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Finn Ørstavik

**Innovation regimes and
trajectories in goods
transport**

**Finn Ørstavik
STEP
Storgaten 1
N-0155 Oslo
Norway**

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STEP
group =

Studies in technology, innovation and economic policy
Studier i teknologi, innovasjon og økonomisk politikk

Storgaten 1, N-0155 Oslo, Norway
Telephone +47 2247 7310
Fax: +47 2242 9533
Web: <http://www.sol.no/step/>



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Preface

Knowledge-intensive services suppliers, such as financial services, R&D, business management consultants, engineering consultants and advanced transport services are important assets of the Norwegian economy. More than 12.000 firms and approximately 115.000 employees work in so-called knowledge intensive business services (KIBS).

These industries, directly or indirectly, contribute to the improvement of the technical or organisational competencies in those industries that purchase knowledge intensive services. However, the literature which deals with the role such knowledge-based services play in a national innovation system, is scarce. Among the questions that until now have lacked adequate answers are:

- ◆ How – or to what extent – do these services stimulate innovation in other services?
- ◆ How do relations between KIBS and the buying firms differ from industry to industry?

The EU Commission's Targeted Socio-Economic Research Programme (TSER) has financed nine national studies on services and innovation, through a joint project called *Services in Innovation – Innovation in Services* (SI4S). The STEP group in Oslo has been the project co-ordinator for the SI4S project. In the course of the project period, STEP has performed several studies on services in innovation and innovation in services. The present paper reports on one of these studies.

The exposition is the result of an empirical study undertaken during 1997, and builds on material gathered through interviews I have had with people in transport and storage companies, logistics firms, goods producing companies, retail companies, information technology firms, and with people in other relevant organisations. I have also gone through statistical publications and screened some of the existing literature and trade publications.

The study has been undertaken as part of the larger SI4S research effort at STEP, and I have received many helpful comments and had interesting discussions with my

colleagues in the group. I have also benefited greatly from discussions with other colleagues in the SI4S research teams around Europe. While retaining all responsibility for remaining errors, I wish to thank my colleagues, and all the people I have talked to in the course of the study which shared with me of their knowledge and gave me useful advice.

Oslo, May 1998

Finn Ørstavik

Abstract

This paper analyses innovation trends in the road freight industry in Norway. The objective has been to map important trends of innovation, and to understand the significance of transport for innovation in other sectors of the economy. The intention has been to develop an analysis with empirical focus on Norwegian road transport of good, but with relevance for the understanding issues related to transport and innovation also outside Norway.

The report starts out by drawing up an overall picture of the road transport business in Norway. Among the questions answered are how many, how large and what kinds of firms are in the industry. Some elements of a theoretical analytical framework is developed, and empirical data from interviews and from statistical resources are utilised in the industry analysis.

While road transport play a limited role in external trade as compared with shipping, it plays a dominating role in internal trade, taking care of almost 90 % of total transport volume in 1995. The transport industry consists of a large number of very small firms (of which most are 1 man truck owning and operating firms), and a small number of relatively large firms, which are in the forwarding and storage business, and seldom own their own vehicles.

The transport industry appears to be a rather traditional industry, with recruitment of a high share of unskilled workers, and with owners who are active managers of their firms. Only the larger forwarding firms appear to be somewhat professionalised.

While the road transport business used to be regulated and had significant barriers to entry, deregulation have in recent times increased the competitive pressure in the industry. At the same time, general economic growth, growth in trade, and changing demand due to a move towards more flexible mass production in other industrial sectors have created new incentives both for growing transport firms into larger units, and to develop ever larger integrated transport systems.

The development towards concentration and systems building has accentuated the need for effective acquisition, processing, storage and use of up to date information

in order to make the large organisations into well working and cohesive systems. This has put pressure on large firms to develop a professional management function. Together with technological development in the IT industry aiming at producing systems applicable to transport operations, the information handling bottlenecks in large firms have also created tremendous opportunities for technological innovation in the industry.

