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## **THE IMPACT OF E-COMMERCE ON TRANSPORT**

### **E-commerce and Consequences for the Logistics Industry**

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## ABSTRACT

The aim of this paper is the logistics consequences of the development of E-commerce concerning physical products. The consequences will be analysed with a Supply Chain view and the perspective from the transport and logistic providers.

An e-commerce model is created by a number of different logistic forces. The model has emerged out of the competitive forces model by Porter. This e-commerce model is demonstrated by a number of examples. Here the model is used to indicate the way the logistics industry will be positioned in the future. A number of case studies have been performed. To analyse the case studies the model is used. The model shows distinctly the way the five competitive forces influences the e-commerce companies as well as the logistics industry. This facilitates for the logistics industry to take a larger part of the value chain.

The focus is directed towards the design and the management of different concepts for the physical distribution. The interrelation between these concepts and the flow structure and the information systems along the Supply Chain are to be defined. Models for Internet distribution, as well as for upstream and downstream consequences for Internet buying will shown.

**Key words:** e-logistics, e-commerce, e-business, logistics, supply chain management and distribution

## 1 Introduction

### 1.1 Background

Interest in the Internet has changed so drastically in recent years that one can speak of a universal breakthrough. The remarkable increase in users can be attributed mainly to the appeal of the World Wide Web, the Internet feature that is enjoying the greatest growth (Bergendahl et al., 1998). There is some uncertainty about how much the Internet and electronic commerce (e-commerce) are being used, and especially about the expansion of such usage in the future. At the same time, e-commerce is a new phenomenon that is surely going to have an enormous impact and significantly change the way both individuals and companies shop, manage their business activities and distribute their products.

The number of households in Europe connected to the Internet is expected to triple, to 50 million, by the year 2004 (Erlandsson and Linden, 1999). But usage will not expand uniformly. Persistent forecasts of explosive increases in sales of goods via the Internet have so far been wrong. In Sweden, The Swedish Research Institute of Trade (HUI), recently assessed retail sales via the Internet to be SEK 600 million, which corresponds to a trifling 0.2% of total retail turnover, (Karp, 1999). Increased access to Internet services must be accommodated by improvements in flow structures. The increased access to and offers of information created by the Internet must consequently be accompanied by a different distribution structure, one assuring that goods can even physically be transported to the customer quickly and rationally.

E-commerce will open an entirely new market for actors in the logistics field. Logistics and distribution systems that function efficiently and effectively in all respects will be crucial for the success of the companies involved. This implies that manufacturing companies, and especially logistics companies, must identify and create effective logistics solutions in order to compete on the marketplace.

Ordering materials of various kinds electronically, and primarily via the Internet, will become more and more common. This applies not only to business-to-business but also to business-to-customer. This end consumer will normally be a private person who orders everything from books, clothes and food to a new model computer. The result is that the end consumer can receive *and will demand to receive* the goods ordered significantly faster than via traditional distribution. The subsequent result will be shorter lead times, the disappearance of one or more physical intermediaries, and direct transports to far more addresses, especially in those cases where retail stores are circumvented. We can anticipate less use of private cars, but more employment of delivery vans, as well as smaller orders to be shipped longer distances, especially in the international context.

During the preliminary phase, we might expect these consequences to imply greater direct costs, while the consumers' indirect costs for seeking, ordering and having their purchases deliver to their homes will go down. Simultaneously, however, we will see new opportunities for creating entirely new distribution systems involving different flow streams than those with which we are familiar. The companies who can cope with these demands

with new approaches to production and distribution will be able to create new business opportunities and prepare for a greatly increased market for their products.

The Internet signifies new opportunities for reaching the global market. Yet this, in turn, also signifies great demands on the actors who want to exploit these opportunities. Right now, there are several big actors who market themselves solely via the Internet (e.g. the booksellers Amazon.com and bokus.se), yet there are very few who do this profitably. Making it possible to use the Internet as a marketing channel requires new knowledge about how the entire logistics system needs to be developed in various environments — and about the consequences this will imply for other actors.

## **1.2 Scope**

The focus of the project was designed as follows.

- The unit of analysis is firstly the transportation and logistics industry.
- The area studied is the physical distribution along the supply chain and the supporting information flow.
- The project covers both business-to-business and business-to-consumer e-commerce, but with a focus on business-to-consumer.
- Both e-commerce in general and its logistics consequences will be covered, but with a focus on logistics consequences of e-commerce. Logistics consequences implies studying the demands on logistics for achieving profitable e-commerce in terms of logistics costs and delivery service, and the possibilities for change and/or improved logistics operations.
- The logistics focus is on the logistics platform in terms of design and management of the physical distribution structure in the supply chain: the different actors, such as producers, retailers, wholesalers, truckers, forwarders, customers, etc. The supporting information flow is also included.

## **1.3 Research questions**

This paper has its basic foundation build in a number of questions. These were developed and further analysed within a number of cases in cooperation with the industry (Hultkrantz and Lumsden, 2000, Erlandsson and Linden, 1999, Freij and Rosengren, 1999)

These questions and possible development are as follows:

1. What modes of distribution are interesting and what volumes and resources will be needed in order to rationalize this commerce? How to organize and coordinate with existing flows while waiting for sufficient volumes to motivate new, separate systems?
2. Will there be a demand for extended cooperation between different actors vertically as well as horizontally? How will this coordination be achieved? Is there a demand for incentive and control?
3. What role will different information systems play in these new, alternative logistics systems?
4. How will the increased cost downstream be compensated with lower costs upstream?
5. How will the time differentiation be affected by the prospect of alternative distribution solutions?
6. How will the distribution be allocated to a 24-hour period and how will this affect resource utilization?

# **2 New flow structures as a consequence of E-commerce**

## **2.1 Flow requirements**

Industry observers expect e-commerce volume to triple in two years, even though their current expectations vary. Business-to-business e-commerce revenues are currently a lot larger than those of business-to-consumer and are forecasted to stay so in the near future. The market for consumer e-commerce requires a major shift in consumer buying patterns and a much larger penetration of the Internet in order to become really big (Cherrington & Capoor, 1999).

