes the business activities that are not closely related to the manufacturing and exchange of the product.

9.2.2 Answer to the second research question

The second research question was *how is the enterprise system used seen from a business relationship perspective?* When applying a business relationship perspective, as based upon the continuous exchanges, the enterprise systems studied take peripheral roles. This study has focused on two kinds of business relationships; those with suppliers and those with customers. When focusing on the focal companies' customer relationships, the utilization of the enterprise systems studied must be considered rather low. Enterprise systems are based upon structured data and fixed ways of handling information, and this does not facilitate the marketers and salesmen's work. Instead, the enterprise system is indirectly manifested through product specification and quotation applications that can be used in paper format or as MS Excel spreadsheets. The sales activities are, in all the business relationships studied, quite free from enterprise system use.

The enterprise systems in supplier relationships are primarily used for sending out order information and receiving warehouse statuses. The medium used for sending the order to a customer has, in the companies studied, been of a different character. Even if EDI has been preferred, other techniques such as web based EDI and (of the enterprise system) auto-generated emails have also been acceptable. The web based EDI solutions also seem to have an advantage over traditional EDI from a business relationship perspective. When presenting order information on a web page it is also possible to add functionality that signals the supplier's status and offers the supplier a possibility to respond. One example found in the case studies was the use of a 'traffic light' signalling green, yellow, or red depending on the supplier's status (a signal based upon the delivery precision). The case studies also revealed plans on forthcoming solutions that allowed mutual communication through a web page. Such, less formalized, information exchanges can complement the standard order and delivery status information that the enterprise system handles today and thereby facilitate other forms of exchanges. This also means that the expanded functionalities in the interorganizational connections mean that more of the exchanges that take place in the business relationship can be handled by the enterprise system.

Information that has not been displayed in the focal company's enterprise systems is the purchasers' and supply managers' evaluations of the suppliers. This is, instead, carried out in complementary information systems such as groupware applications and MS Office programmes. With such a solution it is, in other words, impossible to see the supplier's status on an aggregate level more than in quantitative numbers such as purchased products, delivery precision, and so forth. Apparently, the enterprise systems' 'openness' makes it less appropriate to hold these judgements. The everyday business exchanges that the focal company's purchasers and the supplier's sales personnel have involve more exchanges than the orders. The ongoing business activities involve continuous controls of order statuses, changed orders, revised material specifications, and so forth. This interaction, involving both social and information exchanges, is not captured and, hence, not displayed by the enterprise system. These exchanges are, though, necessary to facilitate the business between the partners (and the central product versus money exchange) but it is not a 'transaction' that the enterprise system handles. A form of exchange that is not connected to a specific order can be the R&D that the suppliers participate in (cf. Newell *et al.* 2003), i.e. an important input to the focal company's future development and innovations. Even if a supplier performs better than others

in such a task, i.e. the business relationship can be seen as valuable, this is hardly covered by the enterprise system.

When applying the dyadic perspective, the suppliers' and the customers' parallel utilization of enterprise systems has, to a low degree, been characterized by inter-organizational connections. Only two of the ten business relationships studied have had EDI, whilst five of them used web based EDI and three others techniques such as email or fax. But as well as technically integrated systems (e.g. EDI) can indicate adaptations and interdependencies so can augmented use or non-use. An example is the utilization of a 'supplier web' that was developed for suppliers and where they pay for the continuous operation of that service. That case signals an initial 'business relationship cost' from the customer's side (to develop the 'supplier web') and a yearly 'business relationship cost' from the supplier's side (i.e. a fee to the firm that runs the 'supplier web'). And even these semi-integrated solutions can be used to a different degree depending on the supplier's prerequisite; this also means that the use of interorganizational information systems are an indication of the mutual orientation in the business exchanges that constitutes a business relationship. As two business relationships revealed; when the data that was sent via the web based EDI did not fit the receiver's enterprise system's structure, there was a complementary procedure arranged leading to even more exchanges between the business partners. That is; flaws in the enterprise systems can increase the exchange intensity and lead to more or less adaptations and hence interdependencies – it is hard to take these routines into another business relationship – which is a sign of an even stronger business relationship.

9.2.3 Answer to the third research question

The third question was *why is the enterprise system used, or not used, seen from a business relationship perspective?* The answer to that question has several answers, and many of them have been touched upon when answering the previous two research questions. Starting with the customer relationships – the sales and marketing activities indicate a rather low use of the focal company's enterprise system. In both case studies, the final sales were often taking place outside the production facility that was the home base of the enterprise system. The low degree of use can thereby be described in terms of the enterprise scope (Markus *et al.* 2000c), i.e. it is a question of the prevailing technical and organizational structures. The non-use in the sales activities can thereby partly be described as caused by the enterprise system's home base (i.e. the producing business unit is prioritized) which means that it does not support the marketing and sales satisfactorily. But the low

degree of use can also be seen as based upon the enterprise system's requirement of a data structure that is directly related to the product's structure. As has been illustrated in most of the customer cases, the products are only one, even so important, part of the sale. This means that the product will be a part of a 'system' and combined with other products (some from the focal company, some from other companies). The exchanges that takes place when selling these 'systems' thereby involve several aspects, which means that the product itself is reduced to a part amongst others. To handle the information in this process the salesmen and marketers use complementary information systems that allow the inclusion of other (even unstructured) data – something that seems to support their business activities better. Given that both cases illustrate such a need for business relationship specific information that is not directly related to the product's structure, it is a function that the enterprise system needs to include if it is to facilitate a company's business relationships better.

When looking at the supplier side, an interpretation is that the focal company does not mind the media as long as they get their products and the feedback (about storages and so forth) needed. As has been illustrated in the case studies, the order information has been sent via different media. It is also interesting to see that even seemingly strong business relationships utilize web based EDI instead of EDI (which can be considered a stronger technical integration) based upon priorities and previous flaws in the data exchanges. The conclusion that can be drawn is that by using such media that does not require a direct exchange of data, the partners can be more flexible and adaptive to the other partners needs. A downside with these approaches is a reduction in the administrative efficiency and that the risk that follows manual (human) information handling is introduced. The pilot study and this study have also indicated how the use of a web based service that is offered to a supplier and customer can be expected to increase over time. As with the supplier Kablageproduktion that through time has learned that it is possible to retrieve more useful information in ABB Robotics' SupplierWeb. A low degree of use can thereby be a question of maturity – through the continuous exchanges new valuable functions will be discovered that increases the use.

