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Corporate Strategies, freight transport and regional development.

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Abstract

Corporate logistics strategies such as outsourcing of individual production processes, have an impact on the volume of freight transportation and in turn on environment and land resources. Due to concentration of core competences, new logistics trends, growing importance of services and liberalization of markets, corporate strategies undergo rapid changes. Their spatial and environmental impact is of interest, especially when taking into account that new corporate behaviour can increase as well as reduce freight transportation. This paper tries to shed some light on this 'terra incognita', that is the interface between corporate logistics and freight transportation.. Although it is obvious that corporate behaviour today is heterogenous, our empirical study in the region of Zug in Central Switzerland produces some clusters of key factors which determine corporate logistics. All in all it is evident that environmental issues do not play any significant role with the responding firms. This is due to lack of awareness and of data. Public policy thus can either sit idle or try to initiate some cooperative endeavour between the private and the public sector. Public-private partnerships seem to hold some promise to the benefit of corporate performance, the environment and regional development.

Key words: corporate strategies, logistics trends, freight transportation, public-private cooperation, regional development.

1 Introduction

1.1 The purpose of the paper

Corporate strategies and their decisions where to locate their activities is of growing concern not only to the corporate world but also to the policy maker, especially when regional development and the environment are concerned.

In the wake of the discussion of internationalization of the economy, it is evident that corporate behaviour shapes social development. New corporate strategies such as outsourcing of individual production processes, have an impact on the volume of freight transportation. Due to concentration of core competencies, new logistics trends, growing importance of services and liberalization of markets, corporate strategies undergo rapid changes. Their spatial impact is of interest, especially when taking into account that new corporate behaviour can increase as well as reduce freight transportation. This is, as a consequence, linked to vehicle-kilometers, emissions and finally to the conditions of the environment.

This paper tries to shed some light on the very intricate relationships between corporate strategies, corporate logistics behaviour and the resulting freight transport. Three basic questions are at the beginning of this research:

- 1 What impacts do structural changes of the economy (e.g. outsourcing, changes in telecommunication) have on the volume of freight transportation?
- 2 In what types of companies does the division of labour lead to increased traffic, and where can freight transportation be reduced by means of communication systems?
- 3 What potentials for reducing freight transportation rest in cooperative, public-private efforts, e.g. in the sense of so-called "client service transportation", improved logistics, etc.?

First, a literature survey reveals very scattered information on this issues. Either it is case-study material for specific economic branches or activities, or studies deal with certain spatial contexts. The empirical background for this paper stems from a recent postal survey with companies located in the Swiss region of Zug and is part of the research project "Corporate Strategies and Freight Transportation" which is funded within the framework of the Swiss National Research Programme 41: 'transport and environment'.

1.2 The outset of the paper

The paper is organized as follows. Section 2 will give an overview on corporate strategies and locational decisions, especially on trends in corporate strategies and logistics as well as on some assumptions about their impact on freight transport and environment. Section 3 develops the basic working hypotheses, while section 4 sets out the stage for the empirical study. Section 5 concludes with some preliminary findings for the corporate world and for cooperative public-private solutions.

2 Corporate strategies and locational decisions

2.1 Trends in corporate strategies and logistics

The literature on trends in corporate strategies and logistics is unnumerable and complex. The driving forces and main causes for these changes or trends are said to be numerous. There are very intricate interlinkages between the development of freight transport, economic structural change, techno-organisational innovation and impact on the environment. On the one hand there is the argument of increasing flows in the world economy, fuelled by global trade agreements like WTO, liberalization of markets or utilization of new, faster and cost-cutting technologies. There is a growing importance of services in the economy, the obvious fact that firms concentrate on their core competencies, outsourcing of individual production processes, just-in-time production and so on. But nevertheless, on the other hand there is evidence of the importance of regional or territorial specificities. Not all economic activities are deterritorialized but instead depend partly on territorial economic organization (Storper 1997).

But taking all the arguments together, one can structure the stage by differentiating the changes in framework conditions as well as changes which stem from either the supply side or from the demand side of the firm.

Looking at the *economic framework* one can detect the following changes which have major impacts on regional development and transport infrastructure (Cooper et al. 1994; Nijkamp 1993; Drewe & Janssen 1995):

- A shift from seller-markets to buyer-markets: customer orientation is increasing and thus diversity of products is increasing.
- Globalisation is the trend towards internationally organized enterprises.

The *technological framework* shows some profound changes:

- Information and communication technologies gain more and more of importance with every size and activity of company. This brings acceleration of processes.
- Integration of transport into production chains and informational networks of companies.

The *ecological framework* all the while is changing also:

- carbon dioxide emissions and other green house gases threaten the global climate but may damage regional or local production systems even worse and in a shorter period of time.
- traffic congestion is increasing rapidly in many agglomerated areas und thus is increasing the cost of transportation time and accuracy of delivery.
- energy prices in real terms still are decreasing since the seventies thus fuelling the long distance exchange of goods, products and people.