Some say the Internet will take over all commerce. That everybody will soon shop on the Web. Others say it is just a fad, and that the Net cannot offer anything of lasting value (Dahlén, 1997). It is recognized that the Internet offers a lot of opportunities. But in order for it to become a large, global channel of sales, there are some growth requirements that have to be fulfilled for e-commerce to truly take off, e.g.:

1. The basic infrastructure must be in place, including logistics.
2. Customers and businesses must have access to the Internet.
3. Sites must have multiple language functions.
4. The cost of Internet access must decrease.
5. E-commerce must be safe in terms of privacy and monetary transactions.
6. The speed of the technology must be satisfactory.
7. International standards must develop.

Interest in the Internet has increased dramatically during the last few years. The Internet is an “abstract network” (further explained in section 3.6 about Logistics systems’ changeability below) which means that implementation times are short and the developments around it are happening very fast. Consequently, Internet use will shift from people with highly developed computer skills to ordinary people, which will result in new possibilities for shopping over the net (e-commerce). This in turn will lead to new business opportunities for all sorts of companies. The products still need to be delivered to the customers however, and effective logistics and distribution systems are hence essential for the success of new business.

Just as with every new phenomenon, the definition of e-commerce is still slightly vague and unclear. E-commerce is one part of e-business, which in turn can be described as the new business logic sanctioned by Internet technology. This new logic

- spans entire value chains and creates new economic value,
- breaks down borders and hence relationships,
- impacts on large empires as well as new start-ups (Erlandsson & Lindén, 1999).

The differences between traditional business logic and the new e-business logic can be seen in Table 1 below. One trend that can be seen throughout the new logic is that it is focused on building a network consisting of suppliers, manufacturers, and customers. Customers can participate in product development by surveys on the Internet, and are thereby, besides helping to develop the product, becoming more loyal customers. Suppliers are seen as partners participating in joint ventures with the company. Production is made to order instead of to stock so as to be more customer adapted. And customer service is becoming more and more important when companies are trying to create a loyal customer segment.

*Table 1 Differences between the old and the new business logic (Erlandsson & Lindén, 1999)*

Value chain	Old logic	New logic
Product development	Technology driven	Customer driven
Procurement	“Suppliers are suppliers”	“Suppliers are partners”
Production	To stock	To order
Marketing	Market share	Share of customer
Sales	Traditional channels	Over the web
Order fulfilment	“It comes when it comes”	Value added functionality over the web
After sales	Customer service second priority	Customer service is the key to survival

One definition of e-commerce might be “E-commerce includes everything from learning about products online and electronic transactions to online customer service and support”, Kevin Koym, president of Praxsys System Development (Erlandsson & Lindén, 1999).

*Alternative media for e-commerce*

In the future, e-commerce need not necessarily mean the transaction between a web shop and a “customer computer”; the transaction might just as well be between an ordinary TV and a TV network. This means that it will be possible, for example, to order products from television advertising directly from the TV set.

*New openings for transportation companies*

With e-commerce, a whole new market will open up for transportation and logistics companies, or whatever they may be called in the future. At present e-commerce is pursued to a fairly high degree between companies, but is still not very developed between companies and private persons. The business-to-consumer (B2C) relation is expected to grow rapidly though, and when this happens it will result in several changes for actors in the logistics area. When delivering to private persons instead of companies, the demand for fast and accurate deliveries will increase. This is because one or more of the physical nodes will disappear when the goods can be transported directly from the producing company to the end customer. Direct home deliveries will request shorter lead times, and more complex distribution systems will be necessary to make this possible.

Expected trends in traffic and distribution from a widely spread use of e-commerce are fewer passenger cars, an increased number of pickup trucks, and smaller consignments, especially on international transports.

Like all other industries, logistics has to consider e-commerce, evaluate the importance of the trend and determine what impacts it could imply. Most other industries are customers of logistics in one way or another, implying that any trend likely to impact other industries will certainly have an impact on the logistics industry. Therefore, the logistics industry has to face the challenges and opportunities created by e-commerce, both from within the industry and from external players. The industry has always been pressed to cut costs and squeeze margins, and the future will be even more formidable as competition forces most companies to continue the streamlining of their business.

**2.2 Model for information in e-commerce**

Internet technology has forced companies to redefine their business models so as to improve the extended enterprise performance (Simchi-Levi and Simchi-Levi, 2001). A model describing how the Internet and information influences the business structure has been developed. The base for the model is Porter's five forces model (Porter, 1980). This model is generally used to analyse a company's position on the market and is used frequently as a means to evaluate the potential of a specific company. There is however nothing that stops us from redesigning the model to analyse e-commerce.

A range of new possibilities opens up as e-commerce is implemented as a way to reach the end-consumers. Companies will have the opportunity to establish a contact outside the traditional marketing channel. If this becomes reality on a large scale there has to be a logistics service developed in order to correspond to the specific needs.

*Potential entrants*

There will always be a threat to the established companies when a new marketing channel is implemented; areas where established companies have failed to predict a demand. Potential entrants can also be established brands that due to a strong trademark they have the strength and the volumes to sell directly to the end customer on the Internet. The latter require that the trademark be sufficiently well known.

One company is Amazon.com, which by selling books on the Internet Amazon became one of the largest book retailers in the USA. Amazon quickly became a threat to the traditional bricks and mortar companies as they could offer the same products to a lower price and with a higher level of customer service. By this they forced their competitors, for example Barnes & Nobles, to take action and to establish a similar business activity.

Another example is when a product or service can be made in a completely different way. Computer programmes or videotapes that for a long time has been sold in regular stores will soon be available on the Internet or the cable television network making the old market structure obsolete.

*Suppliers/Producers*

E-commerce holds a wide range of possibilities for different actors to establish a market place for their products. A supplier can start competing with its retailer customers, a kind of cannibalism that in the long run can drive the traditional marketing and sales channels out of business. This can be considered as a vertical integration of the business process where one company takes control over the whole flow of goods.

There are numbers of examples in which companies have begun to sell their products directly on the Internet as a complement to the retailing line. Computer manufacturers, companies like Hewlett and Packard ([www.hp.se](http://www.hp.se)) and Compaq ([www.compaq.se](http://www.compaq.se)), have to meet the competition from Dell ([www.dell.com](http://www.dell.com)), who started to sell computers over the Internet directly to their customers. In the future there will be opportunities for a wide range of different companies to communicate directly to the consumers and to reduce the costs associated by selling through a net of retailers.