The enterprise system's use besides handling the orders (and later the production) on the supplier side is quite low. Both focal companies have dedicated departments that are continuously in contact with (and also evaluate) the suppliers and their products, but such information has to a low degree been integrated with the enterprise system. The enterprise system's 'openness' makes it less attractive to use for storing judgements more than in quantitative numbers regarding the achi-

eved delivery statistics and faulty articles. This has lead to the companies developing other complementary information systems (such as separate databases or Lotus Notes applications) where they can create their own structures for the data they need for the different forms of exchanges (Johanson 1989) with the customers. The reason for just storing facts (names, addresses, products, and so forth) in the enterprise system thereby seems based upon matters of convenience and appropriateness.

9.2.4 The result implications

This thesis presents an important contemporary technology, enterprise systems, and analyzes it from a business relationship perspective. By doing so, the enterprise system's functionality is put in the spotlight highlighting how it is used according to the companies everyday situation. As has been described, this study pinpoints that these enterprise systems only handle a small part (even so, a central part) of the exchanges that these companies are involved in. But given the epithet 'enterprise system' as a system that takes care of a company's total information processing and offers a 'seamless integration' (Davenport 2000) we could expect it to offer more facilities to the utilizing company's business.

Throughout the study, several other information systems have figured as well as a frequent description of what seems to be today's standard office systems; Lotus Notes (groupware), MS Office applications and email. The enterprise systems studied have also been in a state of change, including the extension of their scope. The following section will discuss these issues.

9.2.4.1 *The use of complementary information systems*

Whilst the enterprise system holds a solid base as the central production supporting information system, some of the *complementary information systems* fill the gaps needed to facilitate the business exchanges. These complementary information systems can also be seen as indicators of necessary functionalities. Given the lessons from the companies studied, the shortcoming when it comes to facilitate or monitor other exchanges than the product exchanges is partly handled by complementary information systems that hold the information the enterprise system does not handle. Examples of functions that these complementary information systems support are; document handling and revision control, web based applications indicating the business relationship status, and groupware applications used for the evaluation of suppliers. The complementary information systems can be seen as a result of the enterprise system's shortcomings when it comes to support

the business partners affected, something that are covered up and handled through the development of complementary solutions.

When studying supplier business relations – seen from a focal company with an enterprise system – the complementary information systems mainly handle technical information that the supplier needs to produce and handle the exchanged products. The information systems that handle drawings, logistic information for packing, 3D-files that can be downloaded into the manufacturing machines and so forth are of different technical sophistication spanning from plain file servers to document management systems. The case studies have also illustrated how the enterprise system used has features that let the user link the complementary information (such as a drawing) to the enterprise system's order information. The supplier can thereby get all the information needed for producing a component via their own enterprise system. The complementary information systems are thereby used side by side, and logically a part of, the enterprise system.

Participatory development of the focal company's product (and its components), and other activities that are a part of the business relationship that the suppliers are engaged in and that cannot be related to an order, are though missed by the enterprise system. Some of the suppliers studied do not have any product development of their own, but they are a part of the focal companies' development (the cases have offered examples of tight interaction and repeated visits from the focal companies' R&D personnel). Whether a supplier adds value through being a competent partner cannot be traced in any enterprise system. Such information can though partly be found in the purchasers' own applications. The study has also illustrated how some business partners put a lot of energy into learning its customer's behaviour and made adaptations according to the customers need by participating in mutual activities. This can be interpreted as a sign of a highly committed business partner. Even this is not seen in any enterprise system.

When moving over to the customer side of the business relationship, the enterprise system has been frequently complemented by regular MS Office applications such as MS Excel and MS Word. The product and price information in the enterprise systems studied has been exported from the enterprise system to MS Excel spreadsheets, which means that the salesmen has received copies of the enterprise system information in a format that they are used to. The risk with this is that the information is as old as when the product information was last exported. The central exchange, that is the ordering and product delivery, is though to a larger extent supported by the enterprise system. The customers' purchasers have, dep-

ending on frequency, more or less structured ways of ordering and gathering information before a purchase. Usually, the customers only put in an order line with whatever information is needed (such as a price and a quotation reference), whereafter the focal companies have to translate this information into their own enterprise system. There are though many more exchanges made. Business activities that to a large extent are facilitated by the salesmen's own created documents and applications.

9.2.4.2 Needed features

The results presented indicate that the enterprise system's role as a production-focused system still is valid. But to complement this functioning, several complementary information systems are (often locally) utilized. The variety of other information systems, with both intra- and interorganizational use, shows that more business activities need to be facilitated and that the enterprise system has a potential to incorporate more functionalities. Some of the functions that could be added were presented as a 'conceptual enterprise system' in the cross-case analysis (see section 8.4). A basic assumption is that information about *more* of the business exchanges would enhance the possibilities for the companies involved to develop their business further even if it, at the same time, raises questions on what data is suitable to store. As illustrated in this study, several of the exchanges and behaviours that are not handled by the enterprise system but that complementary information systems deal with are rather general. Even if each business relationship is seen as unique, there are at the same time common patterns and issues that the businessmen have created own applications for. With an enterprise system that only handles the production specific data, the possibilities to explore other possibilities in the business relationships can be missed. Such an enterprise system is also less valuable for a focal company that tries to evaluate its network position. The idea with the enterprise system, to handle all the information transactions, is great, but seen from a business relationship perspective these transaction focused systems have limitations. By including more types of information (that are partly held by the purchase, marketing and sales departments today), the companies can get a better overview of their business relationships. Some information even originates at departments that are not seen as the interface against the business partners, such as R&D or logistic personnel. As an example; to get information about the suppliers or customer's involvement in the continuous R&D and product modification, it is also valuable to let the R&D departments store information about the business partners' involvement. To summarize, a business relationship involves more personnel than a 'buyer' and a 'seller' and it invol-

ves more than a single product vs. money transaction. This is a fact that an enterprise system that aims at incorporating more of the ongoing business activities that a business relationship involves must consider.