The *social framework* also is changing, often in a unrecognizable fashion:

- regional systems of production or local networks are being broken up through international sourcing strategies thus destroying also informal information exchange between producers and customers. Innovation often are 'only' technology driven and not based on the bottom-up exchange with needs of regional social capital or local diversity of resources.

The *political framework* changes on different spatial levels:

- on the global scale it is the trade liberalization through the World Trade Organisation (WTO) which speeds up at least large scale regional trade.
- transport infrastructure in many countries, regarding the total amount of investment over time, still favors developing road transportation over innovative rail transport systems.

Nevertheless, the question remains, which corporate strategies influence the volume of freight transportation? *Logistics* have significantly gained importance for the competitiveness of firms in trade and industry. In a very narrow sense, market performance depends on three significant factors for a firm's competitiveness: product quality, product price and product supply (ECMT 1997). All three factors are directly affected by logistics. Taken it altogether, one can detect three main logistics trends which help increase a company's productivity (ECMT 1997, 11):

- further reduction in the level of in-house production;
- globalisation of all economic processes;
- growing importance of services for marketing industrially finished goods.

Transport needs are changing accordingly and are affecting the structures used to provide transport services. The change in the patterns of division of labour and the increasing international exchange of goods and services show a tendency of producing higher volumes of freight transport. The reason lies with the tendency towards zero-stocks production and distribution which means that processes must be linked together on a just-in-time basis which ensures the regular and punctual transfer of goods from one producer stage to the next or out of production to the customer. All in all developments lead to an increasingly individualized demand for transport services: “No two shippers have exactly the same need for transport services, even though they may operate in the same sector, produce and distribute similar products and perhaps even supply the same markets and customers.” (ECMT 1997, 16).

2.2 Assumptions about impact on freight transport and environment

Companies need supplies for their products and services and the distribute these products and services to customers of every kind. Thus changes in supply chain design and operation have important consequences for transport, most notably through increasing the average length of haul for goods (Cooper et al. 1996). This statement seems to be one of the core problems with empirical representative studies: today, the degrees of freedom for corporations to develop strategic-logistics options are so numerous, that it is almost impossible to develop a stringent model which links corporate behaviour with its respective volume of freight transport.

In some instances the resulting spatial pattern of corporate organization leads to a clear increase of goods transported and oftentimes also to an increase in environmental impacts (for example CO₂-emissions). But on the other hand, intelligent redeployment of transport vehicles, included technological advancements, can bring along a decrease in these same indicators. Thus, the balance of net effects is very hard to establish and there seems to exist very little convincing approaches to do so. Or, to put it this way: “While rationalising logistics systems often leads to fewer, more focused manufacturing facilities and fewer, more market-spanning distribution facilities, it may also result in a *second level of complexity* [emphasis by the author]. Many more transportation moves result, a greater percentage of which are cross-border hauls. Managing the flow and storage of materials and information across this supply-chain network requires better information systems and more precise co-ordination” (Kobler 1997, 11).

In order to systematize the impacts of corporate strategies on freight transportation it is helpful to structure the strategies along the following lines which in a ideal case a coordinated properly:

- supply
- production
- distribution

If one wants to identify the impact of these different strategic aspects on freight transportation, knowledge about where in a firms hierarchy and functional structure which decisions in logistics and transportation are being taken.

Supply

Certain strategies obviously lead to increased vehicle movement like 'global sourcing' which leads to a enlarged spatial supply network or like 'just-in-time' (JIT) delivery which cuts down delivery frequency and volume of freight per delivery (Frigo-Mosca et al. 1996). But 'just-in-time' also can have the opposite impact: postponing delivery allows for better calculating the exact volume or number of material thus reducing inefficient vehicle movements. The location of the suppliers seems to be the determining factor for the net effect; recent studies support the argument that JIT favors regional suppliers and thus helps to reduce the volume of freight transportation (Jäcker 1997). On the other hand, strategies like 'single sourcing' or 'modular sourcing' which intend to reduce the number of suppliers normally results in fewer spatial interactions. In general, the following seems to hold: the transportation impact of modular sourcing is lower the closer the supplier is located near the manufacturer (Jäcker 1997).

Production

Various studies in all the three aspects of (logistics) strategies and across different economic branches show more or less that the reduction of the level of in-house production in general leads to an increase in freight transportation (Dreher et al. 1995, Haubold 1995, Jäcker 1997, Holzapfel & Vahrenkamp 1993). But it is important to state, that the individual case can easily show the opposite effects. For example, one aspect of changing supply-chain management is reducing the level of in-house production which may multiply the number of suppliers. They in turn deliver the required parts more frequently but in smaller batches thus increasing the volume of freight transportation. On the other hand the manifest trend towards the concentration and bundling of single suppliers in the form of component or systems suppliers tends to reduce freight transpor-

tation for production inputs. Outsourcing of logistics services to specialized firms is another trend today. This results in fewer transportation because these specialists are better capable of bundling transportation more efficiently.