Another example is where transport services are being purchased. Today the main part of all transportation assignments is purchased through haulage contractors like Schenker or Danzas. Internet opens up new possibilities to get in contact with customers on the logistics area.

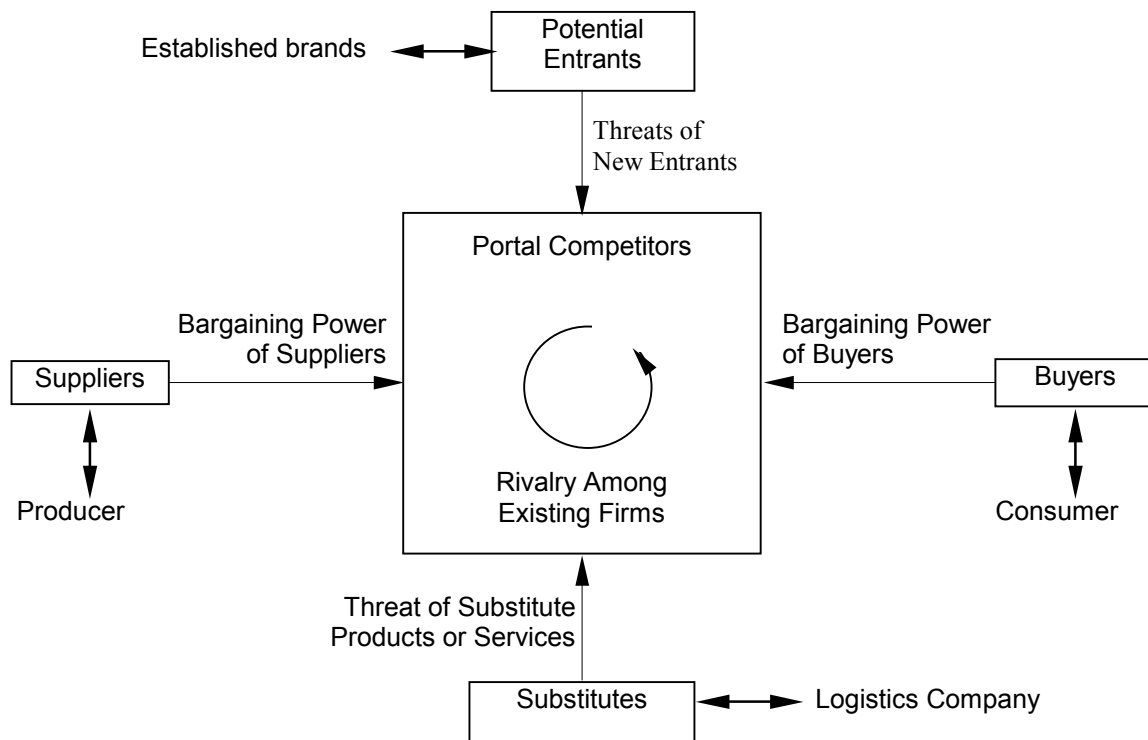


Figure 1 Model for Information in e-commerce (adapted from Porter, 1980)

#### Buyers/Consumers

At the same time as producers will take advantage of the possibilities of Internet consumers, the buyers, will use this forum to negotiate prices and offerings. In the consumer line there are examples like Letsbuyit ([www.letsbuyit.com](http://www.letsbuyit.com)) and different kinds of exchange services that bring together buyers/consumers and producers and providers of different services.

One of the logistics providers that work in this way is Waytrack ([www.waytrack.com](http://www.waytrack.com)). Waytrack bring together truck owners and small hauliers with companies that require a transport or a need for a specific capacity by being a forum for contact. Waytrack does not interfere with the logistics service. They offer a membership to their customers bringing them together into a site where companies that require transportation invite tenderers and transportation companies to compete to get the assignment. In this way Waytrack is a connection between suppliers and buyers without being a part of the transportation process, after the negotiation is finished Waytrack has no responsibility in the transportation process.

#### Substitutes

As a consequence of a late refinement in the value chain new companies have become parts of the manufacturing process, doing simple configurations to make the products correspond to the customer demands. One example is where IBM computers use a logistics provider, Schenker AG, to configure and install software on the computers.

Here the logistics company in e-commerce that in itself is a substitute for traditional commerce takes over services from traditional retailers such as providing the client and carrying out some service on the products.

In general there is a pattern that products are differentiated or consigned as late as possible in the supply chain. This means that logistics companies which have access to terminals and cross-docking opportunities will be able to take a larger part of the supply chain thus increase the potential profit margin

Today there is a battle between post offices, forwarders and integrators for global domination in the expanding express parcel market. Since a lot of the “traditional” freight companies are involved we can say that this is valid for the total freight market. Through acquisitions, deals, partnering etc. the companies try to get a complete European network as a step towards achieving global coverage (Cronin, 2000). One thing that is behind this network war is that the transportation companies want to get a larger share of the supply chain, value-added logistics (Peters and Jockel, 1998). The manufacturing companies try to postpone operations that make their product unique for the customer. This operation can then be done by the logistics company.

### 2.3 The supply chain flows

"The supply chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumers." (Christopher, 1992)

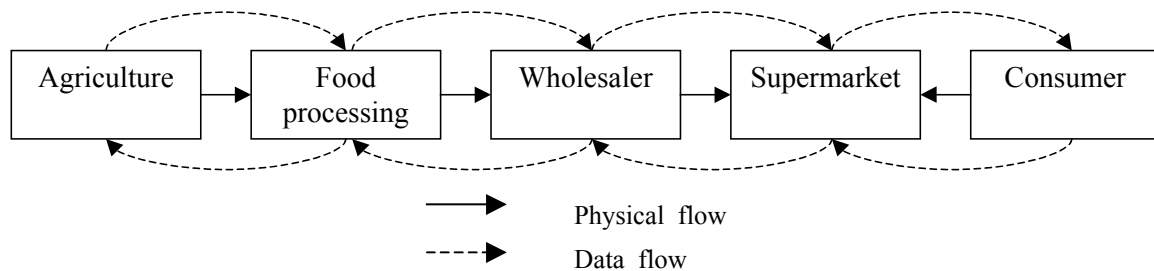


Figure 2. An example of a supply chain.

