

Supplier-Retailer Collaboration in Supply Chain Management: Putting EDI to Work

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"Electronic commerce refers to activities which link businesses together. It relates to marketing, sales, and distribution. Companies can also use the system to effectively disseminate information to their existing business partners, and the system allows business relationships to be created between companies who have had no previous contact with one another."

(Swedish IT Commission; 20 September 1995)

Abstract

This article provides a framework for the use of Electronic Data Interchange (EDI) in Efficient Customer Response initiatives. It shows, how EDI, as an instance of electronic commerce, can be used to make supply chain management more effective and cost-efficient.

Introduction

In the current era of global markets, increasing competition and changing customer demands, there is a growing awareness about the fact, that the conventional ways of managing supply chains do not meet the requirements imposed by a dynamic environment. Therefore, strategies are required that allow industries to manage their supply chains in a more cost-efficient and effective way.

These requirements do not only reflect the need for new forms of collaboration among suppliers and retailer within industries' value adding chains, but introduce information technology (IT) as a powerful enabler for turning these concepts into practice. In the following, the potentials of supplier-retailer collaboration (SRC) will be outlined regarding the opportunities of employing IT in various forms, with a focus on Electronic Data Interchange (EDI).

Supplier-Retailer Collaboration is an idea that has gained considerable attention, especially in the automobile industry, but even in the food and construction sector. Under the governance of the European Union and EFTA, the TEDIS project (Trade Electronic Data Interchange Systems), was established in the 1980s. In the US, where the SRC-concept is recognized under the term Efficient Customer Response (ECR), it is often integrated with efforts to create so called "virtual corporations", i.e. a more opportunistic approach to collaboration. In Sweden, the current effort of Abba Seafood and ICA, a major food retailer has been widely recognized, especially since it is combined with a corporate effort at Abba Seafood to review their entire organizational structure and distribution channels. Other initiatives are Volvo's and SAAB's adaption of ODETTE, a standard developed for the European automobile industry, and the efforts undertaken by Swedish construction firms, such as Skanska. Later on, we will briefly describe how Volvo has used EDI for improving logistics and distribution.

Generally, SRC can be described as "a concept aimed at reducing excess costs in the supply chain and/or improving profitability by increasing sales and gross margins". The mechanisms to achieve these goals can be divided into two categories, operations management, and marketing. Generally, we can define six basic forms of collaboration. In this article, we will our considerations to the operational area, since information technology plays a more important role here.

In the following, we will describe the basic underlying assumptions for SRC, analyze the concept and its different elements with respect to the operational area, and

relate it to the use of electronic data interchange as enabling information technology for improved supply chain management.

The SRC concept

When considering supply chain management from a logistics perspective, we will find two areas that have a considerable impact on the efficiency and effectiveness of the operations being performed—product logistics and information logistics. While product logistics is concerned with the flow of physical goods through the chain, information logistics reflect the need for handling the information flow and administrative tasks around the products. Within these two dimensions, we can identify the following areas for improvement.

Operating standards

By applying common operating standards, the product flow from the supplier to the retailer's regional distribution centers (RDC) or stores can be optimized. When a RDC concept is used, this strategy normally does not include the exchange of information regarding the flow from the retailer's regional distribution centers to the stores, nor analytical EPoS-data (Electronic Point of Sales). However, there is still a significant potential for improvement, e.g. delivery planning, advanced shipping notes, cross-docking, and the use of bar codes on pallets.

Replenishment

Efficient replenishment strategies build on EPoS-data being transferred to the supplier, who takes responsibility for deliveries within agreed levels. If a direct-store-delivery system is in operation, this means sell data from the different EPoS, otherwise the data flow is normally restricted to contain the aggregate levels from the retailer's RDCs.

This concept emburies a potential risk for increasing the supplier's costs, when the underlying supply chain management strategies are not reconsidered. Since the retailer aims at minimizing the warehouse costs, he tends to increase the frequency of orders, while reducing their volume, thus striving for a "just-in-time" delivery concept. This will result in costs being transferred to the supplier, and most likely an increased total cost volume within the supply chain. A way of reducing the negative impact on the supplier is to provide him with sales data and forecasts, which allow a more accurate production and logistics planning.

