

REFEREED

# Corporate Strategies, Freight Transport and Regional Development

Corporate logistics strategies have an impact on the volume of freight transportation and in turn on the environment as well as land resources. But new corporate behavior 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 behavior today is heterogeneous, our empirical case study produces some clusters of key factors which determine corporate logistics. Overall it is evident that environmental issues do not play any significant role with the responding firms – due to lack of awareness and of data. Public-private partnerships seem to hold some promise of benefit to corporate performance, the environment and regional development.

## 1 Introduction

### 1.1 The Purpose of the Paper

Corporate strategies and the decision where to locate their strategic activities is of growing concern not only to the corporate world but also to the policymaker, 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 behavior 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, and the 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 behavior can increase as well as reduce freight transportation. As a consequence, this increase is linked to vehi-

cle-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 behavior and the resulting freight transport.

Three basic questions are at the beginning of this research:

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

First, a survey on the pertinent literature reveals only very scattered information on these 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 postal survey of companies located in the region of Zug, Switzerland. This is part of the research project "Corporate Strategies and Freight Transportation" (Thierstein, Schnell and Schwegler, 1999) funded within the framework of the Swiss National Research Foundation Programme 41: "Transport and Environment."

### 1.2 Paper Overview

The paper is organized as follows: Section 2 will give an overview on corporate strategies, especially on trends in corporate strategies and logistics as well as on some assumptions about their impact on freight transport and environment. Section 3 sets the stage for the empirical study. Our basic working hypotheses are developed and some selected findings for the corporate world and for cooperative public-private solutions are presented. Section 4 presents our conclusions and suggestions for five areas of action.

## 2 Changes in Corporate Strategies and Their Spatial Impacts

### 2.1 Trends in Corporate Strategies and Logistics

The literature on trends in corporate strategies and logistics is innumerable 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-organizational innovation and impact on the environment. On the one hand there is the argument of increased trade 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, one obvious reason being that firms concentrate on their core competencies, outsourcing individual production processes, just-in-time production and so on. But despite all this, 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 and Janssen 1995):

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

The *technological framework* shows some profound changes:

- Information and communication technologies gain more and more in importance with every size and activity of company. This brings about the acceleration of processes.

- Integration of transport into production chains and informational networks of companies.

The *ecological framework* is also simultaneously changing:

- Carbon dioxide emissions and other greenhouse 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, which in turn increases the cost of transportation time as well as the accuracy of delivery.
- Energy prices in real terms have been decreasing since the seventies thus fuelling the long distance exchange of goods, products and people.

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

- Regional systems of production or local networks are being broken up through international sourcing strategies, also destroying informal information exchange between producers and customers. Innovation is often "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, trade as liberalized by the World Trade Organization (WTO) speeds up at least large-scale regional trade.
- The transportation infrastructure in many countries, especially 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 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;
- globalization of all economic processes;
- a 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 labor 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 distribution of 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 behavior 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 CO<sub>2</sub>-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 seem to exist very few convincing approaches to do so. Or, to put it this way: "While rationalizing 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 coordination." (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 an ideal case can be 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 firm's hierarchy and functional structure which decisions in logistics and transportation are being taken is necessary.

### 2.2.1 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 of material or number of parts thus reducing inefficient vehicle movements. The location of the suppliers seems to be the determining factor for the net effect; re-

cent 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 result 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 to the manufacturer. (Jäcker, 1997)

### 2.2.2 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 and 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 toward the concentration and bundling of single suppliers in the form of component or systems suppliers tends to reduce freight transportation for production inputs. Outsourcing of logistics services to specialized firms is another trend today. This results in less transportation because these specialists are more capable of bundling transportation more efficiently.

### 2.2.3 Distribution

More and more, specialized transport firms collect all the orders in one area and deliver them directly to the customer thus reducing the vehicle movement. The same effect seems to develop with the upcoming "Euro-logistics concept," which replaces national logistic concepts by spatially, more integrated ones thus cutting down on overall transportation although this strategy may region-

