



(INstruments and NETworks for developing logistics towards Sustainable Territorial Objectives)

**Contract n° EVG1-CT-2001-00054**

## **District Logistics Analysis of**

**“The Viborg County case study”**

<b>Contents</b>	
1. Executive summary	1
2. Correlation between the LCA hypotheses and the DLA	3
3. The District Logistics Analysis - Logistics flows	5
4. The District Logistics Analysis – Logistics organisation	11
5. A synthesis of logistics flows and logistics organisation in the industrial furniture district of Viborg County	15
6. Freight transport and the environment in Viborg County	23
Annex: DLA questionnaire	26

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# 1. Executive summary

In this document is presented the results and approached used in a District Logistics Analysis (DLA) in Viborg County, an administrative region in the North-Western part of Denmark. This area has been used as a territorial case as a district due to a high concentration of SME's within the furniture production. The large number of furniture producing firms in this locality has been used as a conceptualisation of the analytical term "industrial district" or "cluster". The aim of the DLA has been to identify the logistical flows and logistical organisation of the local furniture district. This entails a description of the main transport flows of incoming goods (exemplified by wood as the main input): where are the suppliers located, which transport routes are used, which transport modes are used. Also a description of the main transport flows of outgoing goods (furniture) is produced: where are the main customers located, which transport routes are used and which transport modes are used. The logistical organisation is analysed by identifying the main actors along the logistical chains, that exert influence on the design and organisation of the logistical flows related to the local furniture industry. Thereby, has the aim been to assess to what kind of transport flows and logistical organisation is produced due to furniture production in Viborg County. Also the location of competencies related to organise and develop the transport and logistics services is identified and assessed.

The current DLA illustrates that the furniture industry in Viborg County is a useful example of an industrial cluster of SME's, where the logistical competence is embedded in a network among a number of firms – specially transport firms. Only parts of the logistical competence (in terms of decision-making on logistical organisation) is locally embedded, while other parts (specially ingoing flows) of the logistical decision-making are located outside the territory of Viborg County. This illustrates the close relationship between the logistical flows and the organisation of the inter-firm network as a characteristic of the logistical organisation.

It has been possible to some degree to utilise data from publicly available statistics in the DLA to identify the environmental load from the freight transport sector – but only on a national level. It has not been possible to extract relevant data on a regional level. From other studies it has been possible to get some useful data on the perception and integration of environmental strategies among firms located in Viborg County. Some of this information is also related to freight transport.

At this stage of the DLA of Viborg County it seems useful to conclude, that a promising gate to develop and implement environmental strategies/Sustainable District Logistics in Viborg County could be through the network among SME's and their transport operators. This is based on the observation, that logistics often is an issue organised in an inter-firm network, than within the single firm.

### **Regional profile and perspective**

The sample in the questionnaire in this District Logistics Analysis (DLA) consisted of 56 furniture-producing firms. 2/3 of the firms were located in Viborg County and the rest was located in other parts of Denmark. Thereby the specificities and similarities of the local furniture producers of Viborg County was better illuminated by contrasting them against a sample of firms located outside Viborg County.

As a more in-depth supplement, 5 firms within transport and wholesaling related to furniture production, was interviewed. These firms represented actors in the transport-logistical chains of transport flows to and from the local furniture industry in Viborg County.

The study was aiming at giving an exploratory new insight of how transport and logistics are organised in a local industrial context. The sample of furniture producers therefore represents different sub-sectors of the more general category of furniture industry. Producers of kitchen and bathroom inventory, office and shop inventory, upholstered furniture and non-upholstered furniture were represented. Also producers from different layers of the production process, sub-suppliers and final assembler, were present in the sample.

Based on the results of the current LDA it has not been possible to measure in specific numbers the size and quantity of the total transport load stemming from the local furniture industry in Viborg County. It is however not likely, that the traffic and transport generated from the local furniture producers in isolation can be identified as a significant environmental problem in terms of pollution, congestion, noise etc. However, the LDA seems to reveal a localised concentration of material flows and organisational networks among local furniture producers and regional transport providers. This is interesting, since it represent promising conditions for innovative strategic actions on the field of transport and logistics among a co-operating cluster of firms related to different parts of the same transport-logistical chain.

## 2. Correlation between the LCA hypotheses and the DLA findings

This section describes the connection between the Local Context Analysis (LCA) innovative options on those derived from the District Logistics Analysis (DLA), underlining the probable impacts of the former on the latter, as well as the possible integrations and modifications to be introduced into the LCA.

### Main hypothesis of innovative action derived from the Local Context Analysis (phase I)

#### Short description

Development of innovative networks in the relationships among local furniture and transport firms as the basis for implementing regional policies aiming at promoting more sustainable district logistics.

#### Expected results

- reduction of traffic load on existing traffic infrastructure (primarily roads)
- reduction of emissions from transport
- reduction in costs on transport for SME's localised in a peripheral region
- development of new localised orientations of the local furniture industry in order to prevent a re-localisation of business, employment and competencies from the region.
- formalisation of inter-firm competencies on transport and logistics within the local furniture industry as example of good practice of mobility management. Established good-practices on transport and logistics (competencies) could be used as good examples of mobility management of freight transport in the County of Could serve as a new tool for mobility management of freight transport for the regional planning authorities.
- promotion of transport and logistics inter-firm competences as a regional and cluster-specific competence, which adds to the competitiveness of the local furniture industry.

#### Organisational measures

- combination of several attempts stemming from local initiatives to follow criteria of economic and environmental sustainable development (e.g. regional spatial plan, reports on transport and infrastructure development, Centre of wood and furniture)
- integration of a regional hub-and-spoke system for the furniture industry (and other SME's) in a formal mobility management policy for Viborg County
- monitoring of selected indicators on transport and logistics in existing web-site at the planning authorities at Viborg County in order to sustain interest in the mobility management initiative.

### Correlated findings derived from the District Logistics Analysis (phase II)

#### Short description of main findings correlated to main hypothesis

Existence of material and organisational networks in a localised setting. Local awareness on the co-operative capabilities among local furniture producers, but lacking awareness about localised cluster of transport-logistical network.

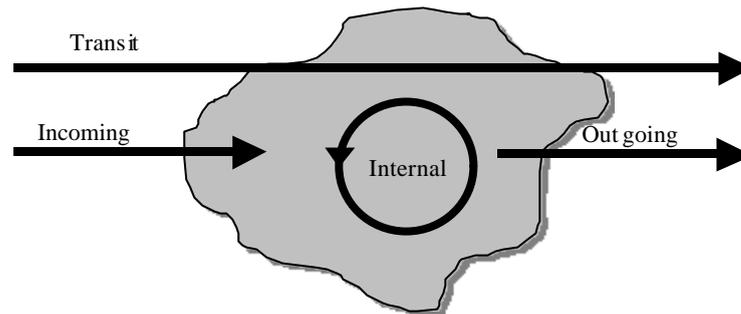
#### Examples of relevant findings:

- a large number of the local furniture producers use the same regionally located transport providers
- the transport providers often organise their pick-up and delivery as round-trips among several local furniture producers
- the transport firms often provide storage facilities for the local furniture producers final products. This also benefits the transport firms in terms of the ability of consolidating consignments and thereby increase the rate of full-loads in distribution to furniture costumers
- no examples of existing co-operation among the local furniture firms and transport firms concerning strategies on environmentally sustainable logistics and transport
- a few projects of implementation of EDI-systems among regional transport provider and a small number of furniture producers
- inbound transport of furniture input to production is mainly organised by non-local actors (e.g. sawmills, wholesalers, forwarders and road haulers)

- outbound transport of final furniture products is mainly organised by local and regional actors (furniture producers, forwarders and road haulers)

### 3. The District Logistics Analysis - Logistics flows

It is necessary to distinguish between four main types of logistical flows in a regional perspective: internal, incoming, out going and transit. Each of these types of flows have different ways of organisation and therefore also different localisation of decision-making. The localisation of different types of actors in a logistical chain or system is of great importance to identify, if one wants to develop alternative (future) strategies and implement them. Only actors with “hands on the issue” can provide researchers with relevant knowledge and commit themselves to actually implement relevant strategies.



*Figure 3.1: Four types of logistical flows in a regional perspective.*

In a short way, it can be hypothesised that incoming freight logistical flows are organised differently than flows leaving a particular region. If, as an example, the producing firms of a commodity in general organise the transport to the customer of this commodity, then the localisation of an important decision-making actor (the transport buyer) is differently located, whether the freight flows are incoming or out going of a particular region. This aspect is relevant in terms of the objectives of the INNESTO-project that intends to identify local actors, which impose influence on the shaping of future sustainable districts. The transit logistical flow reflect a third and distinct form of transport, that affect a local territory. Primarily, the logistical flow in transit affects a local territory by its negative externalities (e.g. environmental load, infrastructure costs). But, local decision-makers have apparently no or limited possibilities to affect the transit freight transport.

In the following sections, data on these three types of logistical flows will be presented, in order to concretise the size and character of the logistical flows of Viborg County.

#### 3.1 National logistical flows of Viborg County

It has been possible to extract data on the logistical flows of Viborg County through the bureau of Statistics Denmark (national statistical bureau) on different time scales, types of transport modes, traffic and transport work. In the figures and tables below, a selection of these data will be presented.