Information flow and administration

Beyond the improvement of physical logistics, the flow of information between the parts being involved in collaboration, and the handling of administrative issues play an important role for succeeding with SRC-efforts. Reducing non value-added activities by using information technology will result in cost reduction, improved data accuracy, and less paperwork.

Benefits of SRC

There are different estimations about the achievable benefits of SRC, especially we can find a considerable difference between European firms, and their American counterparts. A study conducted in Europe identified the potential benefits to be approximately 2,5 % of retail price, which is to be shared between suppliers and retailers. This would bring down the total logistics costs from about 10% of retail price to 7,5%. In the US, the potential benefits were estimated to be at a maximum of 10%. The following reasons can be found to explain the difference between Europe and the US: Higher diffusion of information technology in commerce, lower US telecommunication costs, and different human resources strategies.

The above figures are presenting an average for the countries and industries under concern. It is reasonable to assume, that pioneering companies will be able to achieve higher results than their followers. However, considering these figures in

relation to the annual trade volume in all industries, the potential savings in absolute numbers can hardly be ignored.

Which part is driving SRC?

At the current state, SRC is mostly driven from the retailer side, based on a primary striving for cost reduction. Additionally, retailers are assumed to gain a larger share of the accessible benefits at a rate of 60/40. Another aspect are the different expectations of the parts being involved in SRC initiatives, which range from increased gross margins under disregard of cost reduction aspects, to cost reduction as primary focus. A study, conducted for the Coca-Cola retailing research group in multiple European countries, revealed a significant difference between companies in France and the UK on the one hand, and companies in Italy, Spain and Germany on the other hand. While companies in the first group have a primary interest in increased gross margins, companies in the latter group primarily embark on SRC projects to due the achievable cost reductions.

Another reason, besides the direct financial aspects, for retailers being the driving part in SRC initiatives is the closer contact they maintain with customers and a higher sensibility to changing demands that are experienced from the final consumers. Additionally, the concentration of power in a small group of powerful retailer-organizations, which can be observed for example in the German food- and household appliances sectors, and which has been existing in the Swedish food sector for many years, allows these organizations to add the necessary pressure on their suppliers. This group even possesses the strategic power and financial resources, as well as manpower to manage the required changes in their decision processes throughout their own organizations.

The suppliers' role is to be a close partner during the change process, as well as in the emerging partnerships. These partnerships can either take the form of a strategic alliance, where both partners are equally strong, or result in a virtual integration, i.e. that one part is the leader, while the other is considered as a facilitating partner. Depending on the chosen strategy, the result is collaboration on a short-term, opportunistic basis, where all parts maintain their individual management strategies, or partnerships with integrated strategies and corporate behavior towards third parts.

How to start SRC initiatives

The input being required for initiating SRC efforts is hardly different from what is needed for performing other forms of change projects. They generally require time, money, and a 'critical mass'. The issue of creating the critical mass must gain considerable attention, since it appears to be a significant problem to find the minimum number of partners required to make the embarking on a SRC project beneficial. One of the main hinders is the lack of openness for new technological solutions, as well as the will and capability to overcome ancient procedural thinking, to adopt new, joint operating standards, and to share information with the partners.

SRC must be kicked off with a strategic commitment by top management of all organizations involved in the change process, but the most important driver is the changeability of the participating companies to efficiently join functions like purchasing, distribution, logistics, and others, and the management of the required information flows.

SRC will have a significant impact on how administrative activities, such as purchasing, are performed, and will often result in a reduction of the personnel being involved with these tasks. It is reasonable to estimate the potential lay-offs to 20-40% of the administrative workforce, which is mainly achieved through automation and a more efficient performance of the remaining manual tasks. It will even require a general reshaping of the skill profiles and competencies of the remaining staff. This results in the requirement to handle the implementation process carefully, since eventual change resistance can endanger the entire SRC initiative.

Knowledge exchange and enabling technology

The exchange of knowledge and information between the partners participating in the collaboration is a major precondition for successfully implementing SRC. Depending on the chosen collaborative level, this may include the transferral of analytical sales data, sales forecasts and internal logistics figures, but even more qualitative information regarding purchasing behaviour, consumer requirements and changing demands. This information flow enhances the planning ability throughout the entire supply chain, and allows a faster adaptation to environmental dynamics and variations in demand.