It is unclear where the trend towards large systems building leads. It may lead to integration of distribution and retail, of production and distribution, or even to complete integration of manufacturing, distribution and retail. Another possible development direction is towards third party logistics. In this case, a professionalised transport and logistics firm may be used by other firms who find that it gives advantages to outsource the distribution part of their business.

Among the key policy challenges that face us currently are (1) to reconcile the needs for effective transport with environmental demands, (2) to formulate policies that allow large scale systems building, but also secure effective competition, and take into consideration the interest of transport workers who are faced with de-skilling; (3) stimulate the development of infrastructure that secure the efficiency both of the material and the information flows in the transport system; and (4) promote the development of professional education and relevant research in order to foster the growth of a genuine and codified knowledge base in the transport industry.

Keywords: Fordism; Flexible mass production; Innovation; Information technology; Norway; Road transport; Freight; Innovation policy

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Innovation regimes and trajectories in goods transport

1. Introduction

Some things in society are so pervasive and omnipresent we may easily end up ignoring them. In several fields of modern social science, transport may be one example of such a ubiquitous phenomenon.

In this paper the analytical focus is set upon road transport of goods. Trucks are everywhere to be seen, but how much do we really know about them? We know – or we think we know - something about truck drivers: Down to earth workers, doing routine work of loading and unloading, and moving goods from producers and wholesalers to retailers so that people can buy them. Apparently a simple task, happening in much the same way now as, say, 50 years ago. But how much do we know about what is behind the trucks in the street? What kind of business is road transport today? What is road transport like, compared to road transport in other countries? Is road transport a static industry, a business with strong traditions and little significant change? Does road transport have an impact on the dynamics of other industries and sectors of the economy? Can development or lack of development in road transport teach us something of importance about modern societies?

These questions are addressed in the present paper. I start out, in section 2, making some general comments on the significance of transport in an economy. In section 3 I go on to draw a sketch of the Norwegian road transport business in quantitative terms. Thereafter, in section 4, the cultural dimension of the road transport business is discussed. Innovation in the transport sector is the focus of section 5, while section 6 contains a discussion of how changes in road transport is interrelated with more general changes in modern economies. I briefly touch upon some key policy issues in section 7, and section 8 contains the conclusions.

2. The social and economic significance of transport

The prestige attributed to the transport business does not seem to correspond to the significance of this activity in economic and wider societal terms. Transport, the moving of goods and people, is obviously an integral aspect of economic systems. Still, transport in policy debates often appear to be considered as something *optional* and non-essential (as when mineral water of a particular kind is shipped from a source in southern France to the United States and to Japan, and when meat is shipped from South America to Germany, where agriculture is in crisis because of lack of demand). However, in a general economic sense, *goods have user value only to the extent that they are at the right place at the right time*. Transport is an integral part of efforts to create user value, and economic growth has historically been associated with enormous growth in the transport work that is being done.

Some very important studies in social theory and in economic history have highlighted the close relationship between the industrial revolution and the development of effective transport systems. In Alfred Chandler's study *The visible hand: The managerial revolution in American business* it is argued that railways formed the backbone for establishment of mass production and mass distribution within the institutional framework of large corporations.¹ James Beniger, in his study *The control revolution*, draws on Chandler's work (among others) and argues that what we are witnessing is a revolution in the capacity of human societies to store, process and use information to control societal processes, not least processes of production and distribution of material goods.² But, as Beniger points out, also earlier writers in sociology have been concerned with crucial role of information in the evolution of modern societies. The storing, processing and use of information makes possible the development towards increasing specialisation and large scale systems building, which are the fundament for goal-oriented behaviour and increasing rationality of actions with respect to developments on the meso- and macrolevels of

¹ Chandler 1977.