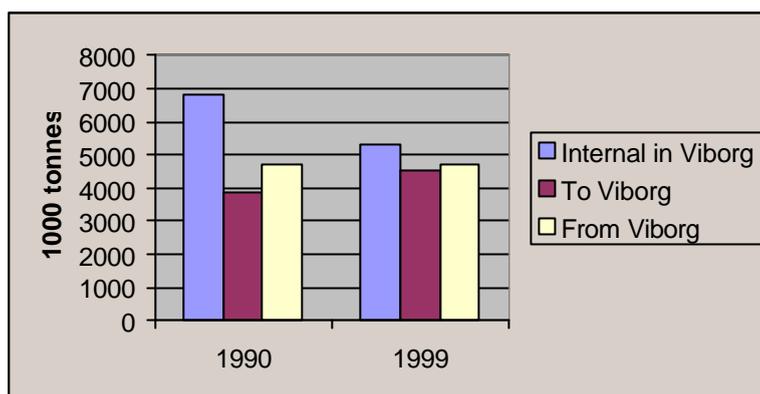


Figure 3.2: National road transport of goods by lorries over 6 tonnes internal, to and from Viborg County in 1990 and 1999 (1000 tonnes). (Adapted from Statistics Denmark, 2000).

In 1990 did the *internal* transport of goods by lorries amount to app. 45 pct. (6.810.000 tonnes) of the totally moved goods in Viborg, while goods coming *to* Viborg (3.900.000 tonnes) amounted to app. 25 pct. and goods departing *from* Viborg County by lorry accounted for app. 30 pct. (4.726.000 tonnes) – see table 3.2 above.

In 1999 had this picture changed in the sense, that goods coming *to* Viborg County by lorry had increased its share and total volume to 31 pct., while the share of *internally* moved quantities of goods by lorries had decreased to app. 36 pct. The departure of goods from Viborg County by lorry in 1999 was fairly equal to the 1990 figure (see table 3.2 above).

	Road transport	Sea transport	Rail transport	Total
<b>National goods transport</b>				
<b>Internal in Viborg</b>	5.770	227	-	5570
<b>To/from Viborg</b>				
From Western Denmark	4227	92	6	4245
To Western Denmark	3879	80	1	3880
From Eastern Denmark	97	12	5	114
To Eastern Denmark	130	15	2	147
<b>Total national goods transport</b>	<b>14.103</b>	<b>426</b>	<b>14</b>	<b>14.156</b>
<b>International goods transport</b>				
Import	-	-	-	737
Export	-	-	-	801
<b>Total international goods transport</b>	-	-	-	<b>1.538</b>

Table 3.1: Goods flows within, to and from Viborg County distributed on different transport modes in 1998 (1000 tonnes) (source: Institute for Transport Studies, 2000:18).

Table 3.1 above illustrate, although only seen from a single year, that the goods flow to and from Viborg County mainly is nationally oriented and secondly internal. Less than 10 pct. of the total quantities is internationally oriented. The table also illustrates, that road-based transport totally dominates the mode choice.

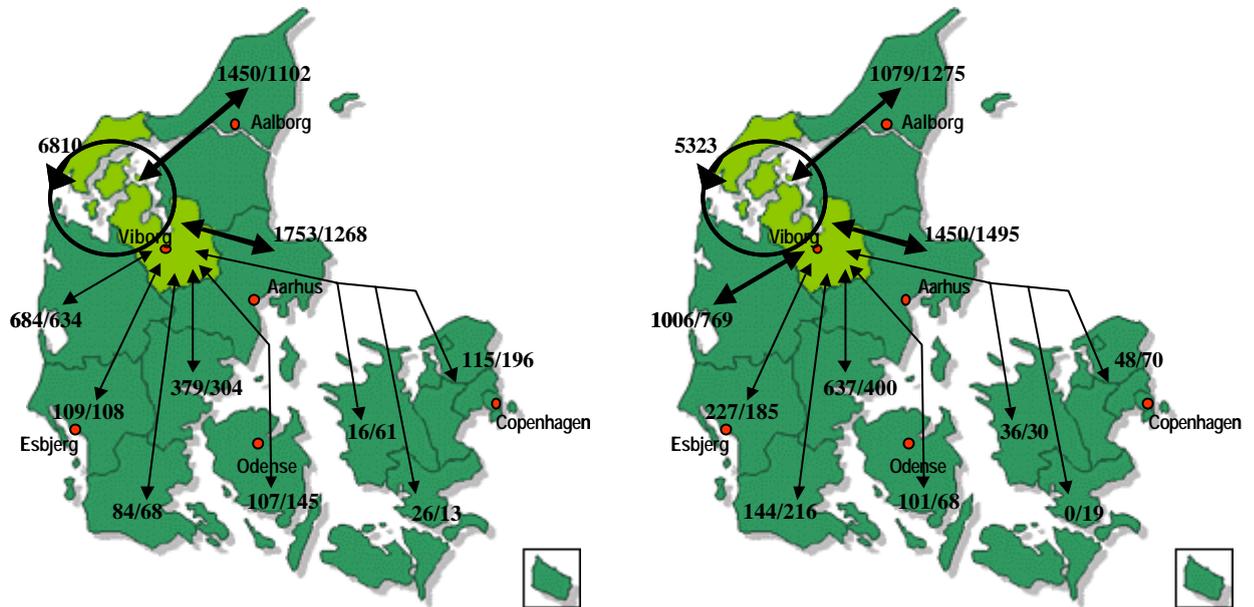


Figure 3.3: National road transport of goods by lorries over 6 tonnes to Viborg County/from Viborg County from different regions in Denmark in 1990 and 1999 (1000 tonnes). (Adapted from Statistic Denmark 2000).

The distance of the logistical flows by lorry to and from Viborg County can further be illustrated in figure 3.4 below. The Figure illustrates, that the intensity of the goods flows are concentrated to the neighbouring counties and internally within Viborg County.

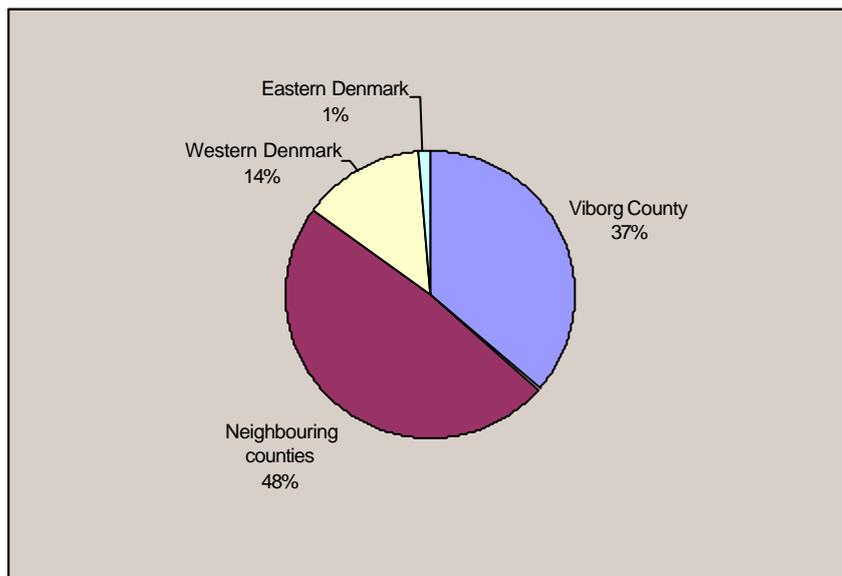


Figure 3.4: National goods transport by lorry within, to and from Viborg County in 1999 (Statistics Denmark, 2000).

A reasonable explanation on the concentration of flows to neighbouring counties could be the transport to and from regional logistical hubs in these counties. From these hubs the goods flows are consolidated and re-loaded for further transport.

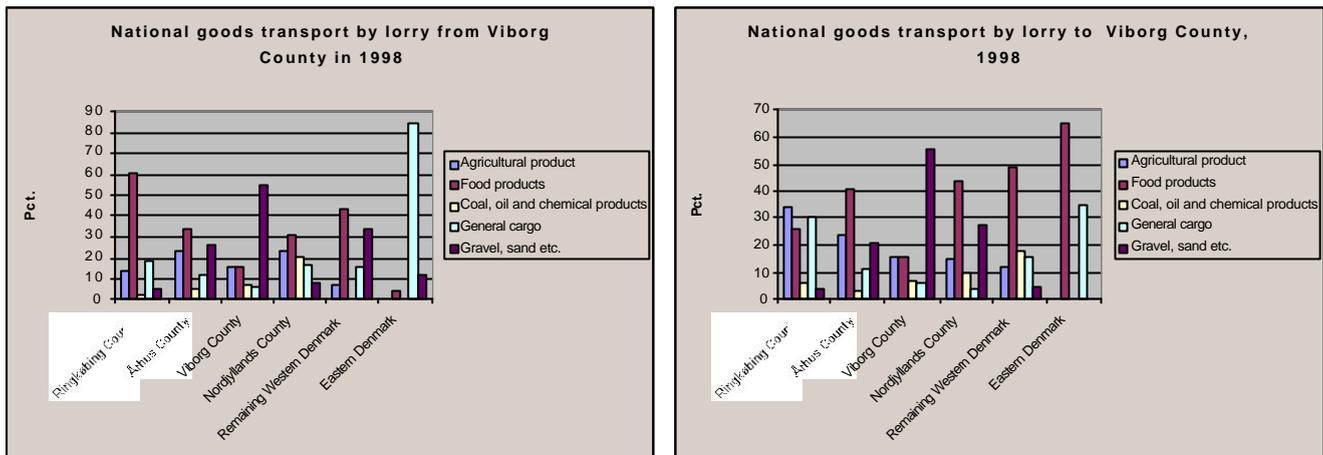


Figure 3.5: National goods transport by lorry from, to and within Viborg County distributed on different types of goods and national regions of origin and destination in 1998 (source: Inst. for Transport Studies, 2000).

Figure 3.5 above identifies the main origins and destinations for main statistical groups of goods in relation to Viborg County in 1998. Internally generated goods flows are dominated by the category of gravel, sand etc. which amount to 55 pct. of the total internally generated goods flow. This category is also the most dominant of all types of goods transport within, to and from Viborg County (see table 3.2 below).