Information technology in various forms is the enabling factor for the successful implementation of SRC in operations, since it facilitates a frequent and extensive exchange of information between the involved parts of the supply chain. Especially Electronic Data Interchange is one of the most common and usable features that can be employed to allow information exchange at the required pace and intensity. Several studies, conducted in many different industries, have shown, that the electronic exchange of primarily quantitative data, but even qualitative information, works very effectively if the necessary preconditions are satisfied. The ability of retailers and suppliers to support SRC in operations with information technology involves two basic elements—Electronic Point of Sales (EPoS) data, and Electronic Data Interchange (EDI).

Technology features

In order to successfully implement IT-support, it is necessary to integrate individual tasks being performed into a strategy that considers the supply chain as a whole. This holistic perspective avoids sub-optimization of the different elements being part of the chain, but must consider the following areas as being critical success factors.

EPoS data

The data scanned at the retailer's points of sale can be used for managing the physical flow from the retailer's regional distribution centers to the stores, and to improve the retailer's warehousing at RDC and store level. In this case, the data must not necessarily be transferred to the supplier, but can be used to develop sales forecasts that enable the supplier to better plan its own operations. When a direct-store-delivery system is in place, the data can even be used to improve the planning of deliveries to the retailer's stores.

When sales forecasts are compiled, and orders placed upon the basis of gathered data from PoS, while the existing ordering procedures are not necessarily replaced by EDI, we talk about *Computed Assisted Ordering*.

EDI ordering

The electronic transferral of orders can significantly reduce the time, work, and costs required for order handling. This benefits can be accessed by both parts, thus resulting in reduced individual and total chain costs, and lead time improvements. The feasibility study being conducted by Abba Seafood and ICA contained an activity based cost study of the order handling procedures, and revealed a saving potential of 85%.

Advanced Shipping Notes

Advanced Shipping Notes (ASN) are electronically transferred from supplier to retailer on departure of the good to be delivered. They contain information about the estimated time of arrival, the content of the shipment, and eventually the organization of the shipment on the vehicle. Advanced Shipping Notes are used for reducing the unloading time at the retailers' docking station, and the assignment of unloading tasks to the personnel at the dock. While the value of ASNs is limited in conventional supply chains, they become important in Just-in-time delivery systems and for the use of cross-docking terminals.

Information ownership and management strategy

An important issue to be raised in SRC concern is the question of information ownership. This includes to determine what kind and amount of information that should be transferred, but at least as important is the impact on the management strategies in use and their adaption to the new way of supply chain management. This becomes especially important when a replenishment strategy is employed.

The core element of electronic support for efficient replenishment is the data gathered at the retailer’s RDC. As the volume of information gathered at this level is of considerable size, the information that is transferred to the supplier should be limited to contain aggregated RDC information, i.e. the total flow out from the RDC, but not the single flows to the retailer’s individual points of sale. In cases where a direct-store-delivery system is employed, or where cross-docking terminals are used and the supplying part takes responsibility not only for the incoming deliveries but even for the docking outlet, disaggregated information is necessary, firstly to obtain an efficient physical flow of, and secondly to identify potential bottlenecks and improvement potentials.

In the first case, there is no need for providing the supplier with disaggregate information, i.e. that the retailer should maintain a sole ownership of the this information, since sales data and the derivable information often is considered as being highly confidential. The second scenario implies an atmosphere of mutual trust between the involved parts, since the retailer has to share internal information with the supplier. While the first alternative can be applied even in opportunistic forms of collaboration, the second way mostly requires a strategic alliance.

It has already been discussed, that the retailers are driving SRC in order to satisfy their primary interest of cost reduction by cutting their stock levels. This would result in gains solely for the retailer, while costs are transferred to the supplier. In order to overcome the negative effects of this for the supplier counterproductive strategy, the supplier can be provided with additional information, such as sales forecasts, that allow him to plan his own purchasing, manufacturing and warehousing in a more efficient way. However, the opportunities for further improvement are rather limited in this case, since it is highly unlikely that an effective chain management can be achieved, as the concept builds on the presumption, that the supplier will fulfil the order as quickly and accurate as possible, regardless the necessary cost and time, which limits the obtainable benefits to the supplier.

In case of direct store delivery, the transfer of stock inventories and sales data for the individual PoS becomes essential. The order system is then reduced to be a ‘pull’-system, since the supplier replaces exactly the amount sold during the period since the last delivery. Eventually occurring variations in demand are handled by increased stocks at the PoS, or by increasing the frequency of orders and deliveries.

