Regional Transport Networks and Competencies
- a case study of transport chains in the furniture industry of Salling

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1. Introduction

In recent years the transport sector has been in focus in relation to the negative environmental externalities caused by the growth in traffic. One of the major problems of pursuing an environmental policy of action at national and local level is the lack of knowledge of possible relationships between specific industries, their locational pattern and the need for transport. In other words, how specific products and specific industrial geographies generate specific transport needs.

This paper presents preliminary results from an ongoing study, financed by the Danish Transport Council, of how transport chains are organised and where the competence for organising the transport is located among specific actors in the Danish furniture industry in general and specifically in a region in west Jutland. The study has identified clusters of transport chains in the industry, that have similar features of involved transport modes, actors, transport corridors and transhipment points in the transport of major input (soft wood), processing, and major output (furnitures). These different clusters of transport organisation reflects differences in locational and organisational patterns in the Danish furniture industry. The study also indicates the presence of a kind of ”localised transport competence” embedded in close relations between local furniture firms and local transport firms.

The study consists of a questionnaire, responded by 56 randomly chosen furniture firms, in order to identify clusters of transport organisation[1]. A second phase is based on in-depth interviews with selected firms representing examples of identified transport chains of furniture firms, wholesalers and transport companies. The present paper reflects the ”work in progress” of the study, which is being finally reported in the end of 1999.

2. Transport systems, productions systems and space

The standard analytical framework of transportation economies deals with transportation investments and their impacts on the economic system, in terms of growth, productivity and regional development. This framework often leads to a kind of structural determinism of regional development through transport infrastructure investments.

The classical industrial location theories of e.g. Alfred Weber , Lösch and Walter Isard during the 20th century developed ”space equilibrium models” based on assumptions of a classical economic rationallity governing the locational behaviour of firms. Weber (1909) assumed in his analysis that factories would be positioned with respect to raw material sources and markets, at points which minimised transport costs. The implications was that there would be a simple linear flow of products from raw material source to final point of sale via a single processing plant. The deductions for locational behaviour made from these premises and assumptions were that a rational location for a new plant would be one which maximised on proximity to raw materials where there was substantial weight loss in production – hence minimizing on

transport costs, and one which maximized on proximity to the market where production resulted in a gain in weight – thus maximizing on transport costs. Weber's hypothetical factories were embedded in very simple supply chains comprising one tier of suppliers upstream and one tier of customers downstream. This model-based perception of rational locational behaviour of firms though over-simplifies the pattern of freight movement in many contemporary industrial sectors, in which factories are intwined in complex networks linking them to many tiers of suppliers, subcontractors, distributors and transport operators.

On the regional level empirical research does call in question a clear-cut correlation of transport infrastructure investments on the one side and economic development and growth of local economic activities on the other side (Hjalager, 1993; AKF, 1993, McKinnon, 1997).The role of the transport operators and forwarders as active parts of organising the transport and logistical system has also to a large degree been neglected in the simplistic view of correlations between physical infrastructures and increased business opportunities for local firms and industries.

The implicit conceptual representation behind models like Weber's refers to the neoclassical framework of localisation of economic activities. In this framework, the improvement of technologies meant to overcome space in interacting (i.e. transportation and telecommunication techniques) will lead to the abolition of spatial friction. This is based on two essential assumptions:

- production is a combination of generic production factors, exclusively procured through market transactions;
- space is a reservoir of generic resources that can be transferred (or are accessible at a certain cost)

Recent theoretical developments on the theory of firm networks and in regional science can be useful to develop alternative assumptions. The evolutionist theories of production and innovation, for instance, adopt an approach in terms of resource creation (as opposed to resource allocation). Production is here based on specific resources created through organisational learning. The paradigm of neutral space, on the other hand, has been contested by a long tradition of heterodox research ranging from industrial districts and growth poles (Marshall, 1919; Peroux,1950) to local systems of innovation (milieu) and production and, more recently, the concepts of proximity related to organisational learning and innovation (Crevoisier & Maillat, 1993; Camagni, 1993b).

An alternative approach to the traditional models can draw on the heterodox approaches in regional sciences of socially constructed space, as well as on the GREMI-approach[2] on innovation processes through firms' network and localised milieu (Camagni, 1993a; Ratti, Bramanti & Gordon, 1997). The creation of products uses specific resources, such as knowledge which can be tacit and non standardised and embedded in actors, organisations and collective learning processes (Granowetter, 1985; Lundvall, 1992).