Table 3.2: National goods transport by lorry from, to and within Viborg County distributed on different types of goods (source: Inst. for Transport Studies, 2000).

	From Viborg County	To Viborg County
<b>Agricultural products</b>	16 pct.	18 pct.
<b>Food products</b>	27 pct.	29 pct.
<b>Coal, oil, and chemical products</b>	7 pct.	8 pct.
<b>General goods</b>	12 pct.	10 pct.
<b>Gravel, sand, etc.</b>	38 pct.	35 pct.
<b>Total pct.</b>	100 pct.	100 pct.
<b>Total quantity (1000 tonnes)</b>	8.552	9.257

From the table above it can be postulated, that bulk goods like agricultural products, coal, oil, chemical products and gravel, sand etc. is the main type of products transported by lorry within, to and from Viborg County.

Transports within Viborg County are dominated by construction and bulk goods. Inter-regionally between Viborg County and other regions in Denmark goods types like agricultural and food products are represented substantially – specially between Viborg County and its neighbouring counties. Transport flows from the Eastern parts of Denmark are dominated by food products (65 pct.), while the dominating type of goods from Viborg County to the Eastern parts of Denmark are dominated by general goods (84 pct.).

### 3.2 International logistical flows of Viborg County

The total imports in quantities in 1998 to Viborg County was 737.000 tonnes and in the figure below the origin of these quantities are outlined.

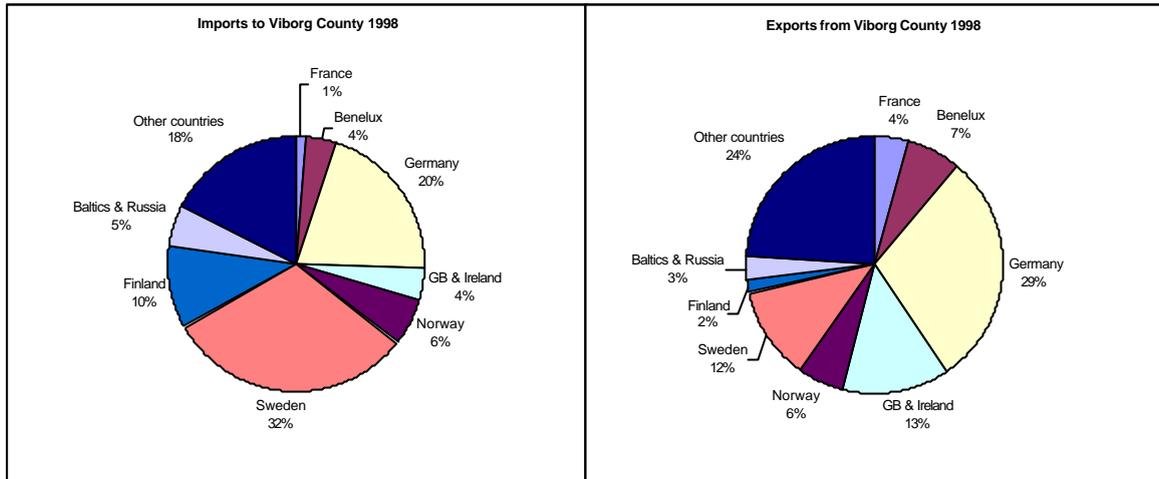


Figure 3.6: Imports and exports of goods to and from Viborg County in 1998 (adapted from Inst. for Transport Studies, 2000).

The main countries of trade flows imported to Viborg County in 1998 were Sweden (32 pct.) and Finland (10 pct.), while the main export markets in 1998 were Germany (29 pct.) and Sweden (12 pct.).

In quantities (tonnes) are the most important origins and destinations of trade flows to and from Viborg County listed in table 3.3 below.

Table 3.3: Quantities of trade flows in tonnes for the most important origins and destinations to and from Viborg County in 1998 (adapted from Inst. for Transport Studies, 2000).

	Germany	Sweden	Finland	UK/Ireland	France	Benelux	Baltic & Russia
<b>Import (tonnes)</b>	150	230	76	28	11	28	39
<b>Export (tonnes)</b>	235	94	14	108	34	55	23

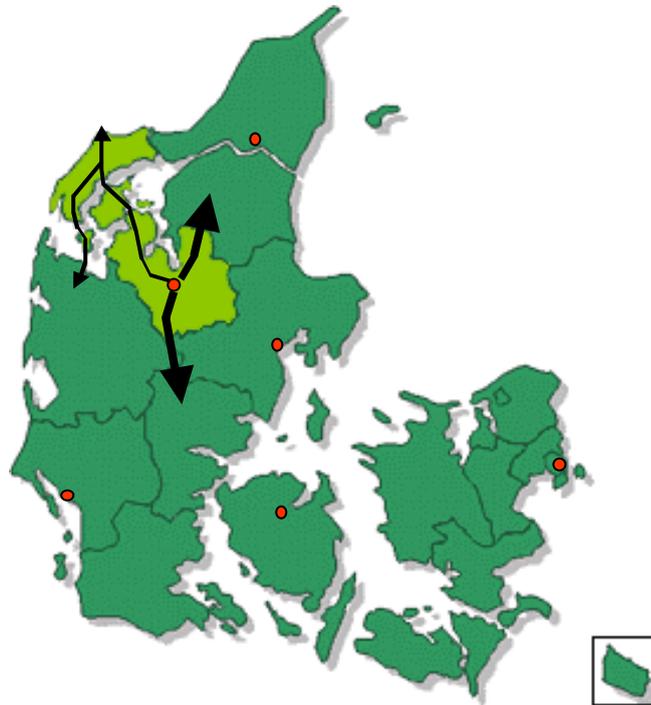
The table illustrates, that there is not an evenly distributed trade balance between Viborg County and its most important trading partners in Europe. It could be hypothesised, that this affects the way the transport system has to organise its transport activities in an economically efficient way. Viborg County imported in 1998 totally 737 tonnes of goods and exported totally 801 tonnes.

It has not been possible to obtain publicly available statistical data on the types of goods, that are imported from and exported to different foreign markets.

### 3.3 Transit logistical flows for Viborg County

The publicly available statistics does not contain information on transit flows of freight traffic on a county level in Denmark. However, the location of Viborg County results in a number of road-based traffic corridors, which runs through the county. By combining existing publicly available data for the interregional goods flows a former study in Viborg County on freight flows has estimated the average quantities and distribution of

freight flows on different road-based corridors in Viborg County for the period 1993-1998 (Inst. for Transport Studies, 2000).



*Figure 3.7: Main road-based corridors for freight traffic through Viborg County.*

The main share of transit freight traffic in Viborg County runs through a North-South corridor between North Jutland County and other neighbouring counties or other destinations in Denmark and abroad. The main part of freight traffic in this road-based corridor carries is running to and from the county north of Viborg, to and from the rest of Denmark, and the Danish-German border in the south of Denmark. Secondary corridors of transit freight traffic are connected via the ferry connections to Norway and the Faroe Islands/Shetland Islands at the Hanstholm Harbour in the North-West of Viborg County (see figure 3.7 above).

## 4. Logistical organisation

In order to analyse the logistical organisation of the furniture industry in Viborg County it is necessary to describe the structure of the local industry. In this section we will describe the significance of the local furniture industry in relation to other sectors in Viborg County. We also describe in more detail what types of firms are included in the furniture cluster. A parallel description is given of the local road haulage industry, which is the primary transport provider for the local furniture industry of Viborg County.

### 4.1 The furniture industry in Viborg County

The furniture industry of Viborg County as an industrial cluster of significant size is relatively short in a time perspective. In the start of the 20<sup>th</sup> century only a few furniture firms were located in the region, which otherwise was dominated by agriculture and fishery business. The furniture manufacturing first evolved as a significant local business during the 1970s, after an economic recession in the World and national economy. In the Viborg County a large number of carpenter and construction firms were located, which were heavily dependent on the market for house construction. When the economic recession began in the mid-1970s in Denmark, the market for constructing houses went down and this hit the, among others, the small carpenters and construction firms in Viborg County.

However, some of these firms turned their businesses to the furniture industry as sub-suppliers to already existing furniture manufacturing firms. Apparently, a kind of entrepreneurial spirit among the local firms secured a

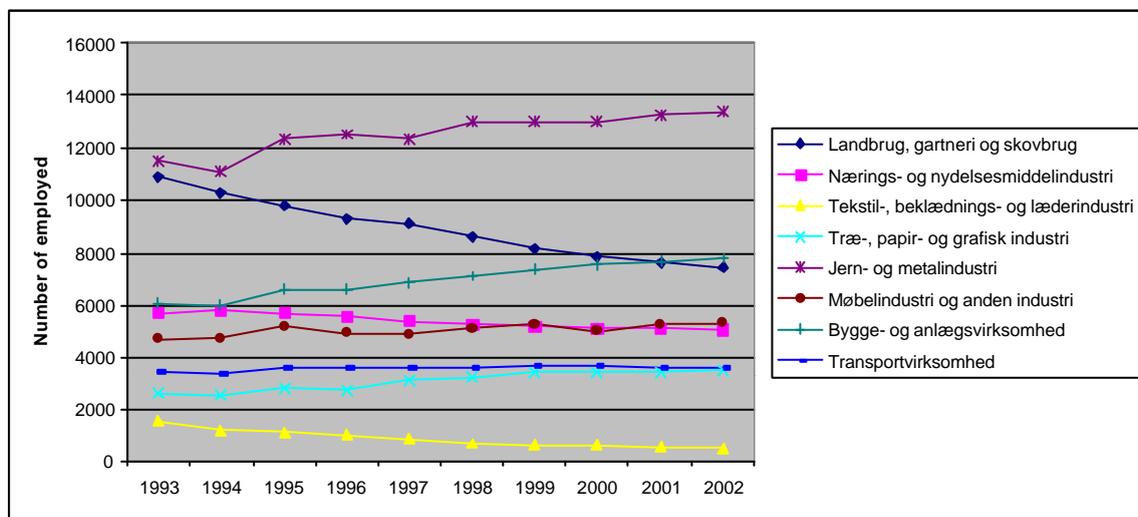


Figure 4.1: The development of employment in selected industries in Viborg County 1993-2002 (source: Statistics Denmark, 2003).