The above figure indicates two important flows that we would like to emphasize — the data flow and the physical flow. E-commerce will impact all elements in the supply chain, which rely on data flow to improve efficiency. Still, physical transportation is needed for most products, implying the usefulness of deriving e-commerce demands on logistics by analysing the logistics customers. Demands on a smooth integration of these flows will increase in the future, from being a competitive advantage to a necessity. In internal logistics, within a plant, fixed installation or permanent information connections often provide physical links between the sender and the receiver, whereas in external logistics (between companies in the chain) there are only virtual (abstract) links between the nodes (Tilanus, 1997). Maintaining the relation between the information system and the physical goods can sometimes be difficult. The shipment may be forwarded by various modalities and different companies, consolidated with larger shipments or broken down into smaller ones. The information is often sent by a number of different means — mail, phone, fax, EDI or physically attached to the shipment. Since global trade is increasing, the physical flows will probably become even more complex in the future. This will increase not only the importance of the logistics service provider as an integrator between players in the chain, but also the demand on his or her role as a coordinator of information flow and physical flow.

EDI has been available to business since the 1980s as an international standard for data communications. However, to set up corporate networks and establish electronic ties with trade partners' using the EDI standard requires costly private data networks and customized software, which makes EDI available only to an elite group of big companies. Therefore, EDI could not satisfy mass demand for integrated information systems, as it is too expensive and too rigid in structure. EDI has remained the province of large companies and their captive suppliers, used only by a small percentage of companies, e.g. 5% in the USA (Lohr, 1997).



### 3 Distribution development within e-commerce

#### 3.1 Conventional distribution

In conventional international distribution, goods pass through several nodes, or stops, before reaching the customer, see Figure 3. After production, and possibly storage at the factory, the goods are delivered to the national distribution center (DC). Here they are stored, consolidated and reloaded, and then sent on to the next stop, the local DC. The goods are handled in the same way as at the national DC, and are thereafter sent on to the retailer, where they are sold to the customer. Since most of the time that goods spend at nodes does not add value, the more nodes there are in a distribution channel the less efficient it generally is (Lumsden, 1998).

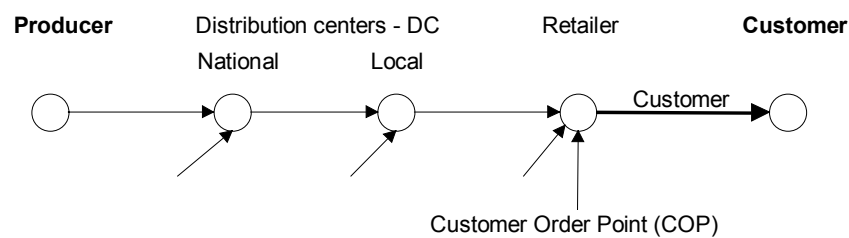


Figure 3. Conventional distribution structure.

The point where the goods change from being delivered to stock to being delivered to order is called the customer order point (COP). In conventional distribution, the COP is at the retailer, where the customers order and buy the products. This is called a *push* system since the company predicts the demand and the goods are pushed through the distribution channel (Coyle et al., 1996).

With e-commerce there are several possibilities for new ways of distributing goods, and presumably there will be different ways of distribution for different types of goods. Time will be of great importance when deciding on what type of distribution model to use. The faster and more direct flow of information on the Internet will make it possible to skip one or more nodes in the distribution channel and thereby increase delivery speed. For example, in the future products might be delivered to the customer directly from the producer or from a national distribution warehouse. One likely scenario is that customers will have the possibility to choose how quickly they want their products delivered. The more the customers are willing to pay, the faster they can receive their products, and the distribution models will then be different according to the lead time allowed.

#### 3.2 Distribution structures for Internet buying

Along with the entry and expansion of e-commerce, it will be possible and necessary to make large changes in companies' distribution processes. This is because the COP will be moved upstream in the distribution channel, in some cases all the way up to the producing company. Consequently, the distribution process can be simplified to consist only of direct distribution from the producing company to the customer.

Several different distribution channels can be seen as possible future solutions, see Figure 4. The base alternative is the conventional distribution, which is described earlier in the section about conventional distribution. An example from the food industry could be that the food producer is located in France, from where the groceries are shipped in full truckloads or trains to a national distribution center (DC) located somewhere in southern Sweden or in Denmark, e.g. Dancargo's national warehouse at Arendal, Denmark. In the DC the groceries are stored, reloaded and consolidated with other products and later shipped on to a local DC in full truckloads. This DC can for example be ICA Väst, located in Kungälv, Sweden. At ICA Väst the goods are again stored, reloaded and consolidated and from here transported to the retailer ICA Maxi by either full truckloads or less than full truckloads. Customers then purchase the groceries at ICA Maxi.

#### 3.3 Distribution Channels

The first alternative for a simpler distribution system for e-commerce products is to remove the retailer and distribute goods directly from local warehouses to customer. This is called home delivery, and an example of this situation could be the purchasing of tulips over the Internet. The tulips are grown in the Netherlands and are shipped to a national DC in Sweden in refrigerated trucks, since the goods are perishable. In this warehouse the

tulips are consolidated into smaller consignments and then transported to the retailers, for example an Interflora store. The customer now places an order at the Interflora store over the Internet, and the florist arranges the bouquet. The flowers are then distributed to the customers, either in Interflora's own vehicles or in a courier's van.

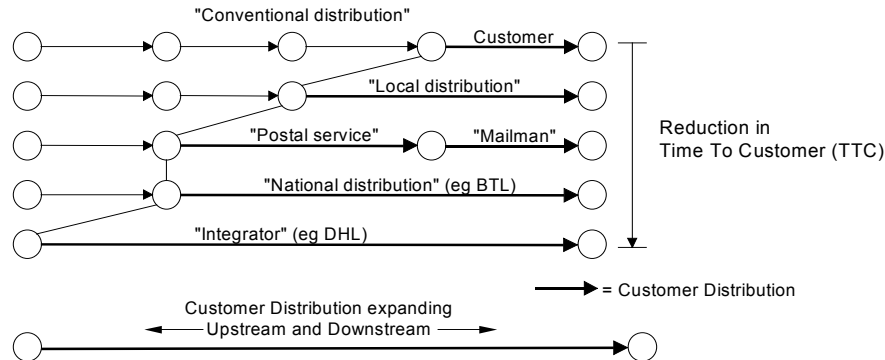


Figure 4. Distribution processes for Internet buying.