Distribution

More and more, specialized transport firms collect all the orders in one area and delivers them directly to the customer thus reducing the vehicle movement. The same effect seems to develop with the upcoming 'Eurologistics concept' which replaces national logistic concepts for spatially more integrated ones thus cutting down on overall transportation although this strategy may regionally lead to an increase of vehicle movement.

Conclusion

For the purpose of the project described in this paper, we produced the following synopsis. It illustrates the manifold recent corporate strategies and their presumed impact on the volume of freight transportation. The two columns on the very right hand side differentiate between vehicle-kilometers (VK) and transport performance in kilometers (TK).

Chart 1: Corporate strategies and possible impacts freight transportation

corporate strategies	aspects/dimensions	possible impacts		
		VFT	VK	TK
new production- and organisational concepts				
<ul style="list-style-type: none"> • lean management • flat hierarchies 	real transportation costs not fully taken into account	↑	↑	
	expectation for customized planning of freight transportation		↓	
concentration on core competencies	designing chains of production and valued added which cover space finely meshed	↑	↑	↑
strategic alliances	growing need for exchanging information, goods and services	↑		
	opportunity to bundle transportation	↓	↑	↑
optimization the level of in-house production	lower levels of in-house production for final manufacturers	↑	↑	↑
product differentiation	composition of freight transportation changes from bulk goods to 'mixed' or packaged goods		↑	↑
customer orientation	distribution concepts like express delivery service (spoke-and-hub principle) increase distances covered and vehicle-kilometers	↑		↑
product innovation				
new logistics concepts				
strategies for procurement	change of modal-split in favor of road transport			↑

logistics				
• just-in-time-procurement with different sensitivity	more frequent transportation movements, but with lesser utilization of freight space capacity		↑	↑
new procurement strategies	conflicting tendencies: accuracy of delivery vs. problems of road capacity		↓	↓
• global vs. regional sourcing	change of modal-split, especially in relation with existing rail infrastructure			↑
• modular sourcing	suppliers within region		↓	↓
• single sourcing	opportunity to bundle transportation	↓	↓	↓

VFT=volume of freight transportation, VK=vehicle-kilometers; TK=transport performance in kilometers

All in all, Chart 1 shows that we face contradicting trends: new corporate strategies may on the one hand increase transport volume; at the same time these changes may also prove to have potential for reducing the input of resources in the whole supply chain.

2.3 Regional and spatial impacts

Since long regional science deals with the link between infrastructure, especially transport infrastructure and regional development. The upcoming European Single Market spurred research in this question. One finding was, that “low growth leads to stable international-national-regional development, whereas very fast growth tends to destabilize an integrated international-national-regional economic system” (Nijkamp 1990, 5). Now that we witness, at the turn of the century, a very dynamic international economic development, one can assume that this speeds up corporate reorganisation in the direction the trends describe in chapter 2. But still, the link between corporate logistics behaviour and regional or spatial development is very rarely evaluated. This might be attributed to the very complexity between initial software - that is the strategies - and the final outcome of these strategies. This latter - the impact of hardware on regional development is treated quite often in scientific research (see for example: Vickerman 1991). Various studies of different methodological background agree in stating: new corporate behaviour can increase as well as reduce freight transportation. The overall impact of these changes is but very unclear and little empirical evidence is available besides various insights mainly from the automotive sector (Womack et al. 1991). Although, there seems to be evidence - on a very general level - that spatial concentration of mobility, and accessibility and amenities will on a spatial level like the Dutch Randstad offer the best sustainability consequences (Nijkamp et al. 1996).

The next section of the paper will present four main hypotheses.

3 Hypotheses

As a result of a survey of theoretical literature and empirical analysis we have been able to generate four main working hypotheses, each of which were differentiated into 3-4 sub-hypotheses in detail during the process of their elaboration. The following four main hypotheses were further discussed with selected experts in the field of freight transportation and logistics management.

Below we only present the key aspects.

- 1 Corporate division of labour and the integration of the value-added chain tend to change in a way that affect the net volume of freight transport.
- 2 Taking a closer look, there are certain recent or new corporate (logistic) strategies that tend to increase the amount of vehicle movement and thus the volume of freight transport, while other (logistic) strategies seem to reduce or compensate these former trends.
- 3 Potential impacts on volume of freight transport very seldom is a decisive criterium with corporate strategic decisions. These decisions focus on the lowering of costs for transportation and for handling and storing of goods.
- 4 Cooperative approaches either between firms - like multi-firm chains of logistics - or between firms and public administration develop and are supposed to have a growing influence on corporate logistics decisions.

These four hypotheses eventually served as a basis for elaborating a questionnaire (see chap. 4).

4 The empirical study

However, knowlegde of the effects of freight transport is, opposite to passenger transport, fairly limited. One restriction we face, is the lack of appropriate data. An other reason that limits knowledge about effects on freight transportation, is the absence of an integrative analysis of corporate strategies and trends in freight transportation; on top there are very few and scattered examples of innovative and proactive public-private cooperation in this field.

4.1 The design of the study

We expected to find the necessary insights on the:

- macro level: the economic structure, spatial interlinkages, regional input-output relations, modal split of transportation;

- meso level: regional production systems, regional economic specialisation, regional volume of freight transportation;
- micro level: corporate (logistics) strategies and organisational features.