It appears clearly, that the employment of various replenishment strategies have a higher potential benefit for the retailer than for the supplier. In order to leverage the obtainable benefits among the SRC partners, the implementation of replenishment strategies has to be aligned with other strategies. The simultaneous implementation of joint operating standards and efficient administration strategies, where the benefits are more leveraged, can significantly increase the suppliers’ will to join an efficient replenishment initiative. This problemacy is clearly depicted in the following table, which describes the main reasons for firms to undertake efficient replenishment efforts. While suppliers expect primarily cost reduction, retailers conceive better service from suppliers as their most important expectation. However, without being embedded in an over-all collaboration, these two expectations are mutually excluding each other.

Suppliers	Retailers
1. Cost reduction	1. Better service from suppliers
2. Better service to retailers	2. Cost reduction
3. Better information flow	3. Better information flow

Table 1: Expected benefits from efficient replenishment

Another strategy for balancing the benefits throughout the entire supply chain would be to further integrate the supplier's value chain with its own suppliers, thus ultimately considering the entire industry value system as a single value-added chain. This concept has been implemented successfully by Abba Seafood, where the value chain of a Danish can-supplier has been integrated into Abba's value chain. This form of collaboration, however, requires a considerable amount of mutual confidence, since it not only concerns an integration of the individual value chains from a logistics perspective, but challenges the entire traditional concept of billing and payment upon delivery.

When looking at the number of companies being involved with different forms of replenishment strategies, we can observe, that there still is an enormous growth potential for this kind of applications. The following chart shows the diffusion of computer supported replenishment strategies in Europe. The chart does not contain data from the UK, where the percentage of companies applying efficient replenishment is significantly higher.

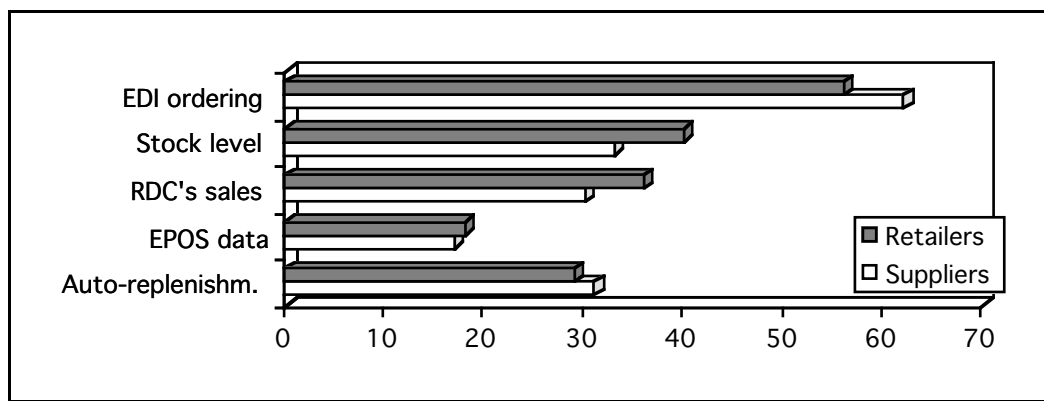


Chart 1: IT-enhanced eplenishment in Europe (except the UK)

At the current state, there is little information available, as far as problems with the implementation are concerned. However, within the EU-EFTA TEDIS program, six potential barriers were identified, namely lack of UNSMs (United Nations Standard Messages), legal requirements for paper based documentation, security requirements, lack of telecommunications, lack of coordination within industrial sectors, and lack of awareness of the potential benefits of EDI, while a study performed with UK companies concluded, that the incompatibility of the existing information systems and the lack of EDI resources are considered as two major problems.

While the need for data exchange among suppliers and retailers in order to establish effective collaboration in logistics has been clearly identified in practice, and gains an increasing interest, there is still a significant lack of using EPoS data for improving the management of the physical flow of goods. So far, approximately 50% of European retailers do not use their EPoS data for that purpose, which is depicted in chart 2. However, it can be expected that this situation will change significantly within a few years, since many companies are planning to use EPoS data not only for sales analysis/forecasts and replenishment, but even assortment planning, identification of customer demands, and the planning of customized marketing strategies.