In figure 4.1 above it is illustrated, that employment within the iron and metal industry is dominant in Viborg County and it has increased slowly from 1994 to 2002. It is important to note, that this industry is locally dominated by single firm manufacturing industrial pumps etc. The sector of agriculture and forestry has significantly decreased its employment rate during 1993-2002. In the same period has the construction industry experienced the highest rate of growth in employment of the selected industries and sectors. The furniture industry has had a relatively steady development, with a minor

growth in numbers of employed from 4673 in 1993 to 5266 in 2002 – a growth of 11 pct. Also the transport industry expose a steady state in the same period with 3597 persons employed in 2002.

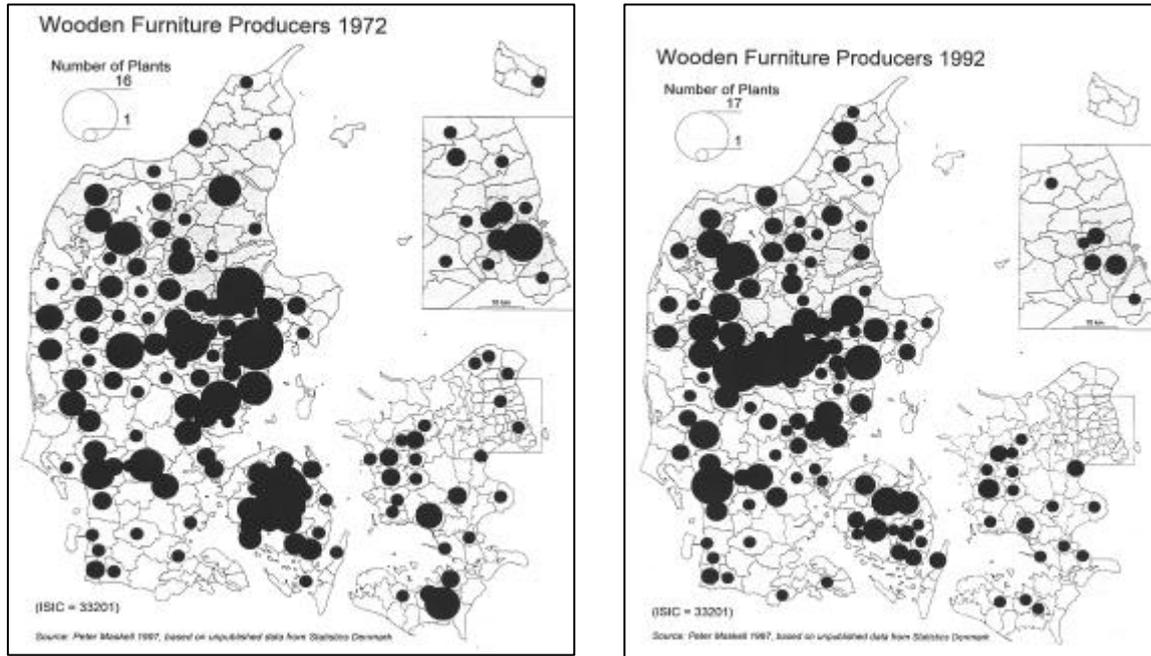


Figure 4.2: The localisation of the Danish furniture industry in 1972 and 1992 (Source: Maskell, 1997).

Figure 4.2, above, illustrate the development of migration of the furniture industry from the eastern parts of Denmark to the western parts in the period of 1972 to 1992. Specially, there are significant concentrations within the counties of Viborg and Ringkoebing in the North-West and Mid-Jutland.

Table 4.1: Number of firms within different sub-sectors of the furniture industry in Viborg County, 1992 and 1999 (Statistics Denmark, 2003).

	1992	1999
Sawmills	20	14
Manufacturers of boards etc.	5	5
Manufacturers of furniture frames etc.	7	3
Manufacturers of chairs, sofas etc.	34	29
Furniture upholstery	27	26
Manufacturers of office and shop furniture	15	14
Manufacturers of kitchens etc.	6	3
Manufacturers of beds, shelves bureaus etc.	101	78
Furniture painting	14	9
Manufacturers of madras's	2	3
Wholesalers of furniture's	42	46
Wholesalers of wood and construction parts	77	58
<b>Total</b>	<b>350</b>	<b>288</b>

Table 4.1 above shows different types of firms included in the furniture industry. It can thereby be defined as an industrial cluster of firms positioned at different stages of the value chain or market segments of furniture making. The table document a decrease in number of firms from 1992 to 1999 and combined with the numbers of employed in

figure 4.1, above, this indicates that the average size of the furniture related firms has been growing in the same period. This is confirmed in the figure below.



Figure 4.3: Size of firms in the furniture industry of Viborg County in terms of number of employed, 1992 and 2001 (Statistics Denmark, 2003).

The total number of furniture related firms has decreased, but the largest categories of firms (more than 50 employees) have increased their number from 1992 to 2001 (see figure 4.3 above).

In this section it has been illustrated, that both the national furniture producing industry and the local industry in Viborg County is dominated by small and medium sized firms. However, a small number of large furniture producing firms employs a relatively large share of the total employed and represents a major share of the total turnover in the industry. In Viborg County a relatively large number of furniture producing firms are located and thereby, in location terms, represents an industrial cluster of furniture production.

## **5. A synthesis of logistics flows and logistics organisation in the industrial furniture district of Viborg County**

In this section the logistical flows and organisation of the local furniture industry of Viborg County has been analysed more in-depth. The intention has been not only to reach a descriptive type of analysis, but also to provide some possible explanations for the actual findings of flows by looking more into the logistical decisions making at the local furniture producing firms in Viborg County.

Based on a questionnaire 56 furniture firms from different regions of Denmark and from different product segments of the furniture industry, were interviewed via telephone. The purpose was to identify general patterns of organising transport and logistics in relation to the actors' organisational and geographical position along supply chains in this industry.

In the questionnaire the firms were asked to describe their: 1) logistical structure (location of production, warehouses, supply and market regions); 2) trading links (relations to suppliers and customers); 3) organisation of product flows (production on-demand or to stock, just in time, etc.), and 4) management of transport (own transport, external freight firms, local or non-local transport firms).

The findings has been elaborated through a series of in-depth interviews in selected firms related to the wholesaling of unprocessed wood and transport services for the purpose of analysing discrete examples of transport chains in the furniture industry. The analytical interest was limited to input flows of wood, processing flows of wooden furniture components and output flows of wooden furniture by furniture producers. Even though the products of the furniture industry consist of multiple types of inputs, wood is the dominant component in terms of transported volume.

### **5.1 The logistical flow of the furniture industry in Viborg County**

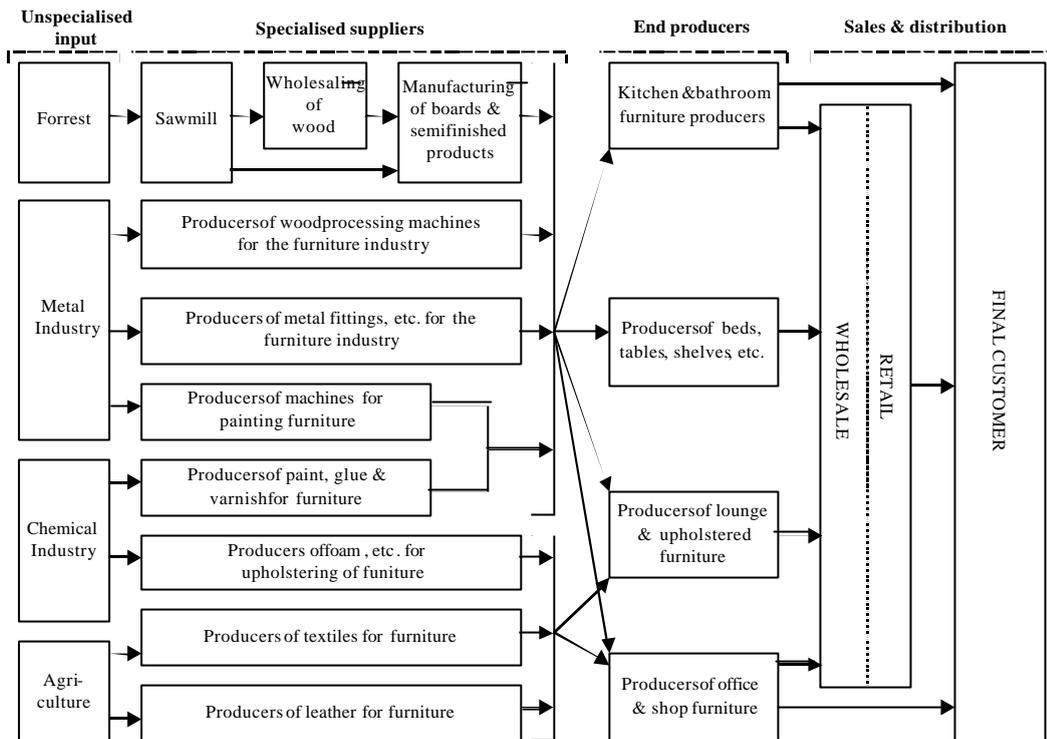


Figure 5.1: Main flows in the value chain of the furniture industry (Maskell, 1997).