Our analytical framework tries to integrate the strategic options of firms and their corporate behaviour in relation to freight transportation. But to be frank, data which covers exactly this field of research does not exist yet and is not available neither on a private nor on a public basis. The reasons are pretty obvious. Private companies are not interested in such data, because transportation costs in general is but a very minor cost factor in their overall calculus. On the other hand, public authorities focus their attention on private motorvehicle traffic and its various impacts.

Our initial interviews with experts of shipping companies, that is firms which distribute or ship their goods themselves, and suppliers of innovative logistic concepts proved quickly that valuable data will be gained only analysing the enterprises themselves. Thus, the crucial point is to approach 'reality' from two sides and find an appropriate link between strategic corporate behaviour and volume of freight transportation which transforms into utilisable data. To face this challenge, we opted for a mixed methodology:

- secondary analysis of federal statistics on number of firms, employees, freight transport;
- a company survey with questionnaire and additional interviews with logistics experts;
- case studies with companies which underwent internal reorganisation processes and where these strategic changes can clearly be identified with a starting and a finish date;
- a feedback workshop with private and public firms and public authorities provides to discuss findings regarding reasonability and to develop approaches for cooperative efforts to reduce impacts of freight transportation on the region and the environment.

To reduce complexity and in order to handle the empirical approaches we chose to study the interlinkages and impacts for the Swiss region of Zug, located in central Switzerland. This region was selected because of its central location within the Swiss rail and road infrastructure; the limited spatial scale of an agglomeration with eight communes and around one hundred thousand inhabitants; with a highly developed and structurally diversified economy which is based on production as well as services like wholesale or financial services; and finally because we cooperated with a private foundation which supported the survey financially and logistically.

This paper concentrates on the results of the company survey. We next discuss the data base of that survey, which was done in March and April of 1998.

4.2 The data base for the postal survey

The agglomeration of Zug consists of eight communes and around 6'400 firms. The survey excludes firms with less than ten employees and excludes branches with presumably no direct regional freight transportation, like public administration and certain services. Questionnaires were sent out to 551 firms in early March of 1998; 118 responses came in, from that 77 were ready for analysis; thus the response rate was about 14 percent, which is reasonable compared to the questionnaire's level of complexity.

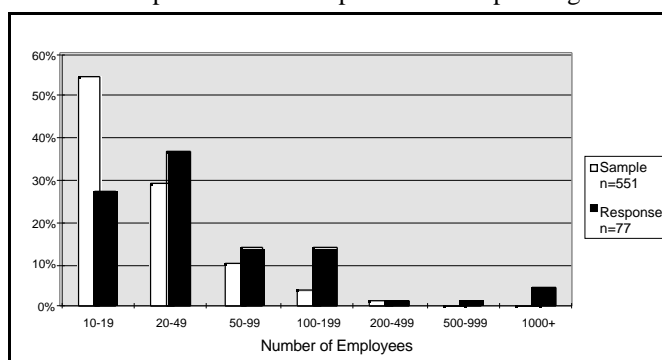
The *branch distribution* corresponds pretty much to the basic sample and is as follows: 42 percent of the 77 firms are in wholesale and retail trade, repair, hotels and restaurants; one third is from manufacturing industry and one fourth from construction.

The *distribution of firm size* can be seen in

Chart 2. We observe the usual fact that the response frequency of small firms is far below its share of establishments in the sample. Firms with 20 to 49 employees make the biggest share of all firms responding; companies with more than

Chart 2: Distribution of firm size

Percents compared for the sample and the responding firms



500 employees are largely overrepresented. One reason for non-response of small firms is the unfamiliarity with topics like logistics and strategic management whereas these issues are daily business with large companies.

Export activities are a vital element for Swiss competitiveness. The responding firms are exporting slightly more intensively than regional average. 12 percent of the response make more than two thirds of their turnover with export compared to 9 percent of all firms in Zug. In contrast, 77 percent of all firms in Zug do not export compared to 61 percent of the responding firms.

4.3 Selected results

This section presents selected results from the company survey and concentrates on structural features of the firms, markets and corporate strategies, the supply and distribution side of corporate transports and on the link between logistics and environment.

4.3.1 Structural features of the companies surveyed

The status of the plant: More than 50 percent of all firms are single plant firms, whereas 22 percent are the head plant of an enterprise to which belong also branch plants or subsidiary companies, the rest is about evenly distributed as a branch plant or a subsidiary of a out-of-canton Swiss company and as a branch plant or a subsidiary of a foreign company.

The development of turnover reflects the rather depressed economic situation at the time of the survey (April 1998). Still, two fifths of the firms said to have increasing turnover compared to the previous year, 34 percent had stable turnover whereas a fourth said to have decreasing numbers. The employment numbers somehow reflect the stiff economic situation for Swiss companies. A third of all firms reported decreasing employment compared to the previous year, while only a fourth had increasing numbers.