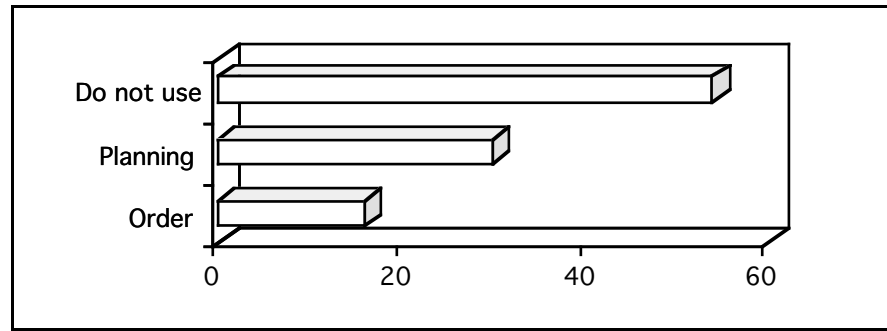
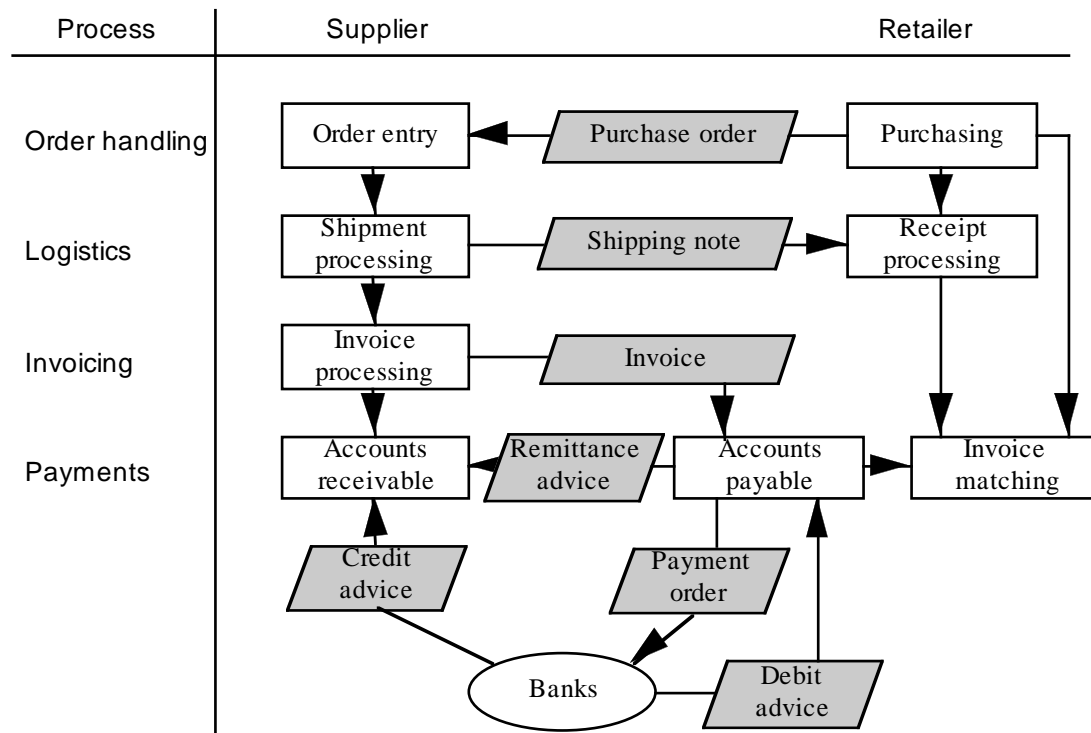


Chart 2: Present use of EPoS data in Europe

From this data it can be concluded, that there is a significant potential to improve administrative activities, not only those being directly related to SRC, but even economic transactions such as invoicing and payments. EDIFACT¹ has identified about 60 different types of messages within 6 areas (Trade, Transport, Customs, Banking & Insurance, Service, Special projects) that can be transmitted electronically in order to improve administration. Picture 1 describes a typical EDI enhanced SRC-workflow.