Strategic Elements	Reflections on Transport	Possible Impact		
		VFT	VK	TK
<b>Production</b>				
Lean Management	Inadequate consideration of real transport costs	↑		↑
Flat hierarchies	Hope for planning of goods transport that is closer to actual needs			↓
Concentration on core competencies	Building of increasingly finely-meshed production and value creation chains	↑	↑	↑
Building of strategic alliances	Growing need for exchange of information and goods	↑		
Optimization of production depth	Chance to bundle transportation	↓	↑	↑
	Lower levels of in-house-production for producers	↑	↑	↑
Product differentiation	The percentage of cargo for bulk goods decreases; there are more joint loadings and individual parcels		↑	↑
Customer orientation				
Product innovation	Distribution by way of express services with hub-and-spoke concepts increases vehicle mileage		↑	↑
<b>Logistics (supply and distribution)</b>				
Procurement logistics strategies	Change of modal-split in favor of road transport		↑	
• Just-in-Time-procurement with various clearances	More frequent transport movement but with less use of cargo room to capacity		↑	↑
New procurement strategies	Counterbalancing tendencies of delivery security and road traffic capacity		↓	↓
• Global vs. Regional Sourcing	Change of modal-split due in part to the existing rail infrastructure		↑	
• Modular Sourcing				
• Single Sourcing	Suppliers in close proximity		↓	↓
	Chance for traffic bundling	↓	↓	↓

VFT = Volume of freight transportation  
 VK = Vehicle-kilometers  
 TK = Transport performance in kilometers

Fig. 1: Aspects of strategic change and their possible impact on freight transportation

ally lead to an increase of vehicle movement.

### 2.2.4 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 (VFT). The two columns on the extreme right differentiate between vehicle-kilometers (VK) and transport performance in kilometers (TK).

Fig. 1 shows that we face contradicting trends: on the one hand, new corporate strategies may increase transport volume; on the other, 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

Regional science has since long dealt with the link between infrastructure, especially transport infrastructure and regional development. The European single market spurred research in this question. One early 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). As we enter a new millennium, we are witnessing very dynamic international economic development, from which one can assume in turn leads to the speeding-up of corporate reorganization in the direction the trends describe in section 2. But despite the logic of this argument, the link between corporate logistics behavior 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. The 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 that new corporate behavior can increase as well as reduce freight transportation. The overall impact of these changes is very unclear and little empirical evidence is available besides various casual observations and insights originating mainly in the automotive sector (Womack et al. 1991). However, there seems to be evidence – at least on a very general level – that spatial concentration of mobility, and accessibility and amenities will offer the best changes for sustainability on a spatial level as seen in the Dutch Randstad (Nijkamp et al. 1996).

The next subsection of the paper will present our four main hypotheses.

## 2.4 Hypotheses

As a result of a survey of theoretical literature and empirical analyses we have been able to generate four main working hypotheses, each of which were differentiated into 3–4 detailed sub-hypotheses during the process of their evolution. 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.

- Corporate division of labor and the integration of the value-added chain tend to change in a way that affect the net volume of freight transport.
- 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.
- Potential impacts on volume of freight transport very seldom are a decisive criteria for corporate strategic decisions. These decisions focus on the lowering of

costs of transportation and of handling and storing of goods.

- 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 section 3).

## 3 The Empirical Study

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

### 3.1 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 specialization, regional volume of freight transportation;
- micro level: corporate (logistics) strategies and organizational features.

Our analytical framework tries to integrate the strategic options of firms and their corporate behavior in relation to freight transportation. But to be frank, data which covers exactly this field of research, does not yet exist and is neither available 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 are but a very minor cost factor in their overall calculus. On the other hand, public authorities focus their attention on private motor vehicle 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 quickly proved that valuable data will be gained only by analyzing the enterprises themselves. Thus, the crucial point is to approach “reality” from two sides and find an appropriate link between strategic corporate behavior and volume of freight transportation, which transforms into usable 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 having undergone internal reorganization processes and where these strategic changes can clearly be identified with a start and a finish date;
- a feedback workshop with private and public firms and public authorities provided a discussion forum for our findings regarding their 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 based on the following factors:

- its central location within the Swiss rail and road infrastructure;
- the limited spatial scale of an agglomeration having eight communes and around one hundred thousand inhabitants;
- a highly developed and structurally diversified economy which is based on production as well as services such as wholesale or financial services;
- finally, because we cooperated with a private foundation which supported the survey financially and logistically for this region.