Storper (1995) has developed this idea through the approach of the "region as a nexus of untraded interdependencies". The untraded interdependencies are not transferable on a market and generate region-specific assets in production. These assets are regarded as the central form of scarcity in contemporary capitalism, and not the availability of generic resources, as it is assumed in more traditional location analysis.

Since such untraded interdependencies rely on knowledge or practices which are not fully codifiable, the particular firms who master it are tied into various kinds of networks with other firms, both through formal exchanges and through untraded interdependencies. The latter include labour markets, public institutions, and locally or nationally derived rules of action, customs, understandings, and values. By identifying so-called untraded interdepencies as a central dynamic of region-specific assets of a local

production system, the approach by Storper and other scholars within regional sciences has seriously challenged the orthodoxy of comparative advantage in location analyses.

Storper (1995:206) has summarised the argument as follows:

1. "Technological change is *path dependent*
2. It is path dependent because it involves interdependencies between choices made over time – choices are sequenced in time, not simultaneous, and often irreversible
3. These choices have a spatial dimension which is closely tied to their temporal uncertainty and interdependence. Some inter-organisational dependencies within the division of labour, that is input-output or network relations involve some degree of territorialisation. But in *all* cases where organisations cluster together in territorial space in order to travel along a technological trajectory, they have interdependencies which are *untraded*, including labour markets and "conventions", or common languages and rules for developing, communicating and interpreting knowledge (although direct input-output relations may also play a role here)"

In Burmeister & Colletis-Wahl (1998) a similar approach is refered to by making the assumption that the main factor of differentiation of space does not lie in the relative prices of production factors nor in transport costs, but in the supply of specific assets and resources which do not compete directly on the market. They make a distinction between *assets* and *resources*: resources are potential production factors, whereas assets are production factors that are in use in a production process. A second distinction is made between *generic* and *specific* resources and assets. Generic production factors exist independently from their participation in a production process and can thus be transferred from one production to another. Specific assets are related to a specific production process and cannot be transferred to another without sunk costs. Specific resources are virtual and can thus not be transferred. These specific resources are critical factors in the process of technology creation.

Traditional location analyses refer only to generic resources and assets which can be transferred in space. In the alternative framework, regional development trajectories are mostly related to specific resources, which cannot be tranferred and which are constructed by the actors of a territory in a path-dependent, cumulative process. The alternative analysis of regional development in relation to the transport system can be translated into the following assumptions:

- Regional development is mainly related to the path-dependent process of creation of specific resources.
- Transport infrastructure is, in most cases, a generic resource which can be used in different production processes.
- The significance of transport systems in regional development is primarely a question of specific resources embedded in organisational networks between production and transport firms.

The conjunction of these three assumptions would imply that regional development is less directly related to the investments in terms of generic infrastructure as to the organisational network between production and transport firms. A network which - in the case of a spatial proximity between the actors – could be conceptualised as a localised governance structure in transport chains. The analytical approach of transport chains in relation to territorially embedded governance structures will therefore be developed further in the next section.