Picture 1: IT enhanced SRC-workflow

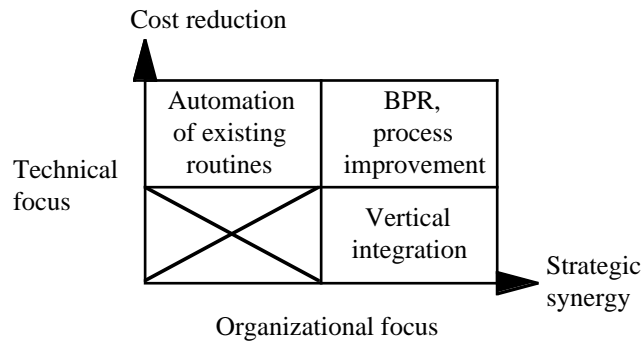
Categories of SRC and the role of IT

We have briefly discussed the role of information technology as a primary enabler of supplier retailer collaboration in operations. The phenomenon of using IT for improving interorganizational communication and collaboration is hardly new. For many years, different forms of EDI have been used to create interorganizational

¹ EDIFACT was created in 1986, when Europe and the US merged their standards. Previously, the European standard was set by the United Nations Economic Commission for Europe Guidelines for Trade Data Interchange (UN/ECE/GTDI), while the North American standard was developed under the American National Standards Institute Accredited Standards Committee X12 (ANSI ASC X12).

systems, often characterized as a subset of 'strategic information systems'. Different forms of IT-supported cooperation have shown to strengthen the competitive position of organizations, since it allows to overcome many limitations imposed by a 'work alone' principle.

The forms of collaboration described here allow us to distinguish four SRC-categories with different intentions and primary foci. They will result in various levels of IT dependency, and organizational collaboration in different forms.



Picture 2: SRC categories

Automation of existing routines

When firms collaborate within this category, the organizational aspect is not primarily considered. Instead, there is a focus on improving administrative tasks and operating standards by using IT as a medium for increased speed and data accurateness. The implementation of this collaborative form is often limited to exchanging large amounts of non-confidential data via EDI. This type of collaboration, in its simplest form, is the construction of a platform for information exchange, but can, in a more complex form, include the development and use of joint applications.

Vertical integration

This category is preoccupied by collaborative patterns that belong to the marketing area, and which have not been discussed here, since they are not primarily enabled by information technology. These forms of SRC (promotion, assortment planning, and product development) require close organizational cooperation, often based on the exchange of confidential information. The basis for integration is a common vision of the involved organizations, while cost reduction is not conceived as a primary concern. Even though we have termed this category "vertical integration", it must not necessarily include changes in the ownership structure of the partners. Collaboration in this case can as well take place within a network structure.

BPR, process improvement

This category is occupied by strategies concerned with improved replenishment, since this form of SRC requires cooperation along the entire logistic process and often comes along with a complete redesign of the physical flow of goods and the information flow that is connected to it. This approach normally includes both a striving for greater efficiency in operations, and the sharing of a common strategy for supply chain management. The initiative is often taken by a company that has launched an internal reengineering effort, and wants to extend it to include its suppliers and/or customers. As far as interorganizational aspects are concerned, it means new forms of collaboration on entirely new levels by joint development and use of information systems and organizational and economic solutions. As it has been shown in numerous studies, this form of SRC allows the most consistent forms of economic benefits for all parts involved.

EDI in Europe

Many companies in Europe are already employing EDI to a large extent. The UK, followed by France are the most developed countries in this concern, while countries such as Germany, Austria, Italy, and Spain are much less developed. It is estimated, however, that the diffusion of EDI technology will increase significantly within a few years, and within some industries, a level of almost 100% can be reached during 1996.

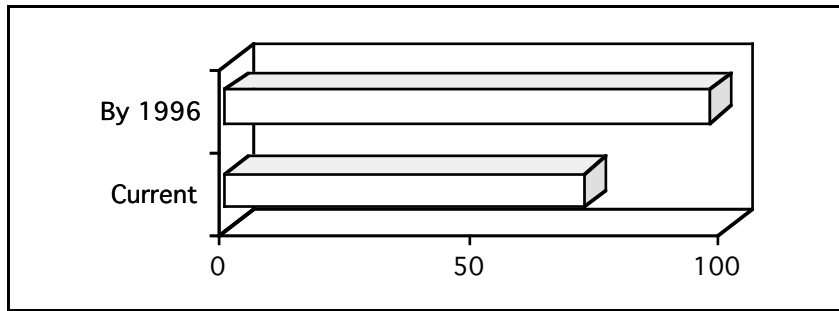


Chart 3: Diffusion of EDI in European retailing

So far, the use of EDI, like the application of SRC principles is mainly retailer-driven, even though exceptions can be found. In the automobile industry, Volvo has been the initiating partner for the efforts regarding its own suppliers, but has even emphasized the necessity of EDI with the retailer organizations. Even the German car industry has been using EDI, mainly with their suppliers, since the late 1970's. The following table shows the implementation years for EDI messages used in the German car industry.