9.2.4.3 A question of scope

Simon (2001) described that the computer technology could be considered a 'moving target' and that is certainly true. The shortcomings that have been addressed can partly be described by the studied enterprise systems' scope (Markus *et al.* 2000c). When addressing large international companies as has been done in this study, there is seldom *one* implementation but several made through time. The enterprise systems studied cannot be described in terms of 'vanilla implementations' (Sumner 2005) or 'best of breed' implementations (O'Leary 2000). It is rather a question of the step-wise migration from one system state to another, involving several new and legacy systems living side-by-side. The findings presented must be seen in this light; more forthcoming functions will be incorporated.

9.3 What about the analytical framework?

The introduction discussed the need for complementing the interest in the single organization and strategy focused research with more descriptive studies that focused on companies' business relationships. Having done this, some comments that present how this approach has been experienced and how the analytical framework has been working.

9.3.1 The advantages

Having answered the research questions and commented on the results, a reflection on the analytical framework applied is needed. Firstly, the business relationship perspective has been easy to apply on the empirical setting selected as the respondents' everyday life fits well with the market mechanisms that the presented business relationship theories holds. The perspective also clearly indicates that *the logic behind the enterprise system is not based upon the business relationship's complexity but it is, on the contrary, based upon the single company and its strategic ambitions* (cf. Davenport 2000, Hedman & Kalling 2002). The studied companies' activities have illustrated several activities that can be considered following the business relationship theories. The applied perspective has also helped pinpoint flaws in the enterprise system's logic, a result that is based upon what the business relationship's theoretical base describes as fundamental for most businesses; the repeated exchanges and the mutually oriented behaviours.

The ensemble view on technology (Orlikowski & Iacono 2001), supported by Kling & Scacchi's (1982) web of computing, has been a valuable support during the case study performed. When performing research that incorporates the context, and that aims at putting forth a specific perspective, this approach is valuable. This usefulness is not only interpreted as a result of this study's approach – it should also be regarded when studying other technologies, in other settings, and with other complementary theoretical perspectives.

The analytical framework (presented in figure 7) has guided the work with the empirical data. It has, inherently, the ideas of Kling & Scacchi's (1982) web of computing but it has also incorporated concepts that emphasise companies' business relationships and the exchanges and behaviours involved. The framework is rather extensive and the different concepts have been used to different degrees. The idea has, though, not been that each concept has to be presented in each part of the empirical material. They have, more, been used as possibilities, i.e. when the empirical data has shown signs that clearly could be described with one of the concepts, then it has been done. In an analogy with the comprehensive analytical framework by Walsham (1993), where he mentions that the researcher has to decide how rigid he or she wants to use a theoretical framework, this study's framework can be used in such a way that the researcher thinks is needed to meet the study's purpose. The activity dimension also offers a bridge between what is technology and what is business that means that it, with modifications, can also be used for other technologies than enterprise systems.

9.3.2 The downside

When reviewing the theories on information systems used, this study has to a lesser degree captured the individual's (the user's) perception and attitude towards the enterprise system than what was done in the pilot study (Ekman 2004). One reason for this was this study's scope; when widening the picture and incorporating several companies, the analytical level becomes higher and the single individual becomes less apparent.

Another problem has been that the activities that enterprise systems support follows what has been described as the traditional approach, i.e. focusing on one organization and following a traditional strategy's strivings including cost focus, segmentation, and so forth. Even if there is a striving to incorporate the importance of a business relationship in practice through academic work, as manifested in the market-as-networks (MAN) or relationship marketing (RM) tradition (Grönroos 1994, Mattsson 1997), it will take time before these perspectives have fully paved

the way into the practitioners' behaviour and vocabulary. Whilst handling customer segments and supplier types, the idea of companies as embedded in networks and having business relationship portfolios demands more types of information. Whilst an organization or strategy perspective may offer a better 'fit' between the theoretical concepts and the practitioners vocabulary, the business relationship perspective has more 'misfits' that, at the same time, indicates the enterprise systems limitations regarding how to capture a company's situation. The practitioner's behaviour, in other words, follows the business relationship logic but their description of the enterprise system's development and use follows the organization and strategy paradigm. This means that the enterprise system solution needs to incorporate other concepts and perceptions if it is supposed to support more of the business relationship related activities.

9.4 Managerial challenges

When viewing a company's business from a business relationship perspective, other issues than the intraorganizational become interesting. This study has illustrated how the enterprise system utilization to a very high degree is based upon the production of a given product. There are though some aspects that need to be considered if striving for an enterprise system that better supports the company's business relationships. Three of the lessons can be expressed in a mathematical form and a fourth presents how to learn from the prevailing situation. The first lesson is:

[i] $Product < Problem\ solving$

The end-customer seldom only needs the product; they need a problem to be solved or a possibility to be fulfilled. Practically, this means that the product sold will be used as part of a larger production unit. If there are mediating companies in between, there might also be other equipment and functionality added. The product *per se* is thereby only a part of what the end-customer requires and this needs to be considered when collecting information about the customer's behaviour. Some information will thereby be hard to relate to the enterprise system's product structure, i.e. it needs to be able to cope with even other forms of information that is adjacent to the products. This discussion also leads us to the second lesson:

[ii] $Customer \neq End-customer$

When dealing with such technologically complex products such as the one studied, the focal company's customer is seldom the user and hence the end-customer.

Instead, the customer may place the product in a 'system' and sell it to a third part. Once again, this puts efforts on the enterprise system's structure to handle information related to the product, but having attributes that may capture actors beyond the focal company's customer (i.e. a part of the business network). The case study has illustrated how information about the end-customer can be gathered when they report a purchase for activating the warranty and during service.

The third lesson is based upon that the product versus money exchange that it is only one, even so a central, part of a business relationship. This is expressed as:

[iii] *Business relationship > product versus financial exchanges*

Each business relationship also involves several other exchanges, which can be cooperative product development, mutually oriented administrative procedures, interpersonal bonds, logistic improvements, and so forth. Several of these other exchanges can be as valuable for the company's survival and development as the product exchange. But much of the information about these other business exchanges that the enterprise system misses can be found in their own organization. This leads to the fourth lesson which is expressed as advice:

[iv] *Scan the prevailing complementary information systems for features needed*

Much of the information that has been exchanged in the business relationships studied has been out of the focal enterprise system's control. Given the idea of an enterprise system as the single – fully integrated – information system, its features need to be further developed. If a company utilizes CAD drawings in their day-to-day exchange with customers, this should preferably be handled by the enterprise system. If a customer sends information on how to treat the purchased products logistically, this should be able to be attached to the customer specific information in the enterprise system. If a supplier or a customer adds value beyond the product exchanges, this should also be seen in the enterprise system. The enterprise systems studied have missed information about many of these activities, meaning that such information has not been a part of what can be considered the company's core information backbone. But the treatment of these processes is often a part of the involved departments' locally developed information systems. As seen in several of the business relationships studied, the personnel arrange and handle other information on file servers, in Lotus Notes databases, as MS Excel spreadsheets, and in binders. All these complementary information systems can offers clues on information that the personnel needs and what to integrate into the enterprise system.