This paper concentrates on the results of the company survey. We next discuss

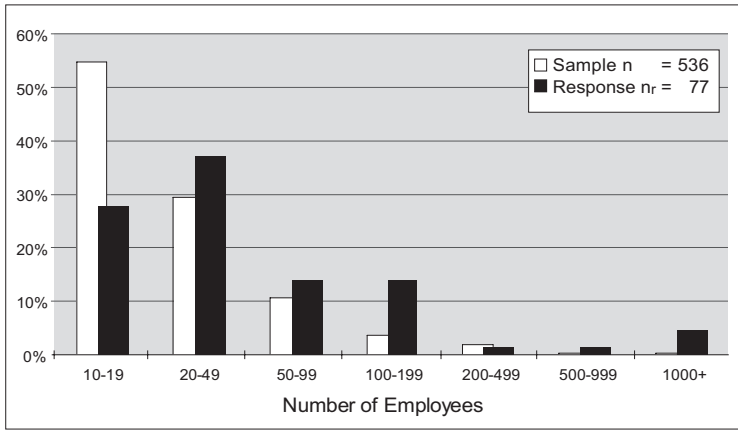


Fig. 2: Distribution of firm size

the database of that survey, which was created in March and April of 1998.

### 3.2 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 536 firms in early March of 1998; 118 responses were received from which 77 were ready for analysis; thus the response rate was about 14%, which is reasonable compared to the questionnaire's level of complexity.

Concerning the *structure of businesses*, we can speak of a representative sampling. The division of companies by branches represents approximately that of the Canton of Zug (2nd and 3rd sectors): production businesses 32%, construction businesses 22%, trade/maintenance/hospitality businesses 34%, and wholesale/transport businesses 12%.

The *distribution of firm size* can be seen in Fig. 2. We observe the usual fact that the response frequency of small firms is far below the share of establishments in the sample. Firms with 20 to 49 employees comprise the largest share of all firms responding; companies with more than 500 employees are largely over-represented. 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.

The *status of the plant*: More than 50% of all firms are single plant firms, whereas 22% 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 an out-of-canton Swiss company and as a branch plant or a subsidiary of a foreign company.

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

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 they had increased turnover compared to the previous year, 34% had stable turnover whereas a fourth stated their figures had decreased. The employment figures somehow reflect the difficult economic situation for Swiss companies. One third of all firms reported decreasing employment compared to the previous year, while only a fourth had increased.

The Swiss economy traditionally has had a dual structure. A third of all firms generate their turnover within the European Union, their most important market. However, for over 80% of all companies, Switzerland is the most important market. Rather typical for small and medium-sized enterprises is the fact that

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

Fig. 3: Characterization of the firms' respective markets

60% of the firms produce their turnover with one single group of products or services.

### 3.3 Selected Results

This section presents selected results from the company survey and concentrates on markets and corporate strategies, on corporate transport and on the link between logistics and environment.

#### 3.3.1 Markets and Corporate Strategies

Corporate behavior or strategies are strongly shaped by the dynamics and characteristics of their respective markets. So we asked the firms: "Which features characterize 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 low," and "very low." The answers were transferred into numbers ranging from 4 for "very high" to 1 for "very low." The ranking of the means for the key factors is presented as follows:

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 determining 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 in Fig. 4.

This ranking makes quite clear that the first six to seven factors seem of more importance than the rest. 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. A survey of empirical literature prior to our own firm survey suggested that there must be some kind of typology of corporate behavior in this regard. On the other hand the rapid proliferation of logistics or strategic options for firms indicated the opposite:

Factors for transportation strategy	frequency
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 customers to wait for goods	11
9 'time-sensitivity' of goods	8
10 price per kilogram 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

Fig. 4: Factors for transportation strategy (frequencies)

there were almost no two single companies displaying the same logistics features.

So best thing is to analyze the above data to see if there are certain clusters of key factors which determine logistic behavior. According to the original research plan, the impact of the market situation on a firms' strategic transportation planning was to be determined with the help of an ordered probit model. Therefore, clusters of firms should be produced and then be taken as a starting-point for weighted ordered probit regressions. Because of various problems we changed this procedure. A regression with a too small database would produce statistical distortion. This distortion would be increased when several statistical methods would be executed one after the other. For that reason, we started with the cluster analysis, but then continued with a discriminant analysis.

The *hierarchical cluster analysis* shows the following characteristics.

First, there are two distinct clusters of key factors representing clearly different economic activities (see Fig. 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 most companies, the "intensity of cost and price competition" in their main markets is very high – not only those who rate "price per kilogram" as a crucial factor for transportation.