The value chain of the furniture industry is like most other types of industries a complex network of relationship across a large number of sectors – e.g. forestry, agriculture, metal working etc. – and between different layers of value adding processes – e.g. raw materials, unspecialised supply, end producer etc.

In the Local District Analysis (LDA) in Viborg County we have selected a narrow perspective on only a part of this value chain complex. Based on information from local informants (firms and local authorities) the focus is on the logistical flow of wood to the local furniture industry in Viborg County. Wood is a component that basically characterise the majority of the furniture products and it is a raw material, which is imported to the region by the furniture firms in large quantities and volumes. Therefore, it is presumed that this product has a significant impact on how substantial parts of the logistical flow in the local furniture industry is organised. This material flow refers to upper flow of unspecialised input, specialised suppliers and end producers in the figure 5.1 above.

The LDA has in our case study been structured as a study of in- and output flows of the local furniture industry in Viborg County. Thereby, have we identified major structures of the logistical flow – e.g. transport corridors, transfer nodes, modal choice. We have also focused on the organisational set-up of how the logistical chains are organised by the different types of actors involved (furniture producers, transport firms etc.). This perspective has served to identify how far the logistical competence is locally situated among local decision-makers or situated outside the regional territory of Viborg County. The location of competencies to organise the logistical flow is important to identify in order to assess the possibilities of the local and regional authorities to implement strategies of sustainable district logistics. As a hypothesis, it is presumed that it is difficult to involve local firms in a process of developing more sustainable logistics, if decisions vital for the structuring of the logistical flow, is situated outside the local/regional planning sphere.

The concentration of the furniture industry in Viborg County has no straightforward explanation in terms of traditional location factors. There is no significant forest to supply the furniture industry, and the major share of the furniture goods is exported to foreign markets. Specially, in the local area of Salling, within Viborg County, is the density of furniture producing firms high. The development of the furniture industry in this area seems to have been closely tied in with a local entrepreneurial spirit. Until the 1970s, only a small number of furniture firms were located in Salling, as well as a similarly small number of carpenter firms related to the construction industry. The general economic recession in the middle of the 1970s caused a crisis in the construction industry, but instead of closures, the carpenters used their knowledge from working with wooden materials for the manufacturing of wooden furniture. The knowledge of furniture production and markets inherited from the small number of existing furniture firms was shared with the newcomers and developed as a common asset and resource of the region in the following years (Lorenzen, 1999).

For that reason, the competitiveness of the local furniture industry has not only been the result of product quality and design content (characterised by the original furniture producers of Salling). It has also been driven by qualitative flexibility in terms of quick response to heterogeneous demand, customisation and continuous product innovations allowing for constant reorientation to customers' needs in different markets with various style preferences. In addition, production flexibility plays a central role in the way that the majority of local furniture producers are both end-producers and sub-contractors. Therefore, in case of lower demand for its own end products, the single firm minimises the idle time of its production capacity by offering sub-contracting work to other local firms.

Most of the wood used to make furniture is pinewood imported from Sweden and Finland, and the primary markets for pinewood furniture are Germany, Denmark, Norway, and Sweden. By analysing the transport network from the specialised suppliers through the end-producers to the distribution of the value chain, the present study has identified where the capability of governance in the transport network is located organisationally and territorially.

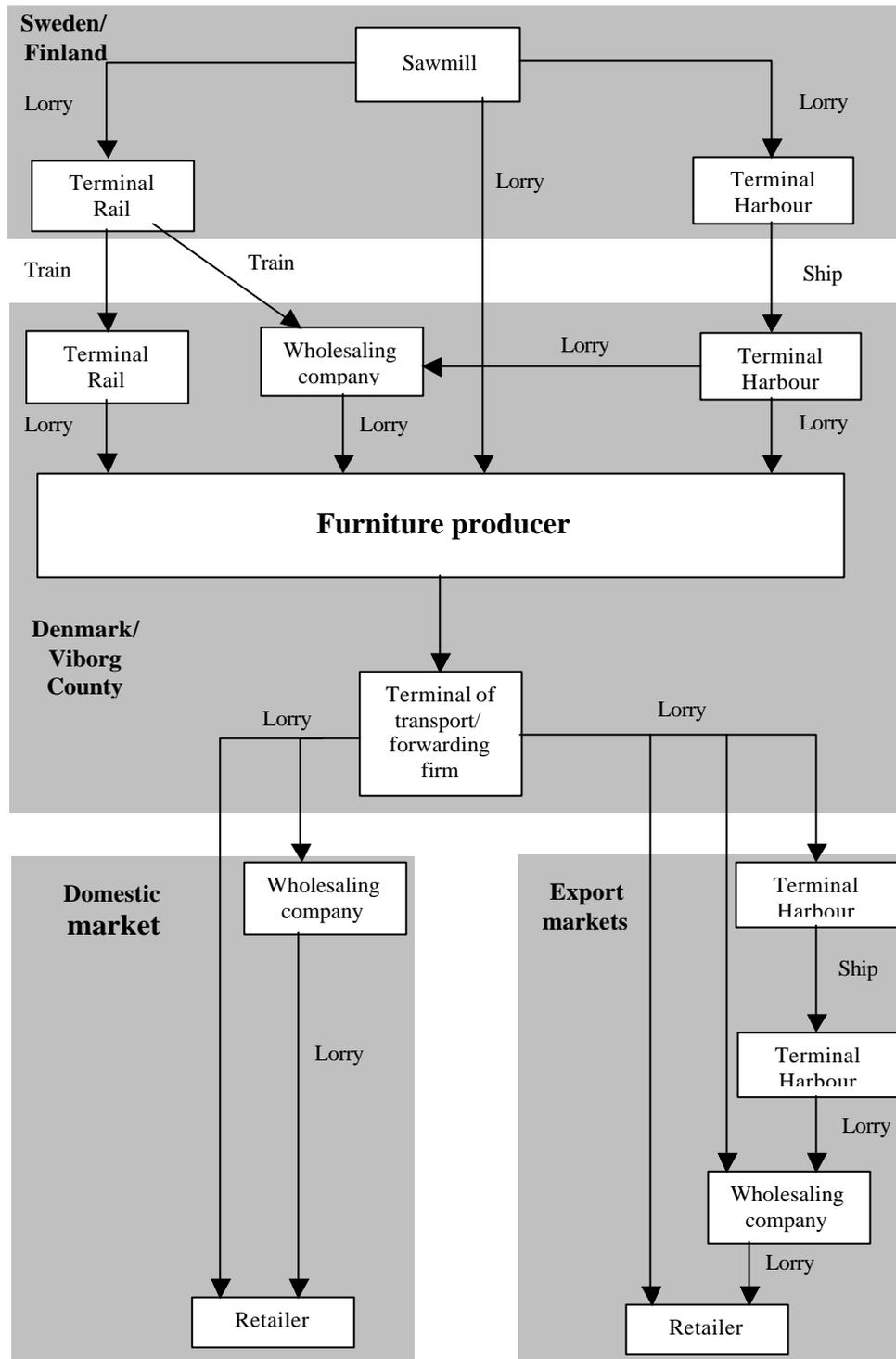


Figure 5.2: Major nodes, links and transport modes in the logistical flow of the local furniture industry in Viborg County.

Figure 5.2 illustrate the logistical flow of softwood as raw material imported to the furniture producing firms in Viborg County. This type of wood, as opposed to different types of hard wood, is an important component in wooden furniture from a large share of the local furniture industry in Viborg County.

Results from the District Logistics Analysis show a marked difference in the way various modes of organising transport by furniture firms is brought into action. On the

one hand, the transport flows of unprocessed wood to furniture producing firms is usually organised by the wholesalers or the sawmills that buy transport services and therefore choose the transport mode and the forwarder or transport operator. For the furniture producing firms in Viborg County, this transport flow of unprocessed wood is furthermore concentrated in specific transport corridors from sawmills in Sweden and Finland. This choice of supply is depending on which type of furniture product the individual firm is producing – soft or hard wood. The latter, is predominantly imported from Sweden and Finland.