9.5 Further studies

When summarizing the experiences from this study, it is clear that the interdisciplinary approach that have been used is rewarding when it comes to understand a phenomena that spans, and also clearly touch upon, two different disciplines as information systems and marketing. This thesis has presented and put forth an analytical framework that shows how to integrate two perspectives and more work needs to be done. As an example, the framework component and its concepts may be developed further into variables that can be measured. It is also possible to go the other way, i.e. to make a deeper study into a single business relationship and try to understand how the utilization of an enterprise system come about and what facilitates respectively hinders the involved people for using the technologies available. Research presented by e.g. Schultze & Orlikowski (2004), Lamb & Kling (2003) and Walsham (2001) have indicated the importance of the interpersonal bonds that reaches outside a company, i.e. what we can describe in terms of business relationships. The marketing research on business relationships have already theorized this phenomena which means that there are knowledge available for IS researchers. The framework also offers possibilities the other way around. By seeing a technology such as enterprise systems as enacted, its use is related to the business setting. The interdisciplinary approach thereby guides the researcher to understand the ongoing exchanges influence on the information system utilization as well as it can indicate the information systems influence on the business.

As has been discussed throughout the thesis, a business relationship perspective takes the repeated business exchanges and the mutually oriented behaviours between a supplier and a customer into consideration. By viewing an enterprise system from such a perspective means that there is a search for all sorts of activities between a customer and supplier, not only the sales and purchase activities. Such a perspective also acknowledges the many interpersonal contacts that take place in a business-to-business situation. There is, in other words, not one 'seller' and one 'buyer' but rather 'sellers' and 'buyers', even if all the involved people do not set their signature on the final contract. Follow-up studies on personnel that interact with customers or suppliers versus how many feed the enterprise system with information would increase the knowledge on how enterprise systems should be designed. The results in this study also pinpoint absent features of the prevailing enterprise system logic. By considering *all* the exchanges in a business relationship, other features that capture more of the exchanges that are carried out with customers and suppliers would be integrated. Given that the IS discipline is an applied one with a design heritage, it would also be fruitful to take this study's result as a

base when designing tomorrow's enterprise system. But even so, it is not only a question of having the functionality in the system; a mind shift where other data than productivity figures and delivery statistics are valued is also needed. On an aggregate level, what information signals the importance of a focal company's business relationships? The logic of enterprise systems follows material structures and product versus money transactions. Must other properties be added to deal with business relationships? When adding a network dimension, one more question can be added. How does the enterprise system help the focal company to get information about its relationship portfolio?

If each business relationship is seen as more or less unique, how does this go with the enterprise systems' best practices? In some cases the standard philosophy may govern the exchanges that take place between two partners, in other cases it may hinder. This study's results indicate that standard solutions need to be complemented with other information systems to deal with the information needed in the business between two partners. To investigate how companies treat the 'standard' aspect in their business, and the need for different forms of mutual oriented behaviours, is worth further studies. Another interesting aspect is the focal company's situation and the company group's striving for homogenous information system's architecture are mentioned by Markus *et al.* (2000c) that pinpoint that when enterprise systems are implemented on several subunits, the complexity increases. Given that a company group can have several types of products and also several ways of doing business; studying the differences between the subunits and their business relationships and how they perceive the company group's enterprise system would offer interesting lessons. As seen in several of the within cases, the selection of an enterprise system is often decided on a company group level. An expectation is, therefore, that there should be a discrepancy when the enterprise system faces the business relationships that the subunits are involved in.

Finally, a new acronym that describes an approach to facilitate information exchange between companies is SOA (service oriented architecture). This approach is based upon the ideas that follow open standards, which means that it should be easier for business partners to exchange different forms of information without static connections between each other's enterprise systems (Magnusson & Olsson 2005). The question is if the possibilities with SOA will lead to that also other forms of information – than the product versus money transactions that enterprise systems hold today – will be facilitated?

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DICTIONARY

The following dictionary offers descriptions of the acronyms and terms that are used in the thesis. Some of the acronyms are originating from the empirical work and they are marked * for the ABB Robotics case and ** for the Volvo Wheel Loader case. The web pages that have been quoted were visited in April 2006.

Add-on	'Programs or systems that are designed to extend the capabilities of existing [enterprise system] products. Also called bolt-ons.' (Sandoe <i>et al.</i> 2001 page 255)
B2B	<i>Business-to-business</i> , business between companies.
Bar-code	An optical signature that can contain information that a bar code scanner can read.
Best practice	A pre-defined way of doing things (i.e. a described process) according to an enterprise system vendor.
Bolt-on	'Usually fully developed programs or systems designed to work with existing [enterprise system]. Also called add-ons.' (Sandoe <i>et al.</i> 2001 page 256)
BOM*	<i>Bill-of-material</i> , SAP R/3's material structure. Sumner (2005 page 91) describe BOM as: 'The recipe of materials needed to make a product'.
BPR	<i>Business Process Reengineering</i> . 'The redesign of business processes in an effort to reduce costs, increase efficiency and effectiveness, and improve quality. BPR is characterized as radical rather than incremental in its approach to change and broad rather than narrow in its organization impact.' (Sandoe <i>et al.</i> 2001 page 257) See for example Hammer & Champy (1993).