Swiss economy traditionally has a dual structure. A third of all firms have their most important markets in relation to turnover within the European Union. But still, for over 80 percent of all companies Switzerland is the most important market. Rather typical for small and medium sized enterprises is the fact that sixty percent of the firms produce their turnover with one single group of products or services.

4.3.2 Markets and corporate strategies

Corporate behaviour or strategies are strongly shaped by the dynamics and characteristics of their respective markets. So we asked the firms: “Which features characterise the principal markets of your company?” Answers could be given with the following key factors to be rated according to ‘very high’, ‘rather high’, ‘rather little’, ‘very little’. The answers were transferred into numbers ranging from 4 for ‘very high’ to 1 for ‘very little’. The ranking of the means for the key factors presents as beneath:

Chart 3: Characterisation of the firms respective markets

key factors	mean rating
Intensity of cost / price competition	3.6
Intensity of quality competition	3.1
Intensity of ‘time’ competition (time to market, order-cycle, delivery)	3.0
Frequency of innovations	3.0
Importance of information and communication technologies	2.6
Ecological requirements	2.4

This list makes clear that for most companies a certain combination of price, quality and time to market are the crucial ingredients for competition; logistics and environment seem to be just a function of these core requirements.

Now with the above ranking in mind we present a list of factors which determine corporate logistics. We asked: “Which are the five most important factors that shape the way your company organizes freight transportation?” And the answers were as follows:

Chart 4: Factors for transportation strategy (frequencies)

1	reliability/accuracy of delivery	61
2	flexibility/short order-cycle time	54
3	transportation cost (percentage of total)	44
4	careful handling of goods	37
5	weight of goods	31
6	volume of goods	24
7	length of transportation itinerary	17
8	willingness of costumers to wait for goods	11
9	‘time-sensitivity’ of goods	8
10	price per kilogramm of goods	7
11	branch of firm	6
12	energy cost (percentage of total), ,	5
13	position within value added chain	5
14	availability of infrastructure	5

This ranking makes quite clear that the first six to seven factors seem of more importance than the rest of them. Nevertheless one has to bear in mind that firms in general not only define their logistics strategies according to one or two single requirements. Instead they follow a certain bundle of factors which determine what they are going to do with regard to freight transportation and locational decisions. So best thing is to analyse the above data if there a certain clusters of key factors which determine logistic behaviour. A *hierarchical cluster analysis* shows the following characteristics. Two closely related clusters of key factors were frequently mentioned (see Chart 5, p.17). The first cluster of factors is: reliability, flexibility and the careful handling of goods. The second cluster encompasses the percentage of total transportation cost, weight of goods and volume of goods.

We are able to identify a third cluster of closely related key factors which is mentioned much less frequently: percentage of total energy cost, position within value added chain, and infrastructure. The previous question dealt with corporate logistics while the next question is more oriented towards recent and more up-to-date corporate strategies. So we asked the firms: “Which strategic options have been implemented or are planned to be implemented in your company?”

The following strategic option were presented for selection:

1 simplify management and production procedures	6 intensify cooperation with suppliers
2 simplify product structure	7 increase transparency within firm about goals and performance
3 skip activities with very low value added	8 decentralize structures of decision/command
4 reduce level of in-house production	9 increase ability for product innovation
5 deepen cooperation with customers	10 assess environmental impacts systematically

About half or more of all the firms in the survey said to have implemented strategies number 1,5 and 6 within the whole company or at least in certain areas. About a third reported that they do not plan to implement the strategies 4, 8 and 10. Astonishing enough, that the strategy number 8, reducing the level of in-house production, is among the options least planned albeit nearly every ‘manager’s guide’ postulates the streamlining of own operations. One explanation at that time of analysis might be that certain of these firms have already ‘reduced weight’ and introduced lean production concepts or simply are so small in size that reducing the level of in-house production does not pay off in any sense. Again, from these first results it seems reasonable to assume that firms not simply follow only one or two of the above mentioned strategies, but choose a combination of some.

In section 5.1 we present the results of a cluster analysis and draw some preliminary conclusions. But first we turn to the transportation side of our research.

4.3.3 Input-side of corporate freight transportation

The volume of freight transportation in 1997 represented in the survey is about 700'000 tons, two thirds of which were minerals and building material. Second large statistical class (15%) are the so called 'other products', which contain machines, electrical products, automobiles and other high-value finished products. Only 14% of responding firms report a decrease in input-side goods compared to the previous year. 43% of the firms report increasing or constant input-tonnage each.

Regional impacts are supposed to be linked strongly with the amount of kilometers driven. Thus, we asked for precise data on works transport with own vehicles (kilometers, tons per kilometer, kind of vehicle). But, for reasons of lacking data or of being short with time too few information came in to make valid statements on this aspect.

The more suppliers of parts or components a single manufacturer has the more vehicle movement will occur - this is one of the standard assumptions there is. Our survey shows that an average firm has eleven suppliers with significant volume of freight. The bulk of these suppliers are producing but single parts or goods, while comparable few are supplying components or moduls and even fewer are so-called 'systems suppliers'.