4. Transport chains and territorially embedded governance structure

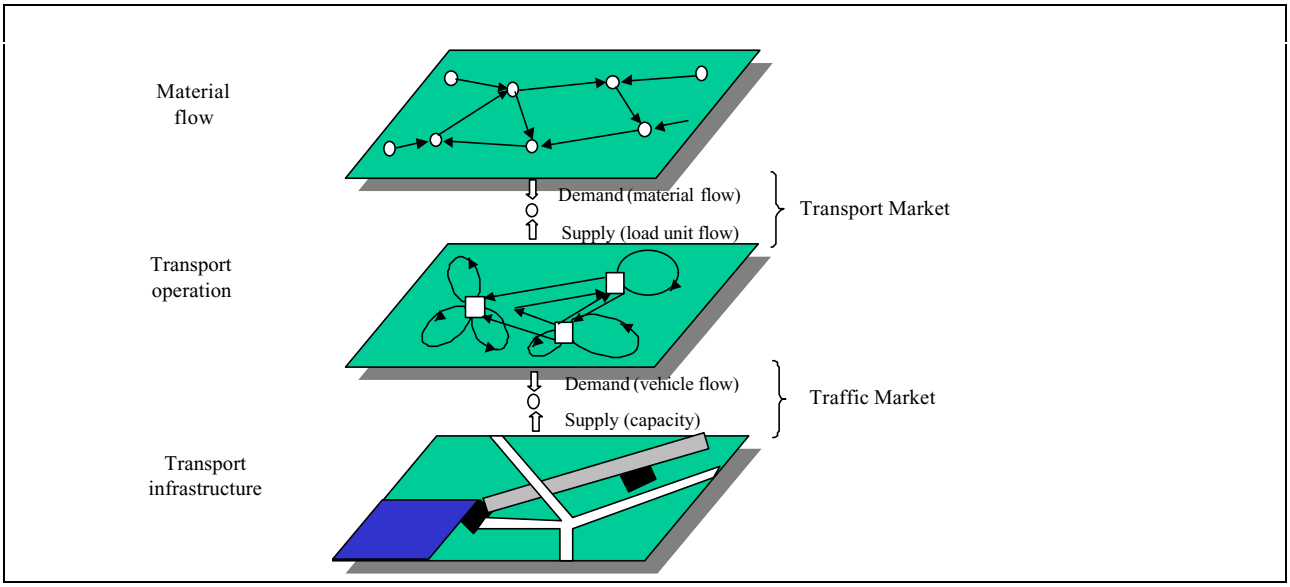

Figure 1: A three-layer model of freight transport (revised version of Wandel & Ruijgrok, 1993:237).

Wandel & Ruijgrok (1993) has developed a conceptual five layer model of different interconnected functional layers in a freight transport system: material flow, transport operation, transport infrastructure, informatics operation and telecommunication infrastructure. In the study introduced in section 1 the focus is primarely on the three first layers which will be elaborated below.

The first layer in figure 1 represents the product logistic activities of manufacturing or trading firms in terms of nodes that are interconnected via links of *material flow systems*. The demand for each link can be described in terms of ton/year, shipment size, frequency, lead time, precision, and flexibility. Demand from all product logistic activities at each node can then be aggregated into the total demand for freight transport services for all the links in the product logistic network.

The second layer involves the logistic activities of transport service companies and reflects the flow of load units and vehicles between nodes, i.e. *transport operations*. In this system, nodes include modal change, transhipment, sorting, consolidation, etc. Load units provide supply opportunities for moving material and goods. The load units are moved by vehicles as trucks, trains, ships, and aeroplanes. The supply of transport capacity for the demand derived from the material flow is then matched on the *transport market*.

The *transport infrastructure* system represents the third layer in the form of roads and interchanges, railways, harbours, airports and aircorridors, pipelines etc. The infrastructure system creates supply opportunities for vehicle movements, i.e. traffic supply in terms of space and time. Vehicle movements for both passenger and material flows generates demand for using the infrastructure. The supply and demand is then matched on the *traffic market*, resulting in actual vehicle movement (Wandel & Ruijgrok, 1993:236-238).

The model developed by Wandel & Ruijgrok focuses on the functional aspects of the freigth transport in terms of interdependent systems. The flow of goods in the material flow, transport operations, and transport infrastructure systems is though governed by actors embedded in the three types of systems. The

actors involved have different capabilities to affect the design of parts of the total system. The capabilities are closely tied to the actual network that the single actor is embedded in, and not only depending on his location within one of the functional subsystems. This contextuality can be related to the actors' resources and assets tied to specific products or services, or it can be tied to a common resource or asset embedded in networks of different actors.

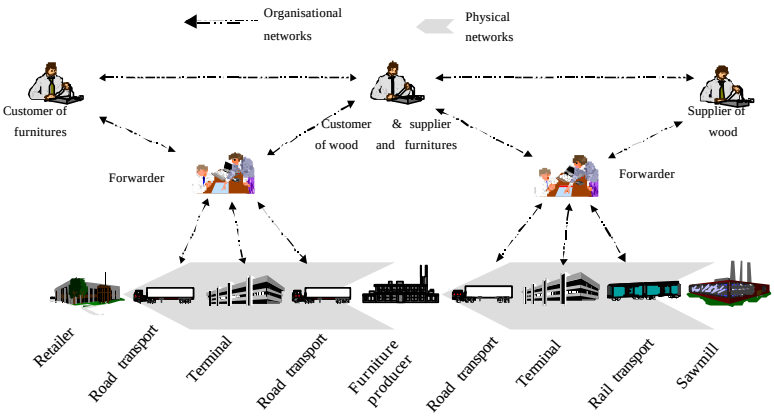

Figure 2: An example of a transport chain within the furniture industry.

As put foreward in section 2 – in the form of three assumptions - the significance of transport systems as regional dynamics for economic development is as much a question of organisational as of physical networks. Inspired by Wandel & Ruijgrok's model it could be interesting to focus more closely on the role of the involved actors in a specific context of material flow, transport operation, and transport infrastructure. The model of a transport chain in figure 2 has been developed in order to integrate the functional dimensions of material and vehicle flows with the organisational dimensions of ressources and assets embedded in interorganisational relationships. By applying this approach the intention has been to describe the actual physical organisation of transport flows on the one side and to identify resources of governance and change among the actors in a specific transport chain on the other side.