CD-ROM	<i>Compact Disc – Read Only Memory</i> , an optical storage device that can hold a lot of data.
CE**	<i>Construction Equipment</i> , a business area within the Volvo Group.
CIM	<i>Computer-integrated manufacturing</i> 'is manufacturing supported by computers. It is the total integration of Computer Aided Design/Manufacturing and also other business operations and databases. This term has generally been replaced by Manufacturing Process Management in the wider field of PLM - Product Lifecycle Management.' (www.wikipedia.org)
Client-server	An information systems solution where some of the data processing is done centrally in the server and some data processing is done at the client (which can be a regular PC or a server).
CO	The <i>Controlling</i> module from SAP.
COTS	<i>Commercial of the shelf systems</i> , information systems and computer applications that have been developed by others (vendors) with a general purpose (e.g. the MS Office package or SAP's enterprise system) (see for example Hedman 2003).
COSF*	<i>Customer Order Specification Form</i> (Swedish: Krysslista), a form that ABB Robotics uses for customer and sales statistics.
COSI**	An information system that holds information about sold wheel loaders.
CP*	<i>Channel Partners</i> , certified business partners that uses ABB Robots in their offerings.
CPU	<i>Central Processing Unit</i> , the part of a computer that carries out the data processing.
CRM	<i>Customer Relationship Management</i> 'systems [that] involve the collection and recall of large amounts of customer information. This information includes the basic customer name and contracts plus sales history, repair history, payment history, customer industry information, date of last sales contact, and any open issues with the customer. CRM involves the integration of all this customer information throughout the entire supply chain.' (Sandoe <i>et al.</i> 2001 page 234)
Database	'A shared collection of logically related data (and description of this data), designed to meet the information needs of an organization.' (Connolly <i>et al.</i> 1999 page 14)
DMS**	<i>Dealer Management System</i> , an information system designed with a distributor or sales organizations needs in mind. Are in the Volvo Wheel Loader case also designed so it can communicate with Volvo Wheel Loaders enterprise system.
Dxf	A file format created by AutoDesk for 3D CAD drawings.

EAN	<i>European Article Numbering</i> , a standardized optical marking (see also bar code).
EDI	<i>Electronic Data Interchange</i> , 'the exchange of standard business documents over computer networks' (Sandoe <i>et al.</i> 2001 page 259). Also described as: 'the computer-to-computer exchange of structured information, by agreed message standards, from one computer application to another by electronic means and with a minimum of human intervention. In common usage, EDI is understood to mean specific interchange methods agreed upon by national or international standards bodies for the transfer of business transaction data, with one typical application being the automated purchase of goods and services.' (www.wikipedia.org)
Enterprise system	A standardized computer based information system, <i>see chapter 2</i> .
ERP	<i>Enterprise Resource Planning</i> systems, in this thesis used as a synonym with enterprise systems.
FA	The <i>Financial Accounting</i> module from SAP.
Freja*	ABB Robotics SAP R/3 project.
FTP	<i>File Transfer Protocol</i> , a protocol for transferring files over the Internet (it allows remote access to data files).
Groupware	Software used for coordinating and supporting group work (use to include common databases, email functionality, information repositories, and so forth).
HR	The <i>Human Resource</i> module from SAP.
ICT	<i>Information and Communication Technology</i> , use to be used as synonymous with IT but also emphasis the communication possibilities with these new technologies.
Internet	'A world-wide collection of interconnected computer networks' (Connolly <i>et al.</i> 1999 page 857). Also described as: 'the publicly accessible worldwide system of interconnected computer networks that transmit data by packet switching using a standardized Internet Protocol (IP). It is made up of thousands of smaller commercial, academic, domestic, and government networks. It carries various information and services, such as electronic mail, online chat, and the interlinked Web pages and other documents of the World Wide Web.' (www.wikipedia.org)
IOS	<i>Interorganizational information systems</i> , information systems that are used between organizations.
IRB*	ABB Robotics product line of robots (are followed by a number indicating the size and application area).
IRC*	ABB Robotics product line of industrial controllers.

IS	<i>Information system</i> which is both (a) a academic discipline and (b) an artefact. Avgerou (2000 page 567) describe it as an academic field with 'its origins in the applied computer science studies of the 1960s which aimed at systematising the design of the data processing applications in organisations. Since those days the IS field has broadened in scope to study the efforts organisations make to respond to the challenge of continuous innovation in information and communication technologies'. The artefact IS can be seen as a 'system of information' (cf. Langefors 1995). Buckingham <i>et al.</i> (1987), which have a socio-technical perspective according to www.isworld.org , describe it as: 'An information system is a system which assembles, stores, processes and delivers information relevant to an organization (or to a society), in such a way that the information is accessible and useful to those who wish to use it, including managers, staff, clientz and citizens. An information system is a human activity (social) system which may or may not involve the use of computer systems.'
ISD	<i>Information Systems Development</i> [methodology], 'a collection of procedures, techniques, tools, and documentation aids which will help systems developers in their choice of the techniques that might be appropriate at each stage of the project and also help them plan, manage, control and evaluate information systems projects.' (Avison & Fitzgerald 1995 page 10).
ISO 14000	A standard from <i>International Standards Organization</i> that is focused on environmental issues.
IT	<i>Information Technology</i> , artefacts used for the handling and exchange of information. Sandoe <i>et al.</i> (2001 page 261) describes it as: 'A collection of generic technology resources – computer hardware, software, networks, databases – and the capability to combine them to support people engaged in meaningful organizational activities. Researchers note: In this thesis these activities can also be carried out between organizational borders.'
KAP*	ABB Robotics Variant Configurators that set the selection rules for robot configurations.
Legacy system	'Artefacts left over from earlier eras that must be managed even as the companies move forward with new technologies. [...] They are often based on outdated, obsolete, and proprietary technologies. Yet they are vital to the business as it operates from day to day.' (Applegate <i>et al.</i> 2003 page 175)
Lotus Notes	A groupware from IBM.
MAIN**	Volvo Wheel Loaders market and sales application.
MAS**	<i>Management Administration System</i> – Swecon's information system for order handling that are integrated with the MAIN/SAMS (a part of Swecon's DMS).