Most interesting in terms of regional development is the spatial distribution of these suppliers. The majority of suppliers are located within the Swiss region of Zug or within the rest of Switzerland and they are supplying mostly single parts. But for firms with more employees Europe seems to be as important as local suppliers from Zug. Systems suppliers typically are located in the survey region itself, that is Zug, because this kind of supplier typically needs intensive exchange of information with the manufacturing firm and thus proximity of location is necessary.

Looking at the output-side as well as the input-side of corporate freight transportation in our survey, it becomes very obvious that road transportation is the prevalent transportation mode. The modal-split for incoming goods shows that 75 percent (80 percent for outgoing goods) of all responding firms use road transportation to move all of their goods and products whereas only four percent (one percent) of the firms use rail transportation exclusively. The combined transportation mode of road/rail has the same marginal role as rail transportation alone. Crossing the

responses in the ‘transport’ section with the information given in the ‘market and strategy’ section we find that the more ‘recent’ strategies are implemented the more a firm is dedicated to road transportation. The reason for the above findings may often lay with cost differences between the two transportation modes; but quite often the decision upon the selection of transportation modes is not with the manufacturing firm: for incoming goods, 41 percent of the suppliers make this decision while in 16 percent of the cases it is a transportation company which in turn selects the transportation mode in 21 percent of the cases for outgoing goods.

This may lead to the conclusion that even when a firm voluntarily decides to select a environmentally more friendly means of transportation - rail or combined rail/road - the decision is often not theirs but somebody elses. Legal transportation arrangements (INCOTERMS) or customs like ‘ex-works’ or cost-insurance-freight (cif) predetermine the selection of the transportation mode.

4.3.4 Logistics and Environment

One of the key issues is the link between logistics and the subsequent impacts on transportation and then via gas emissions and noise on the environment. In our survey we offered the companies the following introductory statement: “There are two main approaches for freight transportation which is environmentally sound and at the same time economical: lesser hauls and intelligent design of freight transportation.” The firms then were asked to choose from a list, those logistic concepts which in their perception could contribute in a certain degree to the above described objective, that is to reduce environmental impacts. The logistics options were differentiated in a supply side and a distribution side:

Options on the supply side	Options on the distribution side
<ul style="list-style-type: none"> • incorporate transportation aspects already in the product development phase • just-in-time • increase global sourcing • increase regional sourcing • prefer components over single parts • intensify cooperation with suppliers • reduce number of suppliers 	<ul style="list-style-type: none"> • intensify cooperation with customers • coordinate distribution on European scale • chose one logistics firm per area/region • incorporate environmental costs of transportation • prefer logistics or transportation firms with eco-certificate

According to more than 80% of the firms intensified cooperation with suppliers and a higher rate of regional sourcing seem to contribute very strong to both, lesser hauls and intelligent design of

freight transportation. For almost two thirds of the firms a more intelligent way of transportation will be strongly supported just-in-time supply and an intensified cooperation with customers. Last-mentioned aspect also is a crucial factor for lesser freight hauls. A strong contribution, at least, to both main approaches the firms ascribe to a very early incorporation of transportation aspects in production planning.

5 Preliminary conclusions

The interpretation of our data is not yet fully completed and comments of various experts thereon are still missing. Nevertheless we are able to present the following preliminary conclusions which concentrate first on the typology of strategies and key factors and second on corporate strategies and freight transportation. At the end we tentatively try to formulate some recommendations for the corporate world as well as for cooperative efforts with public-private-partnerships.

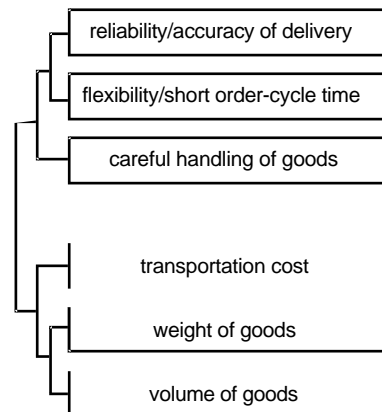
5.1 Typology of strategies and key factors

The second of our working hypotheses (chapter 4) stipulated, that there are certain recent or up-to-date corporate (logistics) strategies that tend to increase the amount of vehicle movement and thus increase the volume of freight transportation, while other (logistics) strategies seem to reduce or compensate these former trends.

A survey of empirical literature prior to our own firm survey suggested that there must be some kind of typology of corporate behaviour in this regard. On the other hand the rapid proliferation of logistics or strategic options for firms indicated in the opposite direction: there is almost no two single companies which display the same logistics features. The pre-survey analysis led us to work with the following typology which centered around certain characteristics of manufactured goods: the cost per unit of weight, the willingness of costumers to wait for goods and the 'use-by' or 'best-before' date. Taking into consideration our results in section 4.3.2, the picture gets a little more focussed.