5. The furniture industry of Salling – an example of regional transport chains and competences

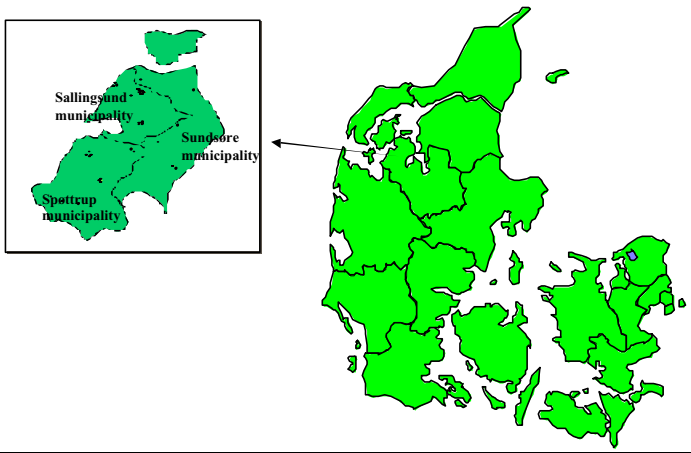

Figure 3: The peninsula of Salling.

The furniture industry in Salling has been chosen as a case to be analysed through the approach outlined in section 3.

The Danish furniture industry in general exhibits two interesting features in terms of the transport chain approach: wood is a dominating input in the manufacturing process and the industry has a large number of firms geographically concentrated in specific areas. Several studies have pointed at a particularly localised and specialised network among local furniture firms in the area of Salling – a peninsula in the north-western part of Jutland (Nielsen & Storgaard, 1981; Christensen, 1992; Maskell, 1997; Lorenzen, 1999).

Displaying the material flow from figure 1 in the furniture industry as a value chain the challenging complexity of the material flow from raw material through processing and finally to distribution and consumption can be illustrated. As indicated in figure 4 below the direct input of the furniture producers is a manifold mixture of wood, metal, chemicals, and agricultural goods. Other inputs as energi, packing, machinery etc. are not included although these goods also require transport.