Another possible alternative is to remove the local warehouse from the distribution channel and use the postal service to distribute the goods from the national warehouse to the customer. This is called mail-order shopping and works as follows. Using an example from the clothing trade, clothes are manufactured in Asia and transported to a national DC in Borås in Sweden. The customer places an order over the Internet to the mail-order company, and the clothes are packed in parcels. These parcels are then distributed to the local post office by the national postal service, and are finally delivered to the customer by the mailman.

A third alternative is to distribute goods from the national distribution centers to the customers. A good example here is Tamro's distribution of incontinence protection articles for elderly people. The products are produced in Germany and transported to Tamro's national DC in Bäckebo, Göteborg. There they are stored and packed, and finally distributed directly to the customers by Schenker-BTL.

The last alternative is to have direct distribution from the producing company to the final customer. This could, for example, be the distribution of tailor-made clothes by the company Tailoronline. The customers state their measurements and place an order over the Internet. The order is then sent to the factory in Estonia where the garments are produced and packed in parcels. The finished products are distributed to the customer by mail. Another example is Bokus.com's selling and distribution of books, which go directly from the printing house to the customer. Amazon.com is also a well-known company selling books via the Internet. They started their business with distribution directly from the printing house, but have had to switch logistics strategy to one in which they have to build warehouses in order to support the demand for shorter delivery time from the customers in the US (Hultén, 1999).

### 3.4 Upstream and downstream consequences

There is little doubt that e-commerce will necessitate changes in the way products are distributed from manufacturer to customer. What these changes will be is uncertain, but it is possible to distinguish the changes in *upstream* and *downstream* consequences, Figure 5. Consequences are said to be upstream when they concern changes in the distribution channel from the customer to the producer. The only thing that is sent in that direction is information, and upstream consequences therefore mainly arise from changes in the flow of information.

The main upstream consequence is that the customer order point (COP) will be moved upstream towards the producer, and the system will therefore change toward a pull strategy. This will demand a more efficient information system, but will lead to reduced inventory levels and thereby reduced capital tie-up (Lumsden, 1998).

The consequences that are said to be downstream are those that concern the actual distribution of the products to the customers. The most clearly foreseeable outcome from widespread commerce over the Internet is that consignment sizes will be reduced. The reason for this is that the distribution channels will stretch all the way to the final customer, and since private consumers do not need the same volumes as for example a retailer, the sizes

will be smaller. Since the total consumption in society will remain the same, or probably even increase, the number of consignments and the number of delivery addresses will increase, and this in turn will lead to more complex distribution systems and more assignments for transportation and logistics companies (Lumsden, 1998).

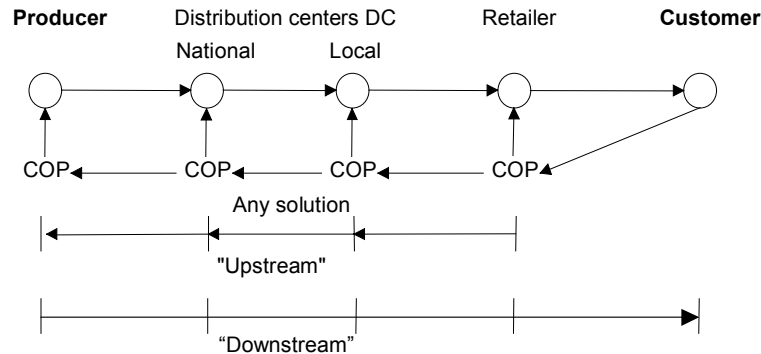


Figure 5. Upstream and downstream consequences for Internet buying.

### 3.5 Delivery parameters

#### Point of delivery

It is very interesting to know whether the customers have the same attitudes and expectations as the producers and distributors.

The results from the diagrams in Figure 6 below show that the drop-off point is still not a fully accepted alternative. More than 60% are willing to pick up products at a post office, while no more than 30% are willing to do so at a drop-off point. This is interesting, since there is basically no difference between the two alternatives; the post office is in fact a drop-off point for Posten's customers. This is a clear advantage for Posten On Line Center and a severe disadvantage for other distributors. For example, Privpak has been delivering mail-order products to drop-off points for a long time, but still there is resistance to this alternative.

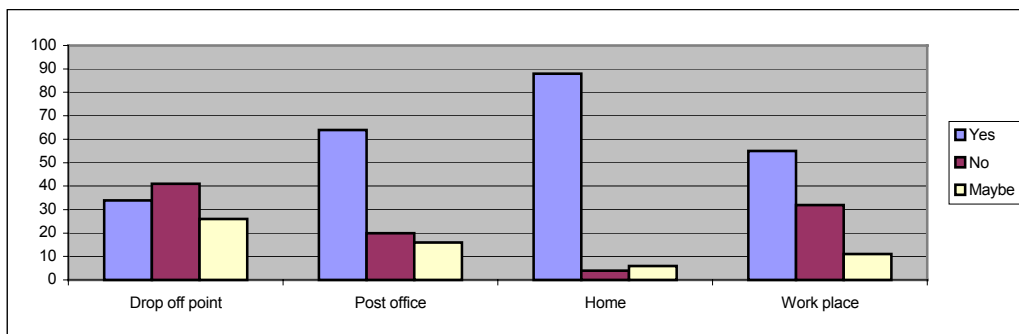


Figure 6. Attitudes toward delivery to drop off points, post, home and workplace.

As could be expected, most consumers want their products delivered to their homes; 89% stated that this was a good alternative. The respondents are in other words prioritising the comfort of receiving the goods at their door higher than the freedom of picking the goods up whenever they want. The alternative of delivering to workplaces got a very mixed result. Over 50% stated that they would like to have their products delivered to their workplace, while over 30% said that they would not. From this we can conclude that this alternative has the potential of being a good way of delivering e-commerce goods, but that it needs to be more thoroughly investigated.

#### Time of delivery

The time when people want their products to be delivered is an issue that has not changed particularly much between our study and Bergendahl & Magnusson's (1998); the most popular time window is still weekdays between 6pm and 8pm. The results in Figure 7 show that most people are prepared to commit themselves to being home for a couple of hours during a weekday to receive their products.