## 5.2 Localised logistical competencies

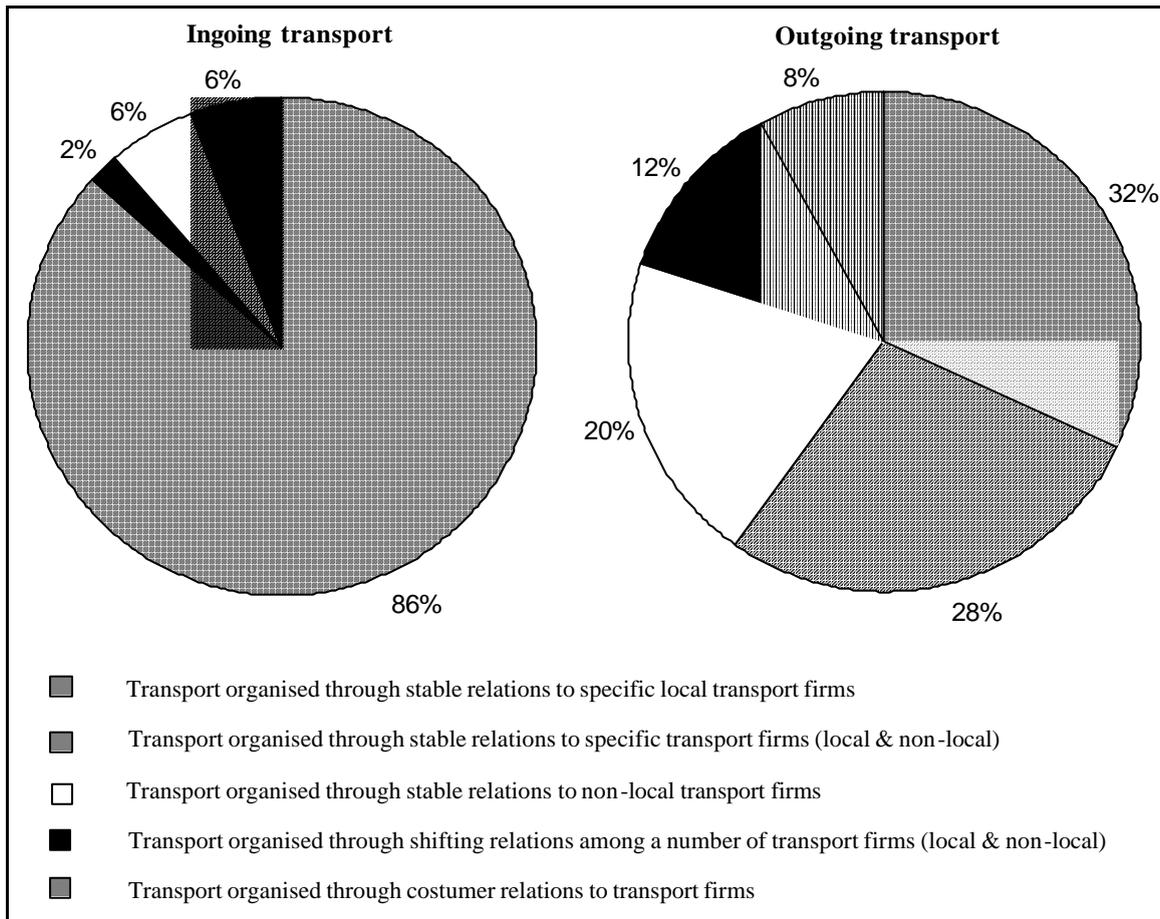


Figure 5.3: Forms of organising in- and outgoing transport among furniture firms (own study).

Like in many other types of industries, firms in the furniture industry usually buy their transport services from external transport firms. In figure 5.3 above, it is illustrated that ingoing transport predominantly is organised by the furniture firm's suppliers. In the survey among 56 furniture producers it is 86 pct. of the firms, which has the ingoing transport organised by their suppliers of wood (e.g. sawmills or wholesalers). This means that choice of transport mode and specific transport firm most often determined by the suppliers of the furniture industry, which often are located outside Viborg County.

The Local District Analysis indicates that the furniture producing firms usually possess the competence to organise the transport of furniture to their customers. The furniture producing firms tend to use transport firms, which have organised their outward-bound

transport flows for longer periods of time. The local furniture firms' use of transport firms primarily within or close to Viborg County reveals a highly localized structure of decision-making concerning the organisation and management of the transport chain related to *intra-regional distribution* and *interregional output*.

*Table 5.1: Location of transport firms used by furniture producing firms located in Salling and Viborg County, the remaining part of the Western part of Denmark, and the Eastern part of Denmark (own study).*

<i>Location of transport firms</i>	<i>Location of furniture firms</i>		
	<b>Salling and Viborg County</b>	<b>Western Part of Denmark</b>	<b>Eastern Part of Denmark</b>
<b>Salling and Viborg</b>	80 pct.	62,5 pct.	0 pct.
<b>Western Part</b>	30 pct.	37,5 pct.	40 pct.
<b>Eastern Part</b>	0 pct.	0 pct.	40 pct.
<b>Multiple locations in Denmark</b>	35 pct.	25 pct.	80 pct.

The present study does not only confirm the existence of a localised specialisation in furniture production, but also identifies a highly localised specialisation within furniture transportation in Salling and the surrounding County of Viborg. This specialisation in furniture transportation is reflected in the way in that furniture-producing firms located in Salling and the surrounding county of Viborg use locally based freight haulage firms. However, furniture producers in other parts of Denmark also do, to a large extent, use freight haulage and forwarding firms located in Salling and Viborg County (cf. Table 5.1 above). These results from the questionnaire and in-depth interviews indicate that a number of transportation firms in Salling and the County of Viborg seem to have benefited from the geographical clustering of furniture production in terms of developing a nation-wide reputation of being skilled and competent in handling and organising transportation and logistics of furniture.

In relation to the furniture producing firms, localised in Viborg County, their use of primarily local transport firms indicates a highly localised governance structure of the *intraregional distribution* and *interregional output* of the total transport chain of the furniture industry in Salling as a whole (illustrated in Figure 5.4 below).

This localised capability seems to be embedded in the inter-organisational relations between the local furniture producers and transport firms that have evolved since the growth of the furniture production from the mid-1970s onwards.

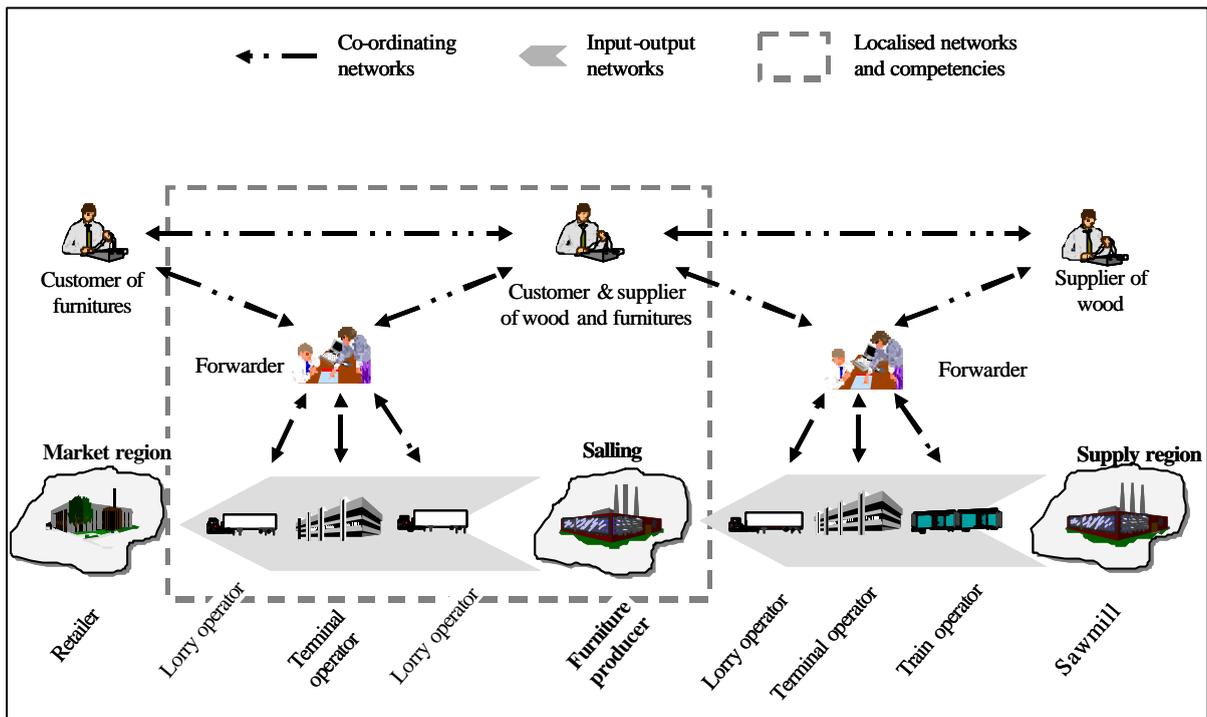


Figure 5.4: A demarcation of the localised competence in the network of actors involved in organising the transport and logistical chains of the furniture industry in Salling and Viborg County.

A major difference between input and output of the producers in Viborg County is the variety of load sizes and frequencies of delivery. Supply of non-processed pinewood is normally organised as weekly deliveries directly from the Swedish or Finish sawmills, or by Danish wholesalers. The furniture producers very often do not have a large inventory, but instead rely on just-in-time deliveries. The sawmills or the wholesalers manage the inventory of non-processed wood. By using contracts of 3-6 months with the furniture producers the wholesalers and sawmills hold the capability of organising full load transport by ship or train in a frequent – but not necessarily fast – transport schedule. The full loads are divided into part loads for different customers at the loading terminals in Denmark (ports or railway terminals). However, the cluster of furniture firms using pinewood, particularly in Salling, makes co-distribution to several customers in one load possible.

A somewhat different procedure is used when the finished furniture goods are to be distributed to the final markets. The major difference is that individual producers can make consignments of varying sizes, from a single chair to a truckload of goods. The furniture industry in Salling includes firms that produce small batch orders of a single sofa as well as firms that mass-produce “knock down” furniture to large retail chains. As in the case of non-processed wood, the furniture producers often do not have storage capacity for the finished furniture goods.

A large number of the transport companies used by the producers have established dedicated storage facilities for their furniture producing customers. These transport companies have to a large degree established a regional network of pick-up and distribution among several furniture producers on each trip. To handle the challenge from the unpredictable shifts in consignment sizes and be able to consolidate transport of furniture goods to particular export markets, the transport companies have developed

particular schemes for frequencies and route networks their trips. The transport companies have often designated days in the week for distribution of furniture goods to specific European markets - for example, the collection of furniture to Germany every Monday and Wednesday. Alternatively, the transport companies collect all the furniture goods for different markets from one producer and bring it to the storage facility of the transport company, where it can be split and consolidated within a week before shipment to the final markets. The furniture producers and their customers seem to accept up to a week of distribution time to export markets in Europe, which gives the transport companies time to consolidate furniture goods - as far as possible - in full loads.

## 6. Freight transport and the environment in Viborg County

It has not in the current DLA been possible to identify available data for the environmentally effects related to the logistics flows and organisation of the local furniture industry in Viborg County. Public statistics does not display data that reflect the environmental load from specific transport and logistics chains as for example the furniture transport chains. The furniture producing and furniture transporting firms involved in the questionnaire and interviews referred to above, did either not hold relevant data or kept them in an aggregated form, which posed problems to use in the this analysis.