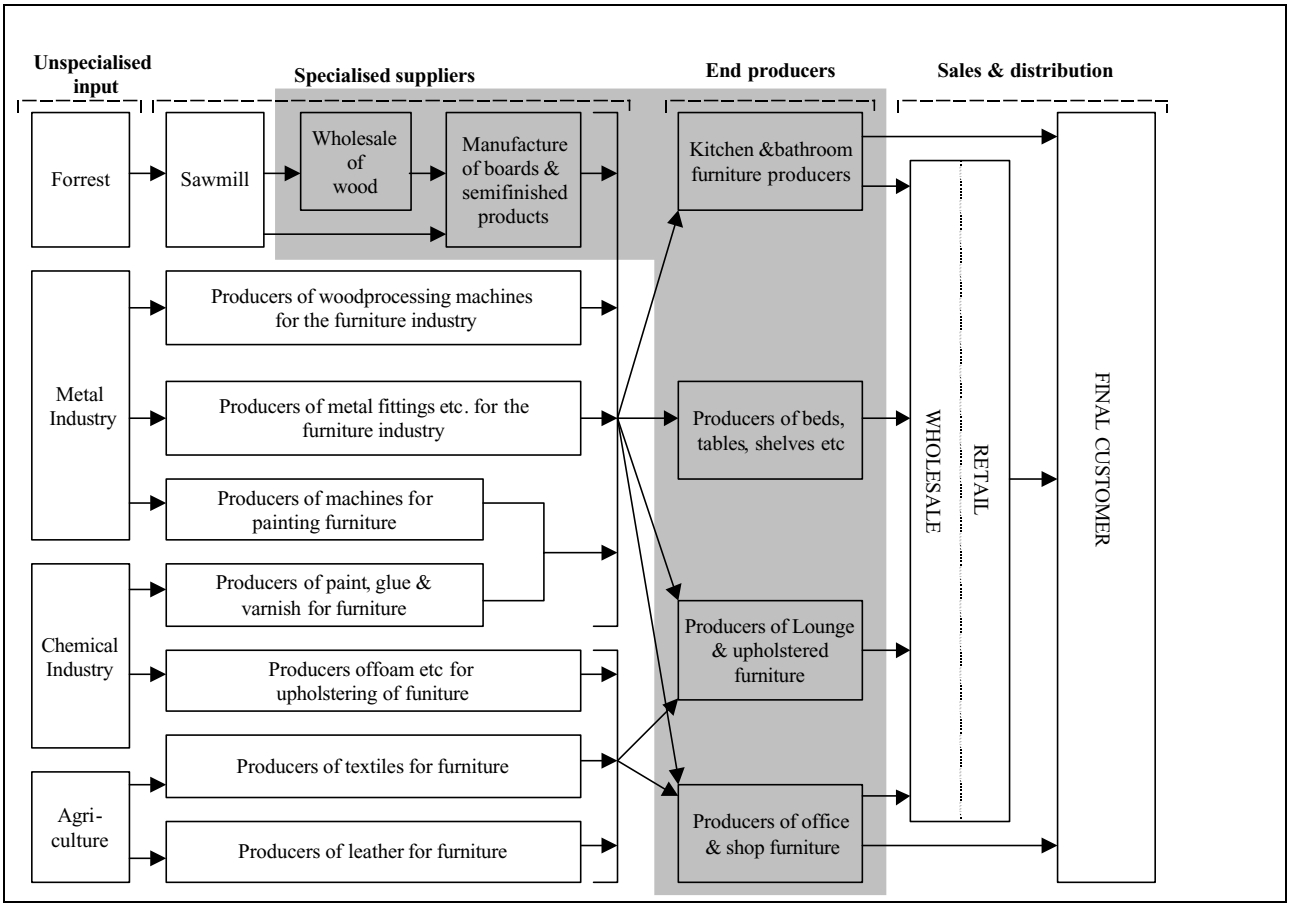

Figure 4: A model of the value chain of the furniture industry. The grey shadowed area of the figure delimits the analytical focus of the current study to only a part of the total value chain of the furniture industry. (revised version of Maskell, 1997:153).

The concentration of furniture industry in Salling has no ”natural” explanation in terms of traditional location factors. There is no significant forrest to supply the furniture industry and the major share of the furniture goods is exported to foreign markets. The development of the furniture industry seems to have been closely tied to a local ”entrepreneurial spirit”. Until the 1970s only a small number of furniture firms was located in Salling and a similar 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 wood materials to the manufacturing of wooden furnitures. The knowledge of furniture production and markets inherited by 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).

The competitiveness of the local furniture industry has though been achieved not only through product quality and design content (characterised by the original furniture producers of Salling), but also through qualitative flexibility in terms of quick response to heterogeneous demand, customisation and continuous product innovations permitting constant reorientation to customers' needs in different markets with various style preferences. Also quantitative flexibility seem to play a central role through the ability to change output volume with existing production facilities and by the ability to allocate idle production capacity between firms within a localised network.

In relation to the organisation of transport of input and output it is only the end producers and parts of the specialised suppliers from the value chain of figure 4 that are located in Salling. Most of the wood used for furniture making is pine wood imported from Sweden and Finland, and the primary markets for pine wood furniture are Germany, Denmark, Norway, and Sweden. By analysing the transport chain from the specialised suppliers through the end producers and to the sales & distribution of the value chain, the current study has identified indications of where the competence of governance in the transport chains is located organisationally and territorially.

The study has shown that both transport by lorry, ship and train is used. Not surprisingly, the predominant part of non-processed wood from Sweden is transported by train and ship, and from Finland by ship. Loads are also transported solely by lorry from the sawmills in Sweden and Finland to the furniture producers in Salling. The "transport corridors" of non-processed wood by sea go from ports at the east coast of Sweden and south coast of Finland to ports at the east cost of Jutland (Århus, Fredericia, Horsens, and Kolding). The transport from the Danish ports to the furniture producers is managed solely by lorries. Non-processed wood from Swedish sawmills to the furniture firms in Salling is also transported by train via ferry across Øresund, through Zealand and Funen to a number of selected railway terminals in Jutland (Kolding, Horsens, Herning, Skive, Århus, and Ålborg). From the railway terminals to the furniture producers lorries are used for the distribution. The transport of furnitures from the producers in Salling to wholesalers and retailers in Denmark and abroad is almost solely done by lorries.

A major difference between input and output of the furniture producers in Salling is the variety of size of loads and frequencies of delivery. Supply of non-processed pine wood 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 inventory of non-processed wood is managed by the sawmills or the wholesalers. By using contracts of 3-6 months to 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 split up in part loads for different customers at the loading terminals in Denmark (ports or railway terminals). But the clusters of furniture firms using pine wood, in particularly Salling, makes co-distribution to several customers in one load possible.