MI*	<i>Manufacturing Industry</i> , even called ‘general industry’, are an ABB Robotics customer classification for industries other than the automotive industry.
MM	The <i>Material Management</i> module from SAP.
Module	A collection of applications that are focused at a specific application area (as accounting, production management, material management, and so forth) offered by an enterprise system vendor.
MOM**	<i>Master Order Management</i> , a software development project for an order application that Volvo CE and their dealers were involved in during the case study.
Monitor	An enterprise system from the vendor Monitor Industriutveckling (see www.monitor.se).
MOPS**	Swecon’s spare parts and after market system (a part of their DMS).
Movex	An enterprise system from the vendor Intenia (see www.intenia.com).
MRP	<i>Material Requirements Planning</i> , ‘the determination of component and materials requirements to support the production plan. MRP uses Bill-of-Material [<i>see BOM</i>] data, inventory data, and the production plan to determine when material needs to be produced and acquired.’ (Sandoe <i>et al.</i> 2001 page 262)
MRP II	<i>Manufacturing Resource Planning</i> , ‘[extended MRP functionality] including order processing, manufacturing and distribution.’ (Kalakota & Robinson 2001 page 244)
Navision Axapta	An enterprise system from Microsoft (see www.microsoft.com).
Odette	An EDI standard for the automotive industry.
PAM*	YIT’s financial information system.
Pdf	A file-standard for documents offered by Acrobat.
PDM*	<i>Product Data Management</i> , an application that supports the management of product and R&D data.
PP	The <i>Product Planning</i> module from SAP.
Protos*	ABB Robotics legacy system.
PROST**	Volvo Wheel Loaders PDM system.
PSS**	<i>Project Support System</i> , an information system that supports Volvo Wheel Loaders purchasers keeping track on articles and suppliers.
PST*	<i>Production Specification Tool</i> , ABB Robotics web based application that allows the user to select a robot configuration.

QlikView	A business intelligence application from QlikTech (www.qliktech.com) that was used by Kanthal in the pilot study (see Ekman 2004).
RobCAD*	Volvo Cars robot simulation software (in 3D).
SAMS**	Volvo Wheel Loaders order system that receives order data from the dealers.
SAP*/**	The world's largest enterprise system vendor (if Microsoft's and Oracle's other product lines are excluded). SAP R/3 is their client server version and mySAP is their web based version.
SAS**	<i>Service Administration System</i> , Swecon's information system for machine information and work shop costs (a part of the DMS).
SD	The <i>Sales and Distribution</i> module from SAP.
SIV	(Swedish:) <i>System I Verksamheter</i> , an approach to select and implement COTS systems (see Nilsson 1991).
SOA	<i>Service Oriented Architecture</i> , an approach to structure information systems to facilitate data exchanges and to support cooperative data processing.
SupplierWeb*	ABB Robotics web based EDI solution.
T1*	<i>Tier-one</i> , ABB Robotics customer category for suppliers to the automotive industry.
VAN	<i>Value Added Network</i> , a company that provides network services to others.
VFS	(Swedish) <i>Välja och Förvalta Standardsystem</i> , a methodology to select and manage COTS systems (see Brandt <i>et al.</i> 1998).
Web based EDI	A Internet based service that allows one business partner to receive the other business partners (in this study, often the customers order information) EDI messages via a regular webpage. This service may be offered by a third party, see VAN.
WISC**	<i>Wheel Loader Interactive Supplier Communication</i> , an information system that was under development and internal evaluation during the study.
XML	<i>Extensible Markup Language</i> , 'a convention of special tags in an HTML source code to characterize elements used in business transactions, such as company names and telephone number.' (Oz 200 page 313). As described on W3C's web page: 'XML is a simple, very flexible text format derived from SGML (ISO 8879). Originally designed to meet the challenges of large-scale electronic publishing, XML is also playing an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere.' (The World Wide Web Consortium, www.w3c.org)

INTERVIEW PROTOCOL

The following pages present the interview protocol that was used during the interviews. A simplified version of this interview protocol was used during the observations and during follow-up visits or when making phone calls.



Interview data

Date: Meeting: ☐ 1 ☐ 2 ☐ 3 ☐ 4 Telephone: ☐
Time (start): Time (end):

Respondent

Title: Dept.:
First name: Second name:
Company:

Main information regarding:
☐ ERP ☐ Production
☐ IS situation ☐ Customers
☐ IS history ☐ Suppliers
☐ R&D ☐

Phone:
Place for interview:
Other:

Empirical data

Recorded on tape/mp3
☐ yes, file nr ☐ No
Photo:
On respondent: ☐ Yes ☐ No ☐ Of observation
☐ FileId: ☐ FileId:
Rich picture: ☐ Yes ☐ No
Other data:

Note! This document is confidential research material which means that it mustn't be used by anyone else than the researcher. If this document is found, please notify Peter Ekman on telephone +46(0)73-960 19 84 or send it via mail to: Peter Ekman, Mälardalens Högskola, Ekonomihögskolan, Box 883, 721 23 VÄSTERÅS, Sweden.

General data

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IT & ERP usage

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Business relationships and respondent network

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Actors

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Resources

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Activities/processes

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Interaction/Exchange

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Other data

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MEMORY NOTE**IS Framework**

- History and going concerns (Before, now, then)
- Production Lattices (R&D, claims, quality, etc.)
- Information systems
- Infrastructure
- Macrostructure

Network

- Actors
- Resources
- Activities

Interaction

- Exchanges
- Atmosphere
- Environment

Notes regarding: ☐ SAP R3 ☐ Lotus Notes ☐ Other:

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Research comment

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Questions after the interview

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Comments regarding the "rich picture" (if any)*

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

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*Inspired by Checkland (1981) System Thinking, Systems Practice

EMPIRICAL DATA

The following pages present the empirical data that have been the foundation for the case stories and analysis in this thesis. To be able to present a maximum of information on a limited space, symbols have been used to indicate what kind of empirical data that have been collected (see the table below for descriptions) and how it have been handled and documented.

The symbols used in the tables			
	Recorded interview (mp3)		Notes was taken during the interview
	Telephone interview/discussion		Meeting (including follow up discussions, observations and reporting)
	Completely transcribed or written interview		Partly transcribed or written interview
	Observation of information system or workshop/office		Documents, OHs, or other material
	Photo on the respondent or the workplace		'Rich picture' or other sketch
	Contact via (e)mail		The respondent has inspected and commented the empirical description