In more strategic and general terms, has a survey been conducted by Institute for transport Studies in 2000, which – among other things - tried to assess the significance of environmental issues related to freight transport among firms located in Viborg County. This survey indicates the current perception among local firms to the strategic importance of integrating environmental considerations in the organisation of transport and logistics activities now and in the near future.

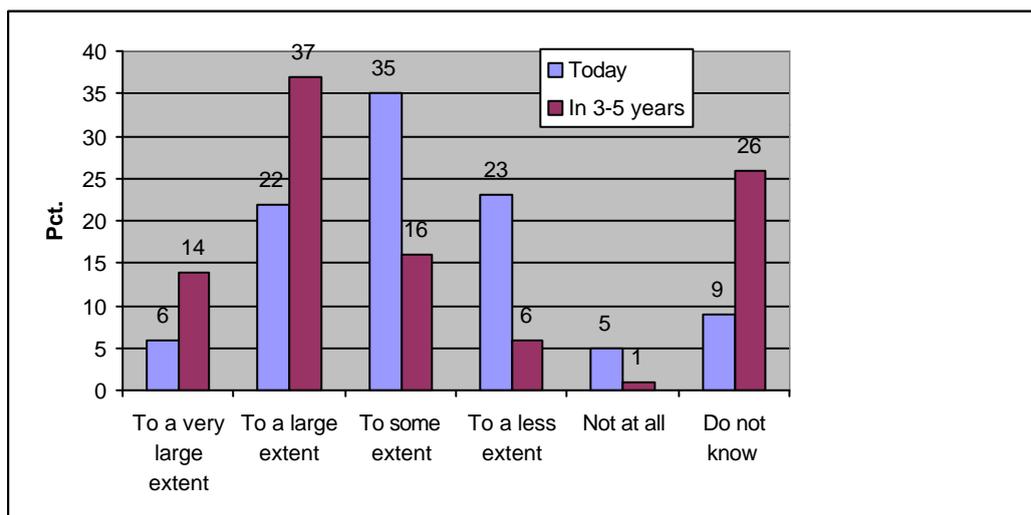


Figure 6.1: To what extent are environmental issues part of the firms priorities – today and in the future ? (Inst. for Transport Studies, 2000).

In the survey, among 86 manufacturing firms in Viborg County with more than 9 employees, it was indicated that environmental issues are crucial for nearly 1/3 of the firms (28 pct.) today, while 58 pct. of the firms stated, that environmental issues only to

some or minor extent is a relevant issue in their daily priorities. According to the survey, does 51 pct. of the firms that environmental issues will play a more important role in their daily business priorities (see figure 6.1).

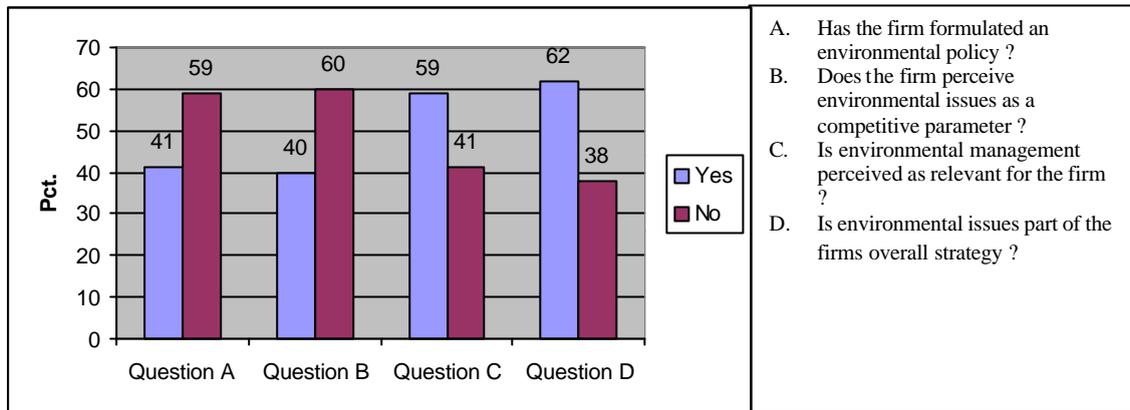


Figure 6.2: The perception of the significance on different environmental aspects of firms in Viborg County (Inst. for Transport Studies, 2000).

App. 40 pct. of the manufacturing firms in the survey state, that they have formulated an environmental policy and perceive environmental issues as a competitive parameter. 59 pct. of the firms perceive environmental management as relevant for their firm, while environmental issues is part of the firms overall strategy for 62 pct. of the firms (see figure 6.2).

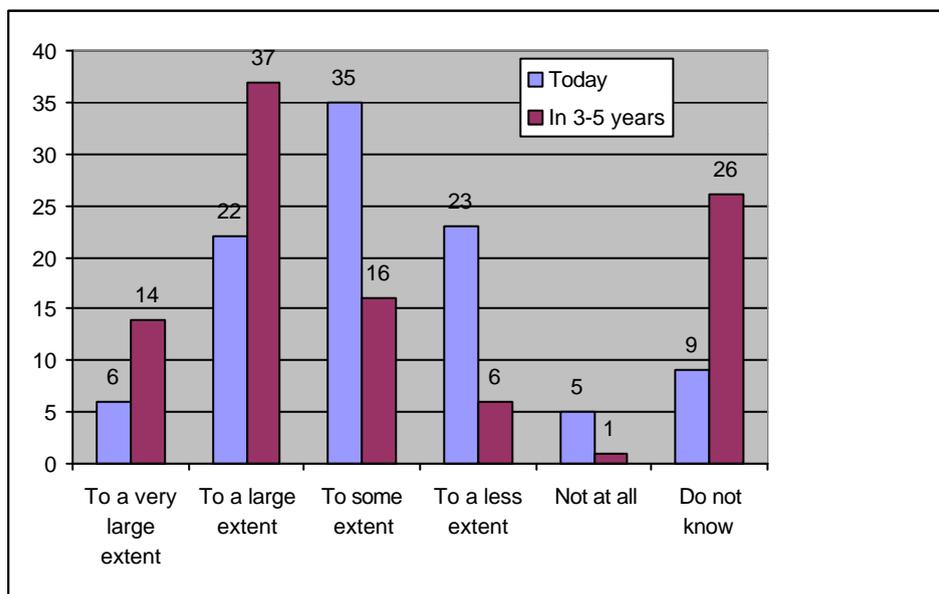


Figure 6.3: To what extent does environmental issues play a role in the firms choice of transport firm – today and in the future ? (Inst. for Transport Studies, 2000).

The survey indicated, that manufacturing firms in general primarily focus their environmental policies in relation to their products and manufacturing processes, while transport only is paid a minor attention. In figure 6.3 above, is illustrated that less than 1/3 of the surveyed firms today use environmental issues to a very large or large extent as a parameter in the selection of transport firms. More than 50 pct. of the surveyed firms expect, that environmental issues to a very large or large extent will be a parameter in the selection of transport firms in the future.

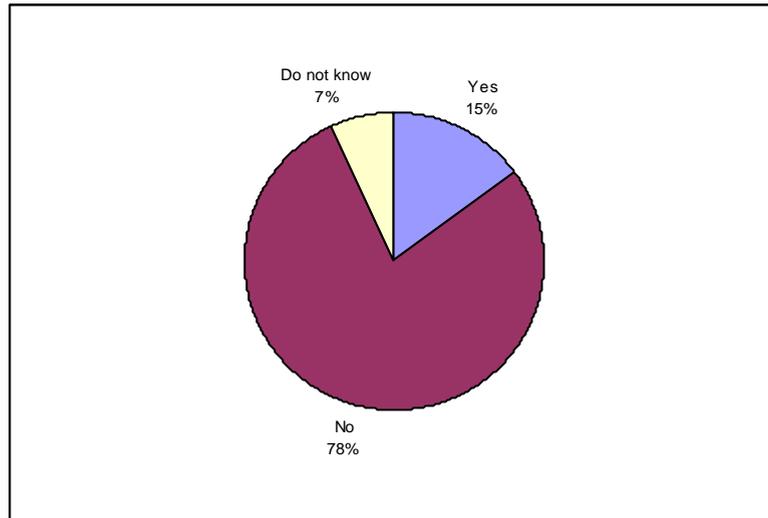


Figure 6.4: Does transport play a role in the firm's environmental policy? (Inst. for Transport Studies, 2000).

Transport from suppliers and costumers are only included as an issue in 15 pct. of the surveyed firm's environmental policies – see figure 6.4 above. Environmental issues are for example transport management to reduce the environmental impact, reduction of packaging in order to optimise the carrying capacity of the vehicles. A few firms state requirements to transport firms about reduction of energy consumption or reduction of emissions. Also a few number of firm's state requirements to the route planning, in order to bypass city centres etc. and thereby reduce the negative impact of their transport (Inst. for Transport Studies, 2000).

## 7. Conclusions

The current DLA illustrates that the furniture industry in Viborg County is a useful example of an industrial cluster of SME's, where the logistical competence is embedded in a network among a number of firms – specially transport firms. Only parts of the logistical competence (in terms of decision-making on logistical organisation) is locally embedded, while other parts (specially ingoing flows) of the logistical decision-making are located outside the territory of Viborg County. This illustrates the close relationship between the logistical flows and the organisation of the inter-firm network as a characteristic of the logistical organisation.

It has been possible to some degree to utilise data from publicly available statistics in the DLA to identify the environmental load from the freight transport sector – but only on a national level. It has not been possible to extract relevant data on a regional level. From other studies it has been possible to get some useful data on the perception and integration of environmental strategies among firms located in Viborg County. Some of this information is also related to freight transport.