It is somehow a different procedure when the finished furniture goods are to be distributed to final markets. The major difference is the material flow which for the individual producers can be consignments in the size of a single chair to a lorry full of goods. The furniture industry in Salling is both covering firms that produce small batch orders of a single sofa and firms that mass produce "knock down" furnitures to large retail chains. As is the case of inventories of non-processed wood the furniture producers often do not have storage capacity for the finished furniture goods. To this purpose the transport

companies used by the producers have established dedicated storage facilities. Especially a handful of local transport operators and forwarders have specialised in transporting and handling of furniture goods. These transport companies were originally small providers of all-round transport services and often chosen as transport operators by the local furniture firms because of the proximity - probably not just spatially but also culturally. The growth of the local furniture industry during the 1970s and up til the 1990s also brought about a parallel growth in the market for furniture transport by the local transport firms. Most of them skipped the capabilities of all-round transport services and specialised solely in furniture transport during the 1980s.

Out of this closely knitted network between a small number of local transport firms and a major part of the local furniture firms a regional network has been developed based on co-distribution. Some of the major challenges of the transport companies have been the unpredictable shifts in consignment sizes and the ability to consolidate transport of furniture goods to particular export markets. This has required the development of fixed routes of collecting furnitures to specific markets on specific days of the week – e.g. the collection of furnitures to Germany every monday and wednesday. Alternatively, the transport companies collect all the furniture goods to 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 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.

5. Some preliminary conclusions and perspectives

Although the ”research is ongoing” some features of the transport system of the very localised furniture industry in Salling can be outlined in figure 5 below. The material flows of input to the local furniture industry seem to be very concentrated in specific transport corridors from Sweden and Finland. It is usually the wholesalers or the sawmills that buy the transport operation and thereby choose the transport mode and transport firm. This indicates that the governance of the *interregional input* of the total transport chain by specific actors is located organisationally and territorially outside Salling.