First, there are two distinct clusters of key factors which represent clearly different economic activities (see Chart 5). The first cluster is characterized by the factors ‘reliability/ accuracy of delivery’, ‘flexibility/short order-cycle time’ and ‘careful handling of goods’. This threesome of key factors seems to be typical for wholesale activities. But also building traders tend to be linked with this cluster. The second cluster encompasses the factors ‘transportation cost (percentage of total)’, ‘weight of goods’ and ‘volume of goods’ which is typical for heavy and bulky material, e.g. in the industrial sector. The cluster analysis also shows that the key factor ‘price per kilogram of goods’ is loosely related to the first of these clusters. This somehow is a surprise because the firm survey also depicts that for the most companies, the ‘intensity of cost and price competition’ in their main markets is very high – not only those who rate ‘price-per-kilogramme’ as a crucial factor for transportation.

Chart 5: Clusters of factors for transportation strategy



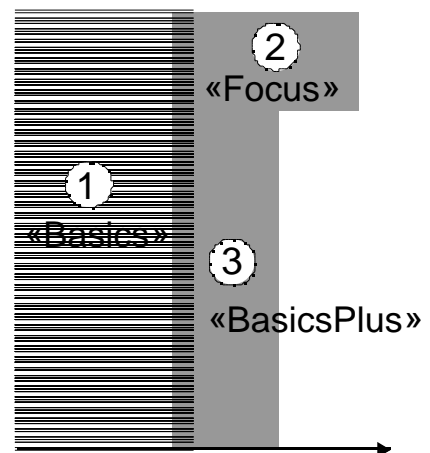
A second conclusion is, although still preliminary, that corporate logistics strategies tend to be very heterogenous (see also chapter 2). Nevertheless, our firm survey produced three clusters of strategic options, although they show not too much differentiation. The following Chart 6 gives an overview on the three clusters and their configuration.

- First, there seems to exist a basic set of strategies which form the ‘must’ of every firm which wants to stay competitive today and maybe also in the future.

On top of these strategical «Basics», the responding firms seem to subscribe to two more clusters of options.

- The second cluster is characterized by rather ‘soft’ strategies that focus on intra-firm processes and can be labelled as «Focus».
- The third cluster is called «BasicsPlus» and encompasses a wider range of strategical features.

Chart 6: Three clusters in strategic behavior



The list below shows which strategic options combine in each of the three cluster. The numbers of the options show a ranking in order to the frequency of mentioning in the survey.

«Basics» (①):

1. deepen cooperation with customers
2. intensify cooperation with suppliers
3. simplify management and production procedures

«Focus» (②):

4. increase transparency within firm about goals and performance
5. increase ability for product innovation

«BasicsPlus» (③):

6. simplify product structure
7. skip activities with very low value added
8. reduce level of in-house production
9. assess environmental impacts systematically
10. decentralize structures of decision and command

5.2 Corporate strategies and freight transportation

The paper so far gives the correct impression that the link or interface between corporate strategies and freight transportation is blurred and some kind of ‘terra incognita’. Our own firm survey aimed – among other purposes – at producing quantitative data about this interface. This hope proved to be wrong. One of the main reasons is the lack of appropriate information and knowledge within the firms about this issue which in turn is due to a still rather isolated view on questions of logistics. Therefore, appropriate controlling tools are lacking.

On the other hand transportation costs in general are too low (energy prices), that they do not enter the corporate calculus very much. Thus, the consumption of environmental and land resources are not covered by sufficient price signals which produces on the management either ignorance or neglect.

What the survey finally could produce is a qualitative assessment (see chapter 4.3.4). The main findings are summed up in the following Chart 7:

Chart 7: Main findings

Strategies	Transportation	Regional development
3 clusters of strategic behavior	freight volume still increasing	regional production systems crucial to better transportation
low structural differences	transport data often not available	regional development framework not insignificant
the more recent strategies, the more road transportation	integrated logistics vs. operative solutions	

There are some hints that structural characteristics like branch, number of employees or else are less important than a general orientation of a firm towards integrated logistics. Firms which are using operative solutions still know little about their situation concerning transportation and value-added chain. However, we assume that such shifts in a corporation's logistical strategies strongly depends on the 'strain' imposed by it's suffering from market situation. Furthermore, effects to a more economic and environmentally sound transportation behavior seem to appear more likely within an intact regional framework that is aware of it's potentials and of conflicts due to space and the environment.

5.3 Recommendations for corporations

Corporate logistics decisions have an impact on the environment. The problem is: who cares? Public administration is inclined to fend off harm done to the public but private or public companies are to produce profit. Now our firm survey shows that in many cases the link between logistics behaviour and volume of freight transportation is not within the mental or pecuniary perception of a firms management. All to often, logistics is still a purely operational approach. Only if a firm is beginning to perceive their performance in chains of value added they realize that integrated logistics concepts are able to optimize their performance all along this chain of value added. The more single logistic measures are integrated the more a firm begins to develop controlling instruments which in turn enable the company to better perceive their impact on the volume of freight transportation and subsequently on environment and spatial development. Raising awareness for this issue needs two things: first moving logistics up the hierarchical ladder of a firm into top management and second an appropriate controlling instrument to better quantify the interface between strategic logistics decision and volume of freight transportation.