A second finding is, that corporate logistics strategies tend to be very heterogeneous (see also chapter 2). Nevertheless, our firm survey produced three clusters of strategic options, although

Fig. 5: Clusters of factors for transportation strategy

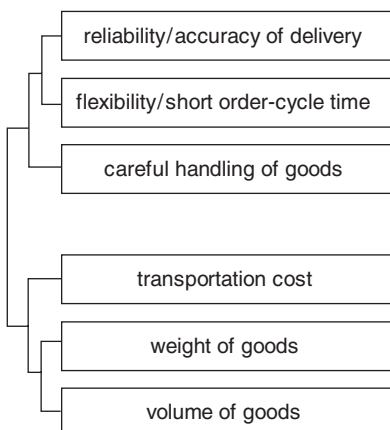
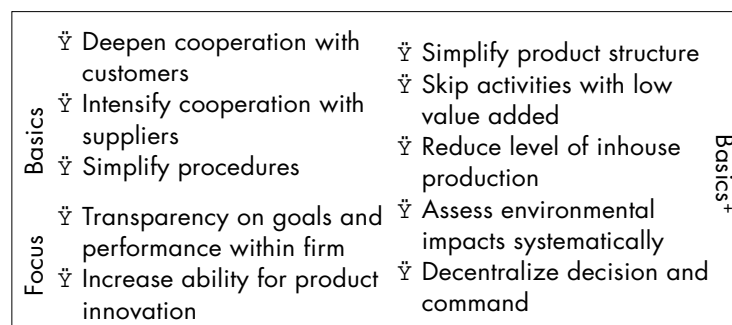


Fig. 6: Three clusters in strategic behavior



they do not reveal much differentiation. The following Fig. 6 gives an overview of the three clusters and their configuration. Strategic options were listed in order of their frequency of being mentioned in the survey, top down and from left to right.

- First, a basic set of strategies seems to exist which form a "must" for every firm which wants to stay competitive today and maybe also in the future. This cluster contains the majority of the responding firms (46).

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 labeled as "focus." This second cluster contains 11 firms.

- The third cluster, with 26 firms, is called "basics plus" and encompasses a wider range of strategic features.

A discriminant analysis was conducted to examine significant features for the statistical clustering of firms' strategic behavior. First, we found not too much differentiation in the division of branches between the three clusters. Small differences could be established within the cluster "focus," which could be explained by the small number of firms in this cluster. In the "basics" group we find more retailers, the two other clusters contain a few more manufacturing firms. As a result of further analysis we found that neither the number of a

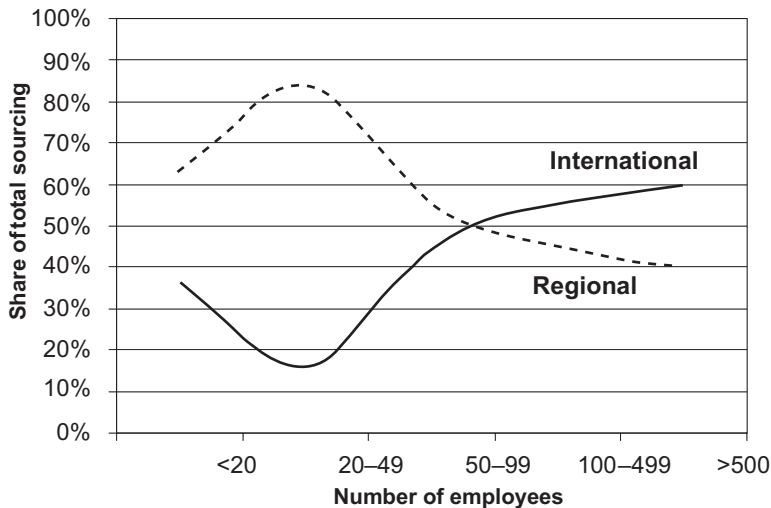


Fig. 7: Regional and International Supply

firm's employees, nor its position in the value added chain was a significant feature for the classification of the firms to the clusters. What seems to have a certain impact on this classification is the self-characterization of a firm's market situation. On this matter most of the responding firms judged the cost and price competition to be very intensive.

### 3.3.2 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. The 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 firms report increasing or constant input-tonnage.