Rank	Type of document	Finished year
1	Delivery instruction	1980
2	Invoices	1984
3	Payment advice	1986
4	Dispatch advice	1987
5	Car identification	1987
6	Just-in-time	1988
7	Transport data	1989

Table 4: EDI messages in the German car industry

The Volvo case

When Volvo Car in the late 1980s decided to launch a major initiative to redesign its entire production- and distribution system, a lot of the conventional wisdom about customers, production, and logistics was challenged, and sacrificed. It was recognized at an early stage, that significant changes in multiple areas would have to take place in order to achieve the ambitious goals being set up. The following main target areas were identified:

- Application of Just-in-time delivery from suppliers to Volvo, enabled through the use of EDI, based on the ODETTE standard.
- A significant reduction of the number of suppliers, while collaboration with the remaining suppliers would be intensified.
- EDI connections with logistics partners, customs, and other parts being involved in the logistics process.
- Production of customized cars on customer demand, with a delivery time of 4-5 weeks on selected markets.

The successful implementation of Electronic Data Interchange was identified as the most critical factor. The core of the new logistics systems for production and distribution, contains the following key elements:

- A global information system, allowing retailers all over the world to communicate with the assembly plants, which are located in Sweden, Belgium, and Canada. Production orders are placed directly at the assembly plant. The goal is to allow customers to modify their car specification until 2 weeks before assembly.
- EDI between plants and suppliers. In the late 80s, Volvo had approximately 600 suppliers, of which 200 in Sweden. Others were located primarily in Germany, Japan, the US, the UK, Belgium, The Netherlands, France, Spain, and Portugal.
- EDI in logistics. Virtually all transportation from Volvo's suppliers to the assembly plants, and from there to the retailers, is provided by Volvo Transport, a daughter company. By using EDI against other parts being involved in the logistics process, delivery accuracy and speed can be improved throughout the entire value chain.

Costs and benefits

The costs for developing the necessary IT infrastructure for the new logistics system for JIT based manufacturing and EDI communication with suppliers were originally estimated to approximately 100 million kroner, which included hardware, internal and external development, and implementation. The costs for the computer based ordering and distribution system were accounted to be another 50-100 million. Even though these estimations had to be revised upwards several times, the total benefits that could be accessed were substantially higher.

The capital tied up in stocks and buffers within the production process was reduced with 400-500 million kroner, from 1.8 to approximately 1.35 billion. A long-term forecast revealed an additional saving potential at the same magnitude, mainly through further stock reductions and a doubling of the annual stock turn-over from 14 to 28 times. Even within the distribution system, the reduction of capital being tied up in stocks counts for the majority of savings. By reducing the number of delivery-ready cars in the stock with 20%, Volvo intends to save another 1 billion kroner.

By today, not all of the goals stated above have been achieved to a 100%, but "we are working on it", as one Volvo executive stated. While Volvo was a follower as far as just-in-time manufacturing is concerned, which was very early adopted by e.g. Mercedes-Benz and BMW in Germany, the distribution system was the first to be operative in Europe in the early 1990s. Since then, however, many other automobile manufacturers have been following, which makes it difficult to assess the competitive advantage that Volvo has gained through the early adoption of this technology.

Managerial issues

According to Volvo, the technical development and implementation of the new logistics systems were not considered as the major critical success factors. The main issue on the agenda was to overcome mental objections to the use of an information system that radically changed the way of distributing and selling cars. Initially, the importers were introduced to the system, and took then responsibility to educate the individual agents and salesmen.

Due to limitations imposed by the geographical distance between the assembly plants and Volvo's markets, customer order based manufacturing will not be applied on all markets. However, in Western Europe and the Eastern parts of the US, delivery times shall not exceed 5-6 weeks, in the Western parts of the US 8 weeks, and in Japan 12 weeks.