C1. The ABB Robotics case

Contact	Date			Data
IS Manager	☺ 040914	📧 041008	☺ 051007	📧📧📧📧📧
IS/IT-support	📧 041111	☎ 041216	☺ 050602	📧📧📧📧
Manager Order Dept.	☎ 041206	📧 041216	☎ 050927	📧📧📧📧
Variant Configurator ^(b)	📧 041216	☎ 050426		📧📧📧📧 ^(c)
Order Administrator ^(b)	📧 041216			📧📧📧📧📧
Project Manager (Customer Sales)	☎ 041216	📧 050111	☎ 050322	📧📧📧📧📧📧
Senior Specialist Automotive Sales	📧 050111			📧📧📧📧
Buyer (Purchasing Dept.)	📧 050324	☺ 050623		📧📧📧📧📧
Manager General Industry & Partner Sales	📧 050330			📧📧📧📧📧
Sales Manager Manufacturing Industry and Channel Partners ^(b)	☎ 050419			📧
Account Manager (Salesman General Industry)	✍ 050419	☎ 050613		📧📧📧📧📧
Account Manager (Salesman Automotive Industry)	☎ 050421	☎ 050613	✍ 050621	📧📧📧📧📧
Robotics Partner Sales (Salesman Channel Partners)	☎ 050421	☎ 050615	✍ 050622	📧📧📧📧📧
Robotics Partner Sales (Salesman Channel Partners)	✍ 050622			-
Manager Material Planning	☎ 050530	📧 050616	☺ 051004	📧📧📧📧📧
Manager R&D Manipulators ^(b)	☎ 050602			-
R&D Process Development	☎ 050602	✍ 050707		📧📧📧📧
Manager R&D Process and Products	✍ 050629			📧📧📧
Sales & Marketing Manager Software Products (RobotStudio)	✍ 050621	☎ 050922		📧📧
Customer Support Technician ^(b)	☎ 050927			-
Former Manager 'Produktkontoret' ^(a)	☎ 050927			-
Business Developer Customer Support ^(a)	☎ 051005			📧📧
Project Manager Order & Control	☎ 051006			-
Manager 'Produktkontoret' ^(a)	☎ 051007			📧📧
Volvo Cars: Manager Manufacturing Engineering	☎ 050421	✍ 050620		📧📧
Volvo Cars: Purchasing Specialist	☎ 050510	☺ 050620		📧📧
Volvo Cars: Senior Buyer	✍ 050620	☎ 050510		📧📧📧
Specma Automation: Business Area Manager ^(a)	☎ 050520	✍ 050531	☎ 051006	📧📧📧
Specma Automation: Technical manager	✍ 050531			📧📧
SKF Mekan: Manager Quality & Production Development	☎ 050522	✍ 050707	☎ 051006	📧📧📧📧📧

Continued table...

Contact	Date	Data
<i>SKF Mekan</i> : HR Manager ^(a)	-	
<i>YTT Krånium</i> : Branch Manager ^(a)	050526	
<i>YTT Krånium</i> : Constructor ^(a)	050526 051006	
<i>YTT Krånium</i> : Administrator ^(a)	050526	-
<i>Kablageproduktion</i> : Managing Director	050524 050603	
<i>Kablageproduktion</i> : Logistic Manager	050603	
<i>Kablageproduktion</i> : Planner ^(a)	051006	
<i>Mekanoj�nst</i> : Sales Engineer ^(a)	050601 050617	
<i>Mekanoj�nst</i> : Manager Planning & Customer Coordination ^(a)	050617 051006	
<i>Mekanoj�nst</i> : IT Manager ^(b)	051006	
<i>Supplier web developer (company name made anonymous)</i> : IT Consultant ^(b)	051006	-

The contact descriptions are based upon the respondent's business card. If the respondent did not have an English title ^(a) their Swedish title was translated. If they did not have a formal title or did not mention one ^(b) the contact description is based upon their work description. ^(c) Text commented by a colleague with the same position. The date format is YYMMDD and the symbols for the empirical data and its treatment are described on page C1.

C2. The Volvo Wheel Loader case

Contact	Date	Data
Vice President & CFO	041102 050309 051110	
Vice President Volvo CE Europe [Sales and Marketing Manager ^(b)]	050309	
IS/IT Manager	050317 050823	
Purchasing Manager	050413	
Supply Chain IS/IT Development	050418	
Material Supply Manager [acting]	050608	
Market Contact	050608 050912	
Material Controller (that handles Bridgestone)	050608 050902	
Material Controller (that handles CH Industry)	050608 050916	
Material Control Logistics	050608 050912	
Product Assistant Manager (Sales and Marketing)	050613 050705	
Planning/Forecasting Manager	050705	
R&D	050912	
HR Personnel ^(b)	050905	-

Change Manager (MOM Project)	☎ 050915		📅
Coordinator (Engineering Change Notes)	☎ 051014		📅
Business Director (Volvo CE)	☎ 050916		📅
IT Specialist Volvo CE Region Europe	☎ 050916		📅
Market Support (Volvo Parts)	📧 050628		📅 📁 📧 📅
Market Support (Volvo Parts)	📧 050628		📅
<i>Svecon</i> : Vice President	☎ 050414 ☎ 051014		📅 📅 📅
<i>Svecon</i> : Salesman ^(a)	📧 050414 ☎ 050906		📅 📁 📧 📅 📅
<i>Svecon</i> : Market Assistant ^(a)	📧 050414		📅 📁 📅
<i>Svecon</i> : Product Engineer ^(a)	📧 050609		📅 📅 📅
<i>Svecon</i> : IT/IS Coordinator	📧 050628 ☎ 050906 ☎ 050915		📅 📁 📅 📅
<i>Svecon</i> : Data Coordinator ^(a)	📧 050628		📅 📅
<i>Svecon</i> : Market Assistant ^(a)	📧 050915		📅
<i>Bridgestone</i> : Product Manager (off-road)	☎ 050510 📧 050617		📅 📅 📁 📅 📅
<i>Bridgestone</i> : Logistic Assistant	☎ 050601 📧 050617		📅 📁 📅 📅 📅
<i>Bridgestone</i> : Purchase/Logistics	📧 050617 ☎ 050912		📅 📅 📁 📅 📅
<i>Bridgestone</i> : MIS Manager	📧 050617		📅 📅
<i>CH Industry</i> : Customer contact ^(b)	📧 050607 ☎ 050912		📅 📅 📁 📅 📅
<i>CH Industry</i> : Quality Manager	📧 050607		📅 📅
<i>CH Industry</i> : Workshop Foreman	📧 050617		📅 📅
<i>CH Industry</i> : Production Manager ^(b)	☎ 050914		📅 📅
<i>DKI Form</i> : Technical Manager ^(b)	☎ 050603		📅 📅 📅
<i>DKI Form</i> : Logistics ^(b)	☎ 050603		📅 📅
<i>DKI Form</i> : Factory Manager ^(b)	☎ 050916		📅 📅
<i>Viaduct</i> : IS Developer (1) ^(c)	☎ 050701		📅
<i>Viaduct</i> : IS Developer (2) ^(c)	☎ 050916		📅

The contact descriptions are based upon the respondent's business card. If the respondent did not have an English title ^(a) their Swedish title was translated. If they did not have a formal title or did not mention one ^(b) the contact description is based upon their work description. ^(c) This company developed one of Volvo CE's web based EDI solutions. The date format is YYMMDD and the symbols for the empirical data and its treatment are described on page C1.