Available surveys on the significance of environmental issues indicate, that the environment primarily is perceived as an inter-firm issue. Many firms have formulated environmental strategies for their internal activities – for example production layout and products. However, the majority of firms demanding transport services from external transport firms, does not currently consider the transport of in- and output to their firms as part of their own environmental strategies. This situation reflects a general picture in

the transport and logistics organisation of firms in many Danish industrial branches, that the external transport and logistics (business-to-business or business-to-end customer) primarily is a matter for freight hauling and forwarding firms. The available surveys indicate, that a large number of firms expect, that they in the near future will have to deal with environmental issues – for example via standards and norms – in the organisation of transport and logistics. It seems therefore, that environmental issues are relevant in strategic processes of individual firms, industrial branches and regional development in general.

Based on these results from the DLA of Viborg County it seems useful to conclude, that a promising gate to develop and implement environmental strategies/Sustainable District Logistics in Viborg County could be through the network among SME's and their transport operators. This is based on the observation, that logistics often is an issue organised in an inter-firm network, than within the single firm.

## Annex: DLA questionnaire

### 1. Basic information

Personal information about respondent ?

Name: \_\_\_\_\_

Profession: \_\_\_\_\_

How many employees are employed in the firm ?

\_\_\_\_\_ Full-time

\_\_\_\_\_ Part-time

What amount was the turnover of the firm last year ?

\_\_\_ < 3 mio. kr.

\_\_\_ 3-10 mio. kr.

\_\_\_ 10-25 mio. kr.

\_\_\_ 50-100 mio. kr.

\_\_\_ > 100 mio. kr.

### 2. Customer relations

How is the turnover of the firm distributed on the following types of markets:

	%
Sub-supplies to final assembly	
Sub-supplies to other suppliers	
Sale to wholesalers	
Sale to major retailing stores	
Sale to retailers	
Sale directly to private end-consumers	
Sale to private companies as end-consumers	
Sale to public end-consumers	
Services	
Other types of markets (what ?)	

*Are goods delivered to central warehouses or to single shops ?*

\_\_\_\_\_

If your firm produce or sell furnitures: What type of furniture product:

Inventory for kitchen and bathroom	Inventory for offices and shops	Upholstered furniture	Non-upholstered furniture (beds, carpets, tables, shelves, chairs etc.)	Other types of products (what ?)	%
					100

How is the turnover of the firm geographically located ?

	Sub-sply to other producers	Sale to wholesalers	Sale to retailers	Sale directly to private consumers
Internal in the locality of Salling <sup>1</sup>				
The rest of Jutland and Fuen				
Zealand and the isles				
Scandinavia:				
• Sweden				
• Norway				
• Finland				
The rest of Europe:				
• Germany				
• Benelux				
• France, Spain, Portugal				
• Switzerland, Austria, Italy				
• Great Britain & Ireland				
• Rest of Western Europe				
Baltic				
Rest of Eastern European countries				
Outside Europe:				
• Russia				
• Asia				
• Africa				
• North- and Latin America				
Any other countries (which ?): _____				

### 3. Transport *from* the firm in general

What characterise consignments from the firm ?

	Sub-deliveries for other producers	Sale to wholesalers	Sale to retailers	Direct sale to final consumers
Sales value per consignment				
Number of distributed consignments per week				
Size of consignments				

*Cubic or tonnes ?*

*Full or less than full loads ?*

*Consignments to single costumers or consolidated consignments to market ?*

*Categories: low value, medium value or high value ?*

What delivery terms are used for sale of furniture ?

	%
Ab fabric	

<sup>1</sup> Med Salling-regionen menes her kommunerne Farsø Morsø Sallingsund, Skive, Spøttrup, Sundsøre og Vinderup.

Free delivery	
Other type of delivery (which ?)	

How is the outbound transport normally organised ?

	%
The focal firm is fully responsible for the transport and organise it by own vehicles	
The focal firm is fully responsible for the transport and organise it by long-term relations to local transport firms	
The focal firm is fully responsible for the transport and organise it by long-term relations to national transport firms	
The focal firm is fully responsible for the transport and organise it by long-term relations to foreign transport firms	
The focal firm is fully responsible for the transport and organise it by day-to-day relations to transport firms	
The costumer is fully responsible for the transport and organise it by own vehicles	
is fully responsible for the transport and organise it by external transport firms	
Other types of organisation (what ?)	

***Relation to the transport firms: long- or short term ? Specialised furniture transport firms ?***

How important are the following parameters in relation to outbound transport ?

1 = very important, 2 = important, 3 = less important, 4 = no importance and 5 = no opinion

	Importance	Priority
High goods safety		
High frequency		
Short transport time		
Punctual delivery		
Low price		
Other parameters (which?)		

#### **4. Input to the firms production**

How is the value of the input to the production distributed ?

	Wood	Metal	Plastic	Chemistry	Leather & Textile
Unrefined products					
Standard furniture components					
Dedicated furniture components					

***What type of wood is being used ?***

Where is the input to the firm delivered from geographically ?

	Wood	Metal	Plastic	Chemistry	Leather & Textile
Internal in the locality of Salling <sup>2</sup>					
The rest of Jutland and Fuen					
Zealand and the isles					
Scandinavia:					
• Sweden					
• Norway					
• Finland					
The rest of Europe:					
• Germany					
• Benelux					
• France, Spain, Portugal					
• Switzerland, Austria, Italy					
• Great Britain & Ireland					
• Rest of Western Europe					
Baltic					
Rest of Eastern European countries					
Outside Europe:					
• Russia					
• Asia					
• Africa					
• North- and Latin America					
Any other countries (which ?): _____					

## 5. Transport to the firm in general

What characterise the different types of input ?

	Wood	Metal	Plastic	Chemistry	Leather & Textile
Sales value per consignment					
Number of distributed consignments per week					
Size of consignments					

*Cubic or tonnes ?*

*Full or less than full loads ?*

*Consignments to single costumers or consolidated consignments to market ?*

*Categories: low value, medium value or high value ?*

Which types of delivery conditions are used for purchase ?

	%
Ab fabric	
Free delivery	
Other type of delivery (which ?)	

<sup>2</sup> The Salling area is defined by the three municipalities of Farsø Morsø Sallingsund, Skive, Spøttrup, Sundsøre and Vinderup.

How is the outbound transport normally organised ?

	%
The focal firm is fully responsible for the transport and organise it by own vehicles	
The focal firm is fully responsible for the transport and organise it by long-term relations to local transport firms	
The focal firm is fully responsible for the transport and organise it by long-term relations to national transport firms	
The focal firm is fully responsible for the transport and organise it by long-term relations to foreign transport firms	
The focal firm is fully responsible for the transport and organise it by day-to-day relations to transport firms	
The costumer is fully responsible for the transport and organise it by own vehicles	
is fully responsible for the transport and organise it by external transport firms	
Other types of organisation (what ?)	

*Relation to the transport firms: long- or short term ? Specialised furniture transport firms ?*

**How important are the following parameters in relation to inbound transport ?**

1 = very important, 2 = important, 3 = less important, 4 = no importance and 5 = no opinion

	Importance	Priority
High goods safety		
High frequency		
Short transport time		
Punctual delivery		
Low price		
Other parameters (which?)		

## 6. Specific example of *inbound* transport

The focus is on a specific example of input to the focal firm. The specific choice of the transport chain is agreed upon within the interview.

What type of good ?	
Origin and destination in the specific transport chain ? Hvorfra og hvortil går den pågældende transportkæde ?	From country _____ from city _____ To country _____ to city _____
Which route ?	
How far is the transport distance ?	App. _____ km.
Quantities per year ?	App. _____ ton.
Size of each consignment ?	App. _____ ton.
What type of consignment ?	- Full load - Less than full load - pallets

	<ul style="list-style-type: none"> <li>- general cargo</li> <li>- other type (what ?)</li> </ul>
The value of the single consignment ?	App. _____ kr.
Choice of transport mode ?	<ul style="list-style-type: none"> <li>- train</li> <li>- lorry</li> <li>- airplane</li> <li>- ship</li> <li>- combination (how ?)</li> </ul>
Use of own or external transport modes ?	
Which type of loading unit ?	<ul style="list-style-type: none"> <li>- container</li> <li>- trailer</li> <li>- veksellad</li> <li>- bulk container</li> <li>- other type (what ?)</li> </ul>
Use of own or external loading units ?	
Who is responsible for organising the transport ? Customer or supplier ?	
Is the transport co-ordinated together with other transports ?	

## 7. Specific inbound transport

The focus is on a specific example of input to the focal firm. The specific choice of the transport chain is agreed upon within the interview.

What type of good ?	
Origin and destination in the specific transport chain ? Hvorfra og hvortil går den pågældende transportkæde ?	From country _____ from city _____ To country _____ to city _____
Which route ?	
How far is the transport distance ?	App. _____ km.
Quantities per year ?	App. _____ ton.
Size of each consignment ?	App. _____ ton.
What type of consignment ?	<ul style="list-style-type: none"> <li>- Full load</li> <li>- Less than full load</li> <li>- pallets</li> <li>- general cargo</li> <li>- other type (what ?)</li> </ul>
The value of the single consignment ?	App. _____ kr.
Choice of transport mode ?	<ul style="list-style-type: none"> <li>- train</li> <li>- lorry</li> <li>- airplane</li> <li>- ship</li> <li>- combination (how ?)</li> </ul>

Use of own or external transport modes ?	
Which type of loading unit ?	<ul style="list-style-type: none"> <li>- container</li> <li>- trailer</li> <li>- veksellad</li> <li>- bulk container</li> <li>- other type (what ?)</li> </ul>
Use of own or external loading units ?	
Who is responsible for organising the transport ? Customer or supplier ?	
Is the transport co-ordinated together with other transports ?	