Regional impacts are supposed to be linked strongly with the amount of kilometers driven. Thus, we asked for precise data on transportation with company-owned vehicles (kilometers, tons per kilometer, kind of vehicle). But, for reasons of lack of data or lack of time too few responses were submitted 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 our standard assumptions. Our survey shows that an average firm has eleven suppliers with significant volume of freight. The bulk of these suppliers are producing single parts or goods, while comparably few are supplying components or modules 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 are. Systems suppliers typically are located in the survey region of Zug, because this kind of supplier typically needs intensive exchange of information with the manufacturing firm and thus proximity of location is necessary.

If one distinguishes between "international" and "regional" (i.e. Swiss) suppliers, a size effect can be found (see Fig. 7). Small firms, especially those with between 20 and 50 employees, do less international purchasing compared to larger companies. They supply production mostly within Switzerland, and to a high degree from within the Zug region. However, half of the middle-sized companies' volume of purchases is done on the international market. Nevertheless, even the largest companies still buy 40% of their semi-finished goods within Switzerland.

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% (80% for outgoing goods) of all responding firms solely use road transportation to move their goods and products whereas only 4% (1%) 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 lie 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% of the suppliers make this decision while in 16% of the cases it is a transportation company, which in turn selects the transportation mode in 21% of the cases for outgoing goods.

This may lead to the conclusion that even when a firm voluntarily decides to select a more environmentally friendly means of transportation – rail or combined rail/road – the decision is often not their's but somebody else's. Legal transportation arrangements (INCOTERMS) or customs-like "ex-works" or cost-insurance-freight (c.i.f.) predetermine the selection of the transportation mode.

### 3.3.3 Logistics and Environment

One of the key issues is the link between logistics and the subsequent impacts on transportation and then via gas emis-

Fig. 8: Logistics options to reduce environmental impacts

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

sions 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 were then 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:

According to more than 80% of the firms, intensified cooperation with suppliers and a higher rate of regional sourcing seem to contribute very strongly to both lesser hauls and intelligent design of freight transportation. For almost two thirds of the firms, a more intelligent method of transportation will be strongly supported by just-in-time supply and intensified cooperation with customers. The previous statement is also a crucial factor for lesser freight hauls. The firms ascribe a strong contribution at least to both main approaches to very early incorporation of transportation aspects in production planning.

## 4 Conclusions and Suggestions for Action

### 4.1 Conclusions

The results of the study clearly show that a multitude of both external and internal factors influence companies' behavior. As external influences of firm's behavior we can cite the conditional factor of transport cost. The study lets us draw the conclusion that transport costs or rather energy prices are too low to play a role in firms' calculations. The use of environmental or natural resources does not produce sufficient price signals, and is therefore ignored or neglected by management.

For the majority of businesses, the conscious planning of goods' transport is not a pressing topic. But the survey responses reveal that each firm acts in a specific manner to changes in their envi-

ronment. This impression was strongly certified within the discussions with experts.

A clear typology – as new business strategies demonstrate – is not recognizable. Consequently it is not possible to determine a "typology of goods transport burden" that could then be used in a general form for state planning or implemented in business planning. However, it is possible to observe a grouping of businesses that forms around the level of logistics integration: on the one hand there are businesses that have a continuous logistics organization and see the value chain creation as an entirety. On the other hand, there are businesses that promise nothing of this and remain true to the conventional concepts of manufacturing and product management. These companies can raise, for example, few figures on the spatial impact of their logistics. For that reason they are much less capable of acting strategically. The analysis shows that this qualitative jump in the development phase of logistics is highly dependent on the market pressure facing each company. In the region of Zug, this seems to have no relation to structural characteristics such as the size of the business or sector of operation.

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 survey of firms aimed – among other things – 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 of questions of logistics. Therefore, appropriate controlling tools are lacking.

### 4.2 Suggestions for Action

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. Our survey of firms shows that in many cases the link

between logistics behavior and volume of freight transportation is not within the mental or pecuniary perception of a firm's management.

Based on the project results, suggestions for future action apply to various players. These suggestions are grouped in five areas of action: Corporate level, Politics, Law, Infrastructure and "Software."