INFORMATION ABOUT THE ABB GROUP[♣]

The ABB Group, noted as ABB Ltd at SWX Swiss Exchange, is a Swiss company ranked as number 207 at the *Fortune 500* list 2003. The ABB Groups Chairman and CEO, Jürgen Dormann, has more than 116,000 employees located in more than 100 countries worldwide. The company is divided into two business divisions, Power Technologies and Automation Technologies. The company had a revenue of 20,721 US\$ in 2004. ABB Robotics is a part of the largest division (regarding net sales) Automation Technology (AT) that is divided into three business areas: Automation Products, Manufacturing Automation (MA), and Process Automation.

ABB Robotics is a part of the business area Manufacturing Automation (ATMA). The strategy for the Automation Technology division is to support the customer with *products* (as those who ABB Robotics produces), *services* and complete *solutions*. To cope with this mission the Automation Technology division has 24 business area units (BAU) covering Europe, the Americas, and Asia/Pacific. For the production of robots there are two product responsible units (PRU), one in Sweden (called 'the Västerås plant' in this thesis plus the Laxå plant) and one in Norway.

[♣] The information in this appendix is taken from The ABB Group annual report 2004 and ABB Robotics presentation material and *it presents the situation when the case study started* in October 2004.

Beside the product responsible units there are also several 'front-end' companies adding functionalities to the robots.

From a Swedish perspective, the ABB Group has approximately 9,000 employees whereas 5,000 are located in Västerås. The Automation Technology division has 14 production plants in Sweden and 65 % of the AT business units' net income is from export. Besides the producing units, ABB got several sales and service offices covering the major part of Sweden.

INFORMATION ABOUT THE VOLVO GROUP^{*}

The Volvo Group, noted as AB Volvo at Nasdaq, is a Swedish company ranked as number 212 at the *Fortune 500* list 2003. Leif Johansson is the Volvo Groups President and CEO and he has about 78,000 employees worldwide (whereas 35 % are located in Sweden). The company is divided into eight business areas producing: trucks (Mack, Renault, and Volvo), buses, entrepreneurial machines (Construction Equipment), boat engines (Penta), aircraft engines (Aero), or offering financial services. Beside the eight business areas there are five business units working cross several business areas, involving different production and service facilities, see figure below. Volvo Group had a net sale of M201,496 SEK in 2004, and Volvo CE stood for M28,685 SEK (14,2 %) of this net sales.

The three truck companies (which stands for the largest net sale, M136,879 SEK in 2004) produces different types of trucks spanning small to heavy trucks. The bus products include buses, coaches and chassis. Volvo Construction Equipment (CE) manufactures construction application and industry equipment, Volvo Penta engines and transmission systems. Volvo Aero is focused on the aircraft and aero-

^{*} The information in this appendix is taken from the Volvo Group annual report 2004 and Volvo CE's presentation material and *it represents the situation when the study started* in March 2005.

space industry and financial service handles customer finances and banking services.

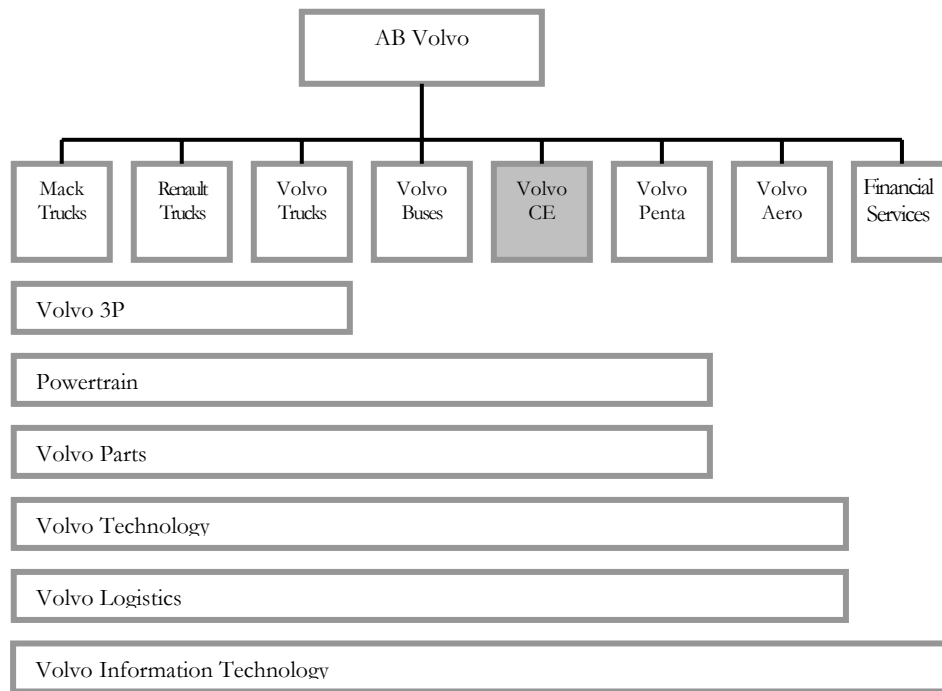


Figure E1 ► Volvo Groups organizational chart [winter 2005]

Besides the business areas, six business units support several of the business areas. Volvo 3P handles the product development and purchase of the truck group. Volvo Powertrain supplies the business areas with diesel engines, transmission and axles, Volvo Parts offers service to the aftermarket, Volvo Technology develops new technologies and business solutions, and Volvo Logistics develops logistic solutions for the business areas. Finally, Volvo Information Technology (IT) offers solutions for industrial processes.

The Volvo Group are active on more than 185 markets and have production in 25 countries. Western Europe is the largest market followed by North America, a pattern that also counts for Volvo CE (and even Volvo Wheel Loaders).



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