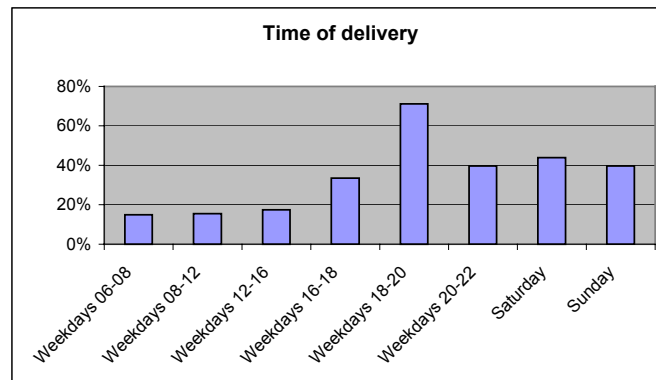


Figure 7. When people want their products delivered.

### 3.6 Logistics systems' changeability

Several different conditions affect the creation and alteration of a distribution network. There are the ideological, political or strategic aspects. There are the abstract network components such as information flow. There are the physical network components such as mobile resources, and there is the physical network, or infrastructure.

When implementing changes in physical distribution, which will probably be necessary to maximize the benefits of e-commerce, the time for changing the different aspects mentioned above will vary. The ideological changes are fairly quick and easy to implement; these are e.g. a politician's words and, as we all know, those can often change from day to day. Changes in the infrastructure, on the other hand, take a lot of time and cost a lot of money (Figure 8). This figure also shows that making changes in information systems, which is in a way what e-commerce is all about, is a fairly quick process. Since new types of infrastructure will probably be necessary to fully utilize the benefits created from e-commerce, it is a rather safe assumption that it will take some time before we will see the whole potential of e-commerce. The complexities and differences in these changes are some of the factors that make it interesting and important to investigate how different actors will reshape their networks to adapt to the new demands of e-commerce.

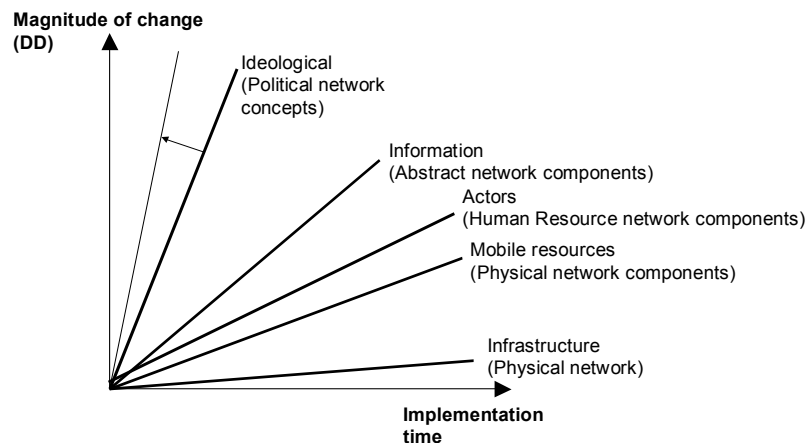


Figure 8. Logistics systems' changeability.

### 3.7 Analysis of distribution development within e-commerce

In section 1.3, six research questions were outlined. Below will follow a discussion that starts out from these questions.

1. What modes of distribution are interesting and what volumes and resources will be needed in order to rationalize this commerce? How to organize and coordinate with existing flows while waiting for sufficient volumes to motivate new, separate systems?

Presumably the e-commerce must be of a certain extent within the distribution chain to be effective. The resources meant to be part of the system must also be adapted to enable the organizing of extensive distribution routes. There will, for instance, be a demand for vehicles which can distribute cold or frozen food together with packages to “refrigerating mail boxes” in residential areas, i.e. carry out deliveries when the customer is not at home and thereby decrease the resource utilization.

2. *Will there be a demand for extended cooperation between different actors vertically as well as horizontally? How will this coordination be achieved? Is there a demand for incentive and control?*

Taking full advantage of the potential offered by e-commerce will require that the actors in the supply chain cooperate to adjust the different subsystems in the chain. This applies to a vertical (along the refinement process) as well as a horizontal (between distribution spots near the customers) way. If, for instance, all shops were to send their own delivery vans for home distribution, the environmental gain would be negligible as compared to the customer taking his/her own car to the shop.

3. *What role will different information systems play in these new, alternative logistics systems?*

Since the number of end customers (addresses) will increase considerably, this will necessitate efficient goods control, which in turn requires refined information systems for planning as well as execution and follow-up. Besides, the systems will be of vital importance when it comes to creating and maintaining customer relations.

4. *How will the increased cost downstream be compensated with lower costs upstream?*

Since the last link in the distribution chain from shop to end customer (downstream) in normal systems does not affect the product, as the alternative cost (for the individual) is often considered low, the new logistics systems for e-commerce will experience a cost increase here. This rise will then require compensation in the form of lower product costs (upstream) towards the customer to make him/her, from a cost independence perspective, choose home distribution

5. *How will the time differentiation be affected by the prospect of alternative distribution solutions?*

Owing to the fact that the ordering via Internet and the deliveries may vary in time, different solutions for distribution can be efficiently. This, of course, enables new forms of price differentiation.

6. *How will the distribution be allocated to a 24-hour period and how will this affect resource utilization?*

The great number of new addresses (end customers) will be an individual with other requests for delivery times, e.g. evenings and weekends, beyond what is normal in company relations. This might, in many cases, lead to improved resource utilization with larger distribution coverage of rural areas. The environmental impact under such circumstances must be carefully analysed.

## 4 Sustainable development

In the transportation and logistics sector there are a number of general trends that can be observed. The trends identified in the transportation and logistics sector is of course closely linked to more general trends that can be identified (TNO, 1999). These more general trends are listed below in no particular order, just to mention the overall trends that can be identified throughout society.

- *More power to the customer*, which basically means that the customers demand more flexibility regarding product supply, delivery both in terms of time and place as well as a trend towards more custom made solutions in general.
- *Globalisation*, which is one of the major trends the latest decennium creating large multinational companies and this trend both allows and forces companies to target market segments on a worldwide basis.
- *Consolidation*, or spatial concentration, is both a trend within industries for companies to consolidate their position through buy-ups that is closely related to the globalisation trend. It is also a trend towards consolidation of product groups and the production, transport and storage of these products.
- *Deregulation of markets*, for example the inner market of the EU that actually is a trend that is both a prerequisite and enforces the globalisation and consolidation trends.