5.4 Recommendations for public-private-partnerships

As a primary conclusion we can say that the biggest potentials for optimizing freight transportation in a 'spatially sound' way lie in the bundling of transports and a better use of transportation infrastructure. In our case, the region of Zug, we find that threats to transport cooperation are poorly designed interfaces, missing examples what can be done at a regional level and, at least, a very sparse knowledge about transportation indicators and about interactions between space and transportation behavior.

However, one main goal is to develop cooperative strategies, tailor-made for a specific regional situation, to provide examples for what is possible in linking the potentials of reshaping value-added-chains with the spatial or environmental side of transport. Thus, public actors have to identify and develop conditions which facilitate such cooperation. We suggest that knowledge-related aspects, public image of transportation and political intentions such as transborder cooperation or flexible use of the legal framework will be top-level issues on a regional transportation agenda.

Thus, in an up-coming step of research we have to pass back our findings to regional actors to find out what can be a successful design of private-public cooperation in which all parties involved will benefit (win-win strategies). And, at least, if there are any possibilities to enforce cooperation.

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References

- Cooper, James, Browne, Michael & Peters, Melwyn (1994): *European Logistics. Markets, Management and Strategy*. Second Edition, Oxford: Blackwell, 1994.
- Cooper, James, Black, Ian & Peters, Melwyn (1996): *Linking the environmental impact of freight transport to the restructuring of supply chains*. Cranfield University, Arbeitsbericht, 1996.

- Dreher, Carsten u.a. (1995): Neue Produktionskonzepte in der deutschen Industrie. Bestandesaufnahme, Analyse und wirtschaftspolitische Implikationen. Heidelberg: Physica, 1995 (Wirtschaft, Technik, Politik - Schriftenreihe des ISI-FHG 18).
- Dreher, Carsten & König, Rainer (1996): Szenarien technisch-organisatorischer Innovationen und ihrer Auswirkungen auf den Güterverkehr. Strukturierung wesentlicher Einflussfaktoren und Projektion alternativer Szenarien. Karlsruhe: Fraunhofer Institut für Systemtechnik und Innovationsforschung ISI.
- European Conference of Ministers of Transport (ECMT), (Hrsg.) (1997): New trends in logistics in Europe. Paris: OECD, 1997 (Report of the hundred and fourth Round table on transport economics).
- Frigo-Mosca, Fabio; Brütsch, David; Hafen, Urs & Tettamanti, Simone (1996): Logistic Partnership: Supply Chain Management in der Schweizer Industrie. Zürich: vdf (Verlag der Fachvereine).
- Harmsen, Dirk-Michael (1998): Auswirkungen technisch-organisatorischer Innovationen auf den Güterverkehr - Ergebnisse einer empirischen Untersuchung bei der verladenden Industrie. : Vortrag an der Traffic98, Internationale Konferenz in Berlin, 5.-6.2.1998, 1998.
- Hartmann, Harald (1996): Der Logistikeffekt in seinen Auswirkungen auf die Wettbewerbsfähigkeit von Region und Unternehmen. Zeitschrift für Verkehrswissenschaft, 1996, Bd. 3, 249-259.
- Haubold, Verena (1995): Umstrukturierungsprozesse in der zwischenbetrieblichen Arbeitsteilung der Industrie: Eine theoretische und empirische Analyse unter besonderer Berücksichtigung logistischer Aspekte. Göttingen: Vandenhoeck und Rupprecht.
- Jäcker, Andreas (1997): Verkehrliche Wirkungen neuer Produktionskonzepte. Eine theoretische und empirische Analyse am Beispiel der deutschen Elektroindustrie. Göttingen: Vandenhoeck und Rupprecht.
- Kobler, Rochus-Andreas (1997): Strategic European Distribution Logistics Design. Bamberg, Diss. 1997 (Dissertation Nr. 2059 der Universität St.Gallen).
- Nijkamp, Peter (1990): Spatial Developments in the united states of Europe: Glorious Victories or Great Defeats. Amsterdam, Arbeitsbericht Department of Economics, Free University of Amsterdam, 1990.
- Nijkamp, Peter, Baggen, John & van der Knaap, Bert (1996): Spatial Sustainability and the Tyranny of Transport: A causal path scenario analysis. Papers in regional science - The journal of the Regional Science Association International, 1996, Vol. 75, No. 4, P. 501-524.
- Plank-Wiedenbeck, Uwe (1996): Interdisziplinäre Fallstudie: Wechselwirkungen zwischen Produktion und Verkehr. Internationales Verkehrswesen, 48. Jg., 27-31.
- Vickerman, R.W., (Hrsg.) (1991): Infrastructure and Regional Development. London: Pion, 1991 (European Research in Regional Science, Nr. 1).

Womack, James P., Jones, Daniel T. & Roos, Daniel (1991): Die zweite Revolution in der Automobilindustrie: Konsequenzen aus der weltweiten Studie aus dem Massachusetts Institute of Technology. Frankfurt/M.: Campus.