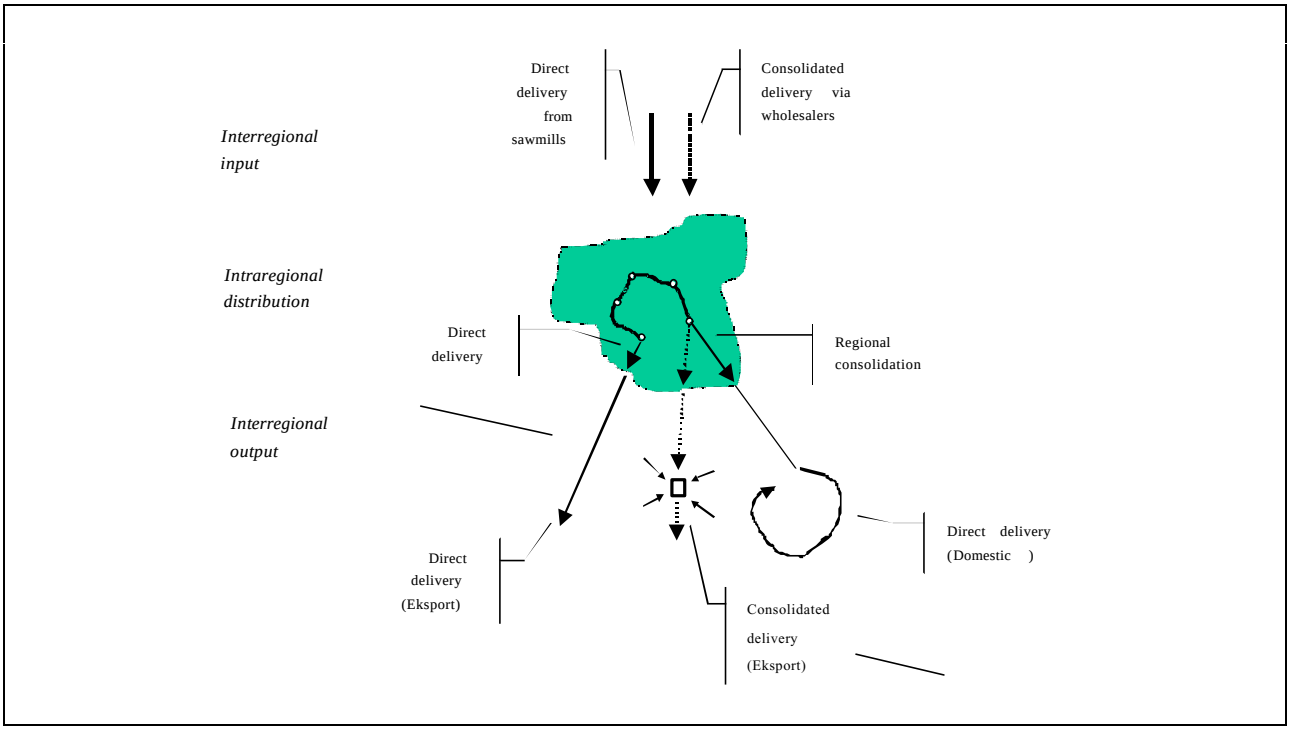

Figure 5: The regional transport and logistic system of the furniture industry in Salling.

On the other hand the study has indicated 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. This localised competence seems to be embedded in the interorganisational relations between the local furniture producers and transport firms that have evolved since the growth of furniture production in Salling from the mid-1970s.

The preliminary findings suggest that spatial proximity, both among the local furniture firms and between these and local transport firms, represent an important condition for the design of the regional transport and logistics system of the furniture industry. The study indicates that there has been developed a kind of localised transport and logistical competence related specifically to the advantage of small and medium sized furniture producers, and that relatively small transport operators has gained a specialised competence in handling furniture goods and organising transport chains from door-to-door. Two aspects seems to be important:

1. economies of scale and scope through networking,
2. and resources of knowledge and innovation embedded in social networks of interaction within a local setting.

First, the large number and concentration of furniture firms has made it possible for a small number of highly specialised transport firms to sustain a dense and frequent distribution and pick up network. This locational pattern of the local furniture industry gives the transport firms the abillity to gain scale economies by consolidation through pick up of furniture goods via multiple stops and through the system of storage and distribution at the warehouses of the transport firms.

In close relation to the scale economies of the local transport system, does the dense distribution and pick up network facilitated by the local transport firms enable a scope economy for many of the small and medium sized furniture firms in terms of markets and shipment size. A common feature of these firms activities is their ability to serve different types of customers in different markets with high variations in size of consignments. Many of the firms send both consignments of a single sofa, table, etc., and part and full loads of furnitures.

A second important feature of the relationship between furniture producer and transport operator is the long term relationships often based on informal aggreements. These long standing relationships are based on trust and – according to respondents in the empirical data – rarely on cost. Trust in this sense can vaguely be defined in terms of the way the transport operator handle the goods, is reliable in terms of delivery to customers and his capability of acting flexible, e.g. in picking up goods at ”any time” needed. This ”trust based” relationships may have a local origin through a common culture between entrepreneurs in the local furniture and transport firms. The long term relationships between many of the furniture firms and a couple of the local transport firms seems to have conditioned the development and reproduction of a common knowledge of strategic importance for the involved actors.

This common knowledge is however not easy to frame explicitly since its character often is embedded in the ongoing social interactions between individuals and organisations. In section 2 this was refered to as untraded interdependencies and it seems as these interdependencies to some extent also are territorially embedded in terms of a dominant localised relationship between furniture firms and transport firms. An important step in the progress of this study is therefore to further elaborate and identify the features of these localised relationships between furniture producers and transport operators.

It is however important to stress, that the transport demand and transport supply of respectively furniture producers and transport operators in Salling also is dynamically related to non-local conditions. Recent

trends seems to indicate a future challenge to this originally localised process of competence development. Examples of these challenges are:

- alliances and take overs of local transport firms by non-local transport companies, which changes the location of governance of transport management
- the expansion of local transport firms markets to non-local customers, which has consequences for the long term efficiency of the transport firms of being located in Salling due to changes in their transport and distribution network
- changes in the products of the local furniture firms from sampled furniture goods to knock-down furniture goods. The former product usually requiring volume transports with a high degree of handling skills of the transport operators involved, and the latter product requiring cost-efficient transport with less importance on handling quality. This development could give more room for non-local and all-round transport firms competing on cost
- a tendency seems to be a growing specialisation of the smaller transport firms in to specific geographical markets. This seems due to a demand from customers of integrated door-to-door services from producer to retailer. This tendency leaves the transport market into two segments of transport operators: on the one side the smaller ones specialised in a specific geographical market and on the other side large transport companies allied with subcontractors (transport operators) operating on several geographical markets.
- Some furniture firms have relocated parts of their production to Eastern European countries in order to gain reduction in labour costs and a proximity to existing German markets and future markets in Eastern Europe. In these cases local transport operators are usually prefered.