#### 4.2.1 Corporate Level

All too often, logistics is still a purely operational approach. Only if a firm is beginning to perceive its performance in value added chains does it realize that integrated logistics concepts are able to optimize performance all along this value added chain. The more single logistic measures are integrated, the more a firm begins to develop control instruments which in turn enable the company to better perceive its impact on the volume of freight transportation and subsequently on environment and spatial development. Raising awareness about this issue requires two things: first moving logistics up the hierarchical ladder of a firm into top management and second an appropriate control instrument to better quantify the interface between strategic logistics decision and volume of freight transportation. Within this framework for action, the main approach for better corporate logistics planning is to foster regional cooperation. Appropriate means are, for instance, to participate in cooperation markets, to aspire the common use of corporate infrastructure, to use flexible-platform pools, or to develop efficient communication means.

#### 4.2.2 Politics

What is primarily addressed here is the formation of conditions, such as the setting of price signals countrywide. Thereby external traffic costs such as energy taxes or energy incentives will be increasingly considered in firms' cost calculations.

It is urgent that the interface of rail and road be made more utilizable. For this, public and private entities must work together. Only in this manner can there be an efficient fusion of rail trans-

port's potential for development with the challenges of businesses. The cooperation between state entities and private enterprise has taken on particular meaning largely due to the introduction of the Swiss *Alpeninitiative*. The survey of businesses in and around Zug confirmed that transport costs do not belong to the deciding criteria in business decisions – not even in the area of logistics. The recognized measures of supply-side economics and free enterprise such as LSA (flexible tax on road freight transportation) do not provide enough force. Beyond that, there is a need for cooperative development – for example in joint shipping – which not only creates attractive business conditions but also breaks down emotional barriers between rail transport, its competitors and customers.

#### 4.2.3 Law

The need for a broad-based site concept for combined traffic is undisputed. Such a concept must be supported on various levels. On the national level, for example, a new start was made at the beginning of 1999 with the legislative proposal for rail reform. It is also possible to envision a federal plan on Rail Transportation and Combined Transport Infrastructure.

On the regional level, the basis of the canton's strategic traffic planning must be improved. As companies do not fit their activities to political borders, the canton has to create its bases for planning on a transborder level. This leads to the question of whether a Swiss national development strategy for the current environment is needed, to create a framework for this spatially variable cooperation of Swiss cantons.

Based on the results of this project, we recommend that communities pursue more vigilantly the efficient use of space in transport and traffic infrastructure in their plans. This becomes even more important as many key players in the Zug region consider traffic to be the "Motor of City Development." The opportunities range from the elimination of certain site characteristics for newly-locating firms to planning shutdowns for business reasons or the application of cooperative

tools in the planning process. Thereby the state asks businesses to cooperate and provides these private entities with useful information. In this manner, companies begin to learn the needs and motives of public offices. It is important that a regional level for cooperation is found. In the near future, the canton and communities of Zug must get closer to the customer than ever before and therefore closer to the needs of the economy and the general population.

#### 4.2.4 Infrastructure

As the demand for intermodality of transport rises, a need for an appropriate physical infrastructure also arises. Business decisions on transport containers, transport methods and transport depend on the network for joint transportation being available. For example, at the Rotkreuz railway station the Zug region has a strategically favorable site whose infrastructure still needs development.

Until now infrastructure policy was always one-sidedly based on supply: that is to say that when there was a traffic jam, it was counteracted by an expansion of traffic infrastructure. Recently, availability and networking of functions such as working, living or shopping are being demanded locally. For that reason, efforts are to be judged on the basis of their contribution to sustainable spatial development and their spatial and environmental effects.

#### 4.2.5 "Software"

This term – in contrast to hardware – refers to the "soft infrastructure." What is needed first of all is information. As an example, few firms know that it is possible to get subsidies for investment in a works siding – provided by the Canton of Zug as a clean air measure. A first step toward overcoming this communications deficit is the newly created Office for Long-term Promotion in the canton's Office for Economic Development. Moreover, "software" also covers voting processes in logistics as well as the availability of knowledge and skills in the region. In this area, deciding factors stem from spatial planning and site policy.

The administration's proximity to the customer should not be restricted to business. On the one hand, nontransparency in traffic processes and impact links make it more difficult to lead a discussion oriented toward future abilities. On the other hand, the population increasingly views the ever-smaller living space as a problem. This situation calls for public discussion (about values and quality of life). The public administration has the obligation to take the needs of all constituents seriously and to provide them with a forum for exchange.

#### Notes

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