EDI drivers and obstacles

Compared to other forms of technological cooperation, EDI is a relatively simple form of exchanging information. However, many companies conceive numerous

problems related to the technical implementation of EDI. Besides the technological implications, economic, legal, and organizational aspects have to be taken into account for the development and implementation of systems across organizational boundaries. The following aspects should be carefully considered.

Management commitment

As in virtually all projects that result in major changes of procedures, organizational structure and technology use, top management commitment is a necessary presumption for a successful diffusion of EDI, since the power to overcome change resistance is found within this group. However, this requires that top management is aware of the potentials and risks of new forms of collaboration and the implementation and use of new technologies.

Industry diffusion

In order to achieve the full potential of benefits from EDI and interorganizational collaboration, a majority of actors has to embark. While strategic alliancing between individual partners becomes more and more widespread, the industry wide commitment has not always reached the 'critical mass' yet. However, as the following table shows, the global EDI market has grown significantly, and will continue its development.

<u>Year</u>	<u>\$ mil</u>	<u>% growth</u>
1991	250,6	
1992	360,59	43,9
1993	510,27	41,5
1994	699,01	37,0
1995	928,17	32,8
1996	1.199,90	29,3
1997	1.520,54	26,7
1998	1.867,02	22,8
1999	2.269,20	21,5
2000	2.726,74	20,2
2001	3.195,44	17,2

Table 5: World EDI Market, Projected Revenue and Growth

Standards

The still existing lack of standards (EDIFACT vs. national standards; UK: TRADACOMS, GE/AT: SEDAS, FR/BG: GENCOD) raises significant barriers, since it requires an extensive involvement of the company internal information systems for data conversion, and reduces the opportunities for accessing EDI potentials with partners in other countries.

Internal information systems

When EDI is implemented in a relatively simple form, i.e. for transmitting orders or invoices, the company's internal information systems must not be considered as a critical factor, since EDI in this case is used for automating existing routine work only. However, when applications become more sophisticated, e.g. when analytical data is exchanged as part of an efficient replenishment strategy or for supplier's purchasing, manufacturing, and warehousing forecasts, the internal ISs become more important and their capabilities more critical.

Data accuracy

Without transferred data being accurate and consistent it is difficult to achieve the potential benefits. There are several possible reasons for a lack of data accurateness, where inconsistent data collection is the most significant. Additionally, there must be mechanisms for using the transmitted information efficiently and correctly in the organization's internal information systems.

Investments

In the beginning of EDI implementation projects, costs are no critical factor, relatively simple solutions can be purchased for approximately 2.000 USD and up. Large, sophisticated systems, however, can cost up to 100.000 USD and more, as the Volvo case shows. EDI is not limited to a specific environment, it can be employed using any technical platform from a mainframe to a personal computer, while the efficient use of large amounts of data can require substantial computing power.

Shared benefits

It has been previously discussed, that both parts involved must be able to gain a fair share of the achievable benefits. The approach that often is adopted at the current stage, one part wins, one part loses, makes it difficult to gain industry wide commitment to the concept. Additionally, it is difficult to assess the achievable benefits in advance, a factor that prevents companies from embarking on a journey without clearly specified and accountable targets and results.

Business process reengineering

SRC initiatives and EDI implementation often come along with a major effort to redesign an organizations business processes. This major disruption of procedures, organizational structures, and technology use may result in a significant resistance against the adoption of EDI. As a first step to overcome change resistance, it might be recommendable to use EDI as a tool for automating, even if this is contradictory to the basic intentions of reengineering, and implies an delay in the ability to access strategic synergies.

To access the benefits of EDI effectively, a total reengineering of entire processes, e.g. the logistic process, may be required. In this case, a deliberate and purposeful approach to the change imposed by the reengineering process and the adoption of new technologies becomes an implication for succeeding in the efforts.

Emerging technologies

The technological progress we could observe during the past years, more computing power at lower costs, the spreading of networks, and the increasing diffusion of IT in all industrial sectors will most certainly be a major driving force for the adaption of EDI, since it allows even minor actors in the industry to embark.

Legislation

So far, legal constraints, mainly regarding the electronic storage of documents, and the transmission across country borders, have been a source of duplicated paper work and redundant storage of information, with all the error sources this implies. As in other areas, legislation has shown to be unable to quickly adapt laws and regulations to the rapid development of IT. In the future, legal deregulations, e.g. within the European Union, or on a global level within the GATT, will hopefully allow to reap the benefits of EDI fully.

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