The ongoing development could therefore result in both a positive or a negative effect on the local competence development of furniture related transport and logistics. From the perspective of the firms in the region – both transport and furniture – it is a question of getting access to new capital, knowledge, markets, etc. For the region in terms of localised governance and capabilities it depends whether the governance and capabilities embedded in the interaction of firms remain locally orientated or relocates to networks linked to non-local actors. Seen in a regional transport policy perspective it could be of major importance whether competence and governance of transport is located within or outside the borders of the regional territory. As indicated in this study the governance of organising transport in the local furniture industry of Salling is in parts of the transport network very localised and thereby representing a potential for locally and regionally co-ordinated initiatives of policy development between private firms and public institutions.

References

AKF (1993): *Transportinfrastruktur og regional udvikling – udenlandske undersøgelser.* Transportrådets notatserie nr. 93-06. Transportrådet, København.
Burmeister, A. & Colletis-Wahl, K. (1998): "Proximity in Networks: The Role of Transport Infrastructure", in Reggiani, A. (ed.): *Accessibility, Trade and Locational Behaviour*. Ashgate, Aldershot.
Camagni, R. (ed.) (1993a): *Innovation networks: spatial perspectives*. Belhaven Press, London.
Camagni, R. (1993b): "Local 'milieu', uncertainty and innovation networks: towards a new dynamic theory of economic space", in Camagni, R. (ed.): *Innovation networks: spatial perspectives*. Belhaven Press, London.
Christensen, P.H. (1992): "Industrial districts in West Jutland, Denmark", in Pyke, F. & Sengenberger, W. (eds.): *Industrial districts and local economic regeneration*. ILO Publications, Geneva.
Crevoisier, O. & Maillat, D. (1993): "Technological innovation and territorial development: an approach in terms of networks and milieux", in Camagni, R. (ed.): *Innovation networks: spatial perspectives*. Belhaven Press, London.
Granovetter, M. (1985): "Economic Action and Social Structure: The Problem of Embeddedness", *American Journal of Sociology*, Vol. 91, Nr. 3, 1985, pp. 481-510.
Hjalager, A.M. (1993): *Transportinfrastruktur og regional udvikling – danske undersøgelser*. Transportrådets notatsserie nr. 93-07. Transportrådet, København.
Lorenzen, M. (1999): *Localised learning and community capabilities*. Copenhagen Business School, Copenhagen.
Lundvall, B.Å. (1992): *National systems of innovation – toward a theory of innovation and interactive learning*. Pinter, London.
McKinnon, A. (1997): "Logistics, Peripherality and Manufacturing Competitiveness", in Fynes, B. & Ennis, S. (eds.): *Competing from the Periphery*. The Dryden Press, London.
Marshall, A. (1919): *Industry and Trade*. London.
Maskell, P. (1997): "Localised Low-Tech Learning in the Furniture Industry", in Eskeleinen, H. (ed.): *Regional Specialisation and Local Environment – Learning and Competitiveness*. NordREFO, 1997:3.
Nielsen, L.D. & Storgaard, K. (1981): *Teknologi og regional brancheudvikling i træ- og møbelindustrien*. DTI, Høje Taastrup.
Perroux, F. (1950): "Economic space: Theory and applications", *Quarterly Journal of Economics* 64/1, pp. 89-104.
Piore, M. & Sabel C.F. (1984): *The second industrial divide*. Basic Books, New York.
Ratti, R., Bramanti, A. & Gordon, R. (1997): *The Dynamics of Innovative Regions – The GREMI Approach*. Ashgate, Aldershot.
Storper, M. (1995): "The resurgence of regional economics, ten years later: The region as a nexus of untraded interdependencies", *European Urban and Regional Studies, 1995, 2 (3), pp. 191-221*.
Wandel, S. & Ruijgrok, C. (1993): "Innovation and structural changes in logistics: a theoretical framework", in Giannopoulos, G. & Gillespie, A. (eds.): *Transport and communications innovation in Europe*. Belhaven Press, London.
Weber, A. (1909): *Theory of the Location of Industries*. University of Chicago Press, Chicago.

Noter

[1] The process of developing and analysing the questionaire has been performed in close co-operation with ph.d.student Jesper Aastrup, the Transport Research Unit, Copenhagen Business School.

[2] Groupe de Recherche Euroéen sur les Milieux Innovateurs (GREMI) is a research network founded in 1985 with the aim of developing a common methodology and theoretical approach to the study of innovative processes in economic and territorial systems.