- *Development of new technologies* such as the Internet that allows for rationalisation and the creation of more custom made systems with retained efficiency and also allows for new business models, such as E-business.
- The trend towards *increased return on invested capital* also creates new demands on especially transportation and logistics solutions in order to cut down on storage and other buffers in the systems.
- The *environment considerations* are also a major trend that affects the way companies do business and is the basic factor behind the strive towards a sustainable society which creates new demands on all industry sectors.

These different trends both enforce the complexity of transportation and logistics systems as well as make them less complex. In fact, some of the trends are the effect of industry sectors trying to restructure their systems in order to make them less complex and therefore easier to handle. The spatial concentration of inventory is a typical trend toward simplification of the network and process that is to be handled in order to fulfil the customer demands and be as efficient as possible. The trend towards globalisations is something that enforces the complexity of transportation and logistics systems since the networks used and the processes created to handle this global presence become larger and more complex and very hard to survey by the stakeholders involved.

#### 4.1 Requirement of a sustainable society

The focus in this context is given in Figure 9. In the figure the original ideas of the two different approaches to handle complexity in transportation and logistics systems are given. The basic assumption was, and still is, that there exists a trade off between a reductionistic approach and an integrated approach. In the context of transportation and logistics this will mean a trade off between using an overcapacity of resources and the use of methods and strategies that uses information as the source to handle the complexity.

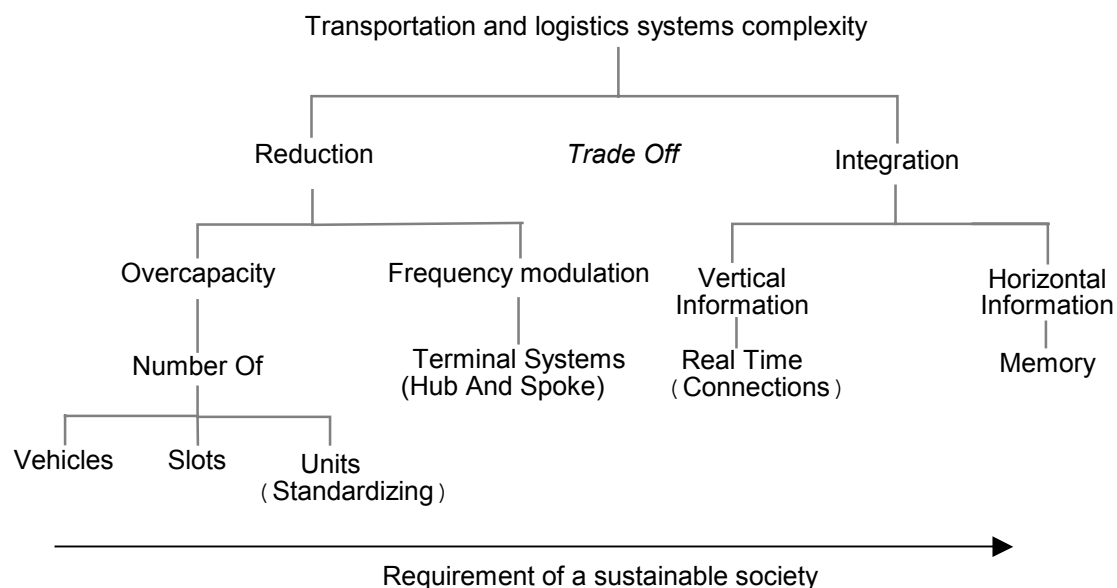


Figure 9 The requirement of a sustainable society regarding the trade offs on transportation and logistics systems (Lumsden et al., 1998 and Waidringer, 2001).

The basic assumption of course being that by using a more sophisticated, integrated, approach it will be possible to handle the larger and more demanding problems, that occurs due to an increasing consolidation and globalisation of industry, in a more efficient way than is currently the practice. The upper level in Figure 9 is the strategy level, where the basic decision is whether to choose to reduce the system or keep it integrated. The traditional approach has been to choose the approach where we reduce the system in order to try to make them easier to handle. Methods and strategies to handle the problems arising in complex systems have not been readily available why this strategy is the predominating in the transport and logistics industry today. The next level is the tactical level showing the two dominating ways of creating simple enough systems to handle a complex demand or environment, surplus capacity or higher frequency (over transport), than necessary to accomplish the current

volumes. The last level in this figure is the operational level that shows the practical solutions that are deployed in order to solve the problem, such as hub and spoke. The right hand side describes the other choice, sophisticated solutions to match the complex problem. In these strategies information and knowledge are the main sources to handle the complexity. In order to make the solutions sustainable for the future we believe that we have to move the approach from the side where we reduce the systems in order to make them easier to cope with to the other side where we integrate them and use the information in order to control and manage them.

The requirements of the future will also be the requirements of a sustainable society and this demand for higher sophistication is both economic in that industry and consumers demand faster and cheaper solutions with less environmental impact. The demand for more sophisticated solutions to the transport of goods and persons also requires more sophisticated approaches, methods and models both to assess these systems properties and to be able to manage and control them in the most efficient way. This is the ultimate goal in using complexity to assess and model transportation and logistics systems (Waidringer, 2001).

## 4.2 Perspectives of e-commerce

Regarding e-commerce we can look at the figure out from two perspectives. The shippers' and the forwarder's perspectives. The shipper is more concerned about good valid and precise information about the cargo and the actual transport. The shipper is though not really interested in how the actual transport, capacity etc is solved, i.e. the shipper is not interested if we use a transport system with over capacity or a system that use over transport. In this way we can say that the shippers focus is the commerce in this case e-commerce. The forwarder is on the other hand more concerned over enough transport capacity and an easy to manage and redundant system (Hultkrantz, 1999).

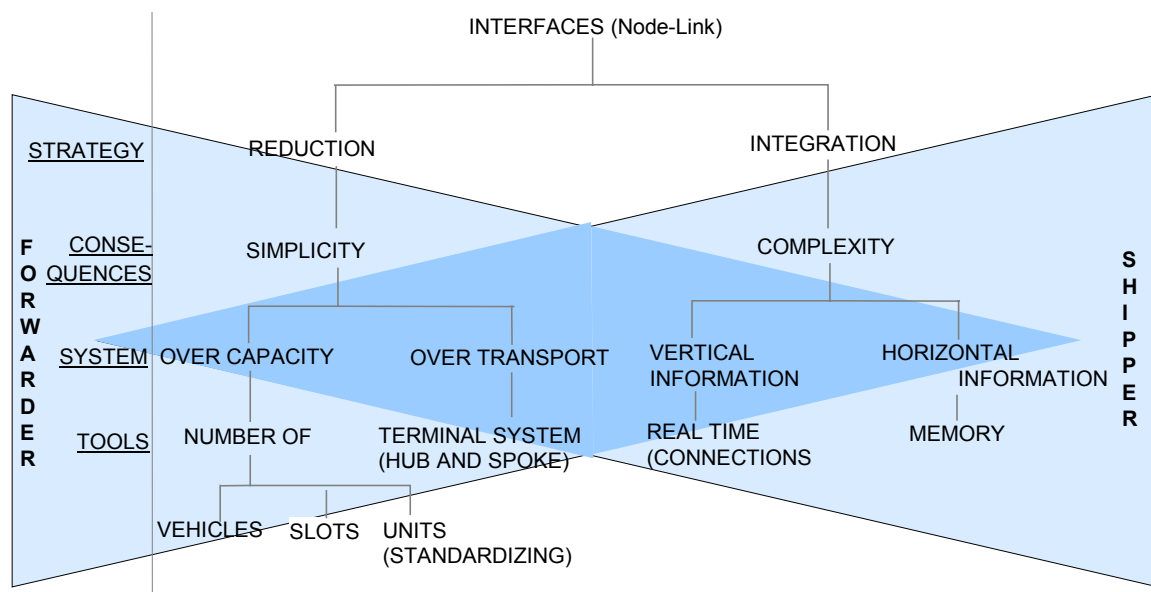


Figure 10 The two perspectives of e-commerce - Participant Focus (Lumsden et al., 1998).

Buyers want to know their landed cost of the products, when and where the products can be delivered, etc. This additional information, the order management, the IT services on which these are based, and the Just-In-Time transport and delivery are summarized by the term e-fulfilment. But e-fulfilment can and frequently does cover much more: arranging for the insurances of goods in transit, export and import customs clearance etc. (Spectrum, 2001). In the same way, as the shipper is interesting in the e-commerce the forwarders are interesting in the e-fulfilment. One problem the e-business has been struggling with is that these two perspectives haven't matched each other. The shippers haven't understood the forwarders perspective and the forwarder haven't understood the shipper's perspective.

## 5 Summary

Many argue that e-business will grow a lot in coming years. But in order for it to become a large, global channel of sales, there are some growth requirements that have to be fulfilled for e-commerce to truly take off, e.g.:

1. The basic infrastructure must be in place, including logistics.
2. Customers and businesses must have access to the Internet.
3. Sites must have multiple language functions.
4. The cost of Internet access must decrease.
5. E-commerce must be safe in terms of privacy and monetary transactions.
6. The speed of the technology must be satisfactory.
7. International standards must develop.

At present e-commerce is pursued to a fairly high degree between companies, but is still not very developed between companies and private persons. The business-to-consumer (B2C) relation is expected to grow rapidly though, and when this happens it will result in several changes for actors in the logistics area. When delivering to private persons instead of companies, the demand for fast and accurate deliveries will increase. This is because one or more of the physical nodes will disappear when the Customer Order point (COP) will be moved upwards the supply chain. Direct home deliveries will request shorter lead times, and more complex distribution systems will be necessary to make this possible.

E-commerce will impact all elements in the supply chain, which rely on data flow to improve efficiency. Still, physical transportation is needed for most products, implying the usefulness of deriving e-commerce demands on logistics by analysing the logistics customers. Demands on a smooth integration of these flows will increase in the future, from being a competitive advantage to a necessity.

In the distribution chain we will see a number of new possibilities. There won't be one way to distribute e-commerce goods. In fact, even for one company, there will be a number of ways. The distribution alternatives will be different for different customers as well as for different categories of products. Which alternative the company (or actually the customer) will choose will be regarding to time limits and how much the customer wants to pay for the service. This means that a company will use more than one sales channel for, a customer, if the customer buys different products with different demands regarding e.g. time as well as for different articles.

There is little doubt that e-commerce will necessitate changes in the way products are distributed from manufacturer to customer. What these changes will be is uncertain, but it is possible to distinguish the changes in *upstream* and *downstream* consequences. The main upstream consequence is that the customer order point (COP) will be moved upstream towards the producer, and the system will therefore change toward a pull strategy. This will demand a more efficient information system, but will lead to reduced inventory levels and thereby reduced capital tie-up. The consequences that are said to be downstream are those that concern the actual distribution of the products to the customers. The most clearly foreseeable outcome is that consignment sizes will be reduced, the number of consignments and the number of delivery addresses will increase, and this in turn will lead to more complex distribution systems and more assignments for transportation and logistics companies.

When implementing changes in physical distribution, which will probably be necessary to maximize the benefits of e-commerce, the time for changing different aspects will vary. These aspects are e.g. ideological, information, actors, mobile resources and infrastructure. The complexities and differences in these changes are some of the factors that make it interesting and important to investigate how different actors will reshape their networks to adapt to the new demands of e-commerce.

We can look at e-commerce from two perspectives, the shippers and the forwarders. The shipper is concerned about good, valid and precise information about the cargo and the actual transport but not in how the actual transport is solved e.g. regarding route, resource utilization etc. but on the other hand this is what the forwarder is interested in, in order to solve the transport as effective as possible. The forwarder is also responsible for the e-fulfilment which includes activities such as; additional information, the order management, the IT services on which these are based, the Just-In-Time transport and delivery, arranging for the insurances of goods in transit, export and import customs clearance etc. From this point of view we can say that the shipper is interesting in the e-commerce and the forwarders are interesting in the e-fulfilment. One problem the e-business has been struggling with is that these two perspectives haven't matched each other. The shippers haven't understood the forwarders perspective and the forwarder haven't understood the shipper's perspective.



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