² Beniger 1986.

social life. Emile Durkheim and Max Weber are the most prominent analysts concerned with such issues.³

In all but the most trivial of cases, transport is a complex social phenomenon. Even when poor farmers living in the periphery of a West African city walks the road from home to the city market with their crop in a bundle balanced on their head, planning and making estimates of probable sales is important: In order to make a decent living, maybe even to survive, they should carry everything they will be able to sell - not more, because the load is heavy and the goods might be fragile and perishable, and not less, since any income is welcome, and the goods might be worth significantly less the next day.

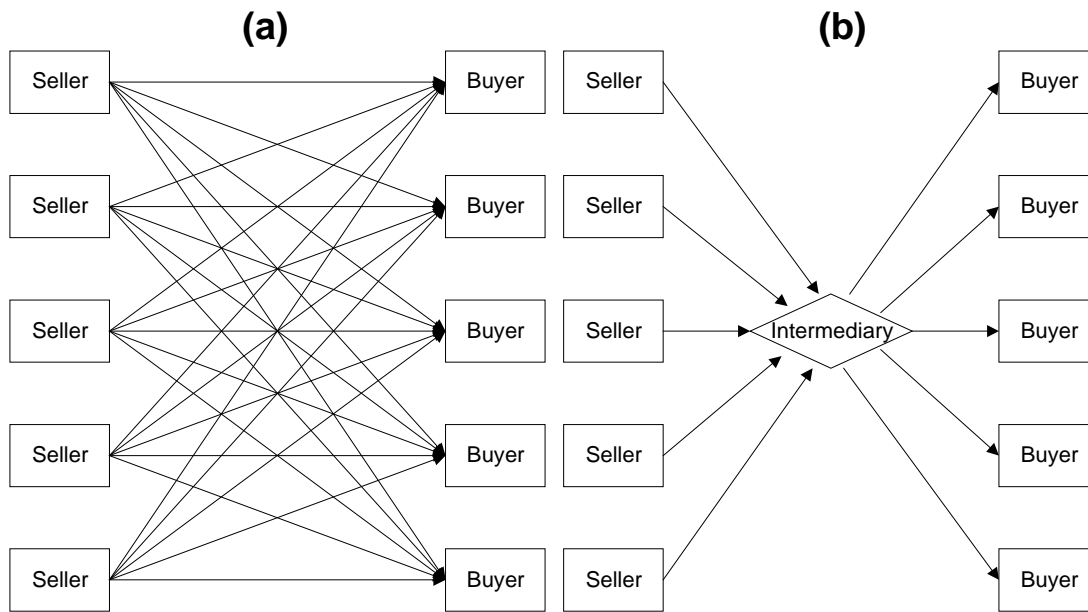
But how much is enough, and what is too much? It is easy to see that even in this case, access to updated information, and effective use of information is essential for prosperity. And development does not need to progress far before transport becomes an even more complex issue with much more pronounced systemic properties; with more specialisation and pressing needs for information and control. Farmers may sell to shop owners, whom themselves come to get what is produced at the farm, and as the complexity of exchanges in an economy grows new categories of intermediaries - agents and wholesalers - emerge which buy, transport, store and sell products, and which handles information and documents and ensures the integrity of transactions and the reliability of the system as a whole.⁴

Again, it would appear that the significance of such arrangements often go more or less unnoticed in policy discussions. Rather than representing merely links of a production chain adding costs to the final product, such links in reality greatly reduce the overall costs of productive activities in an economy. The efficiencies inherent in a distribution system with intermediaries is easy to grasp when we consider how the number of transports and the number of dyadic relationships which need to be maintained go down as the intermediaries enter the exchange. (Figure 1 below.)

³ See for example Durkheim's analysis of cyclical economic crises and anomie in his study of the division of labour in society (Durkheim 1963), and Weber's analysis on bureaucracy in chapter 9 of his monumental work *Economy and Society* (Weber 1978).

⁴ This is the kind of development that Chandler analyses historically with reference to the history of the United States during the nineteenth century. See for example pages 33-36 in Chandler 1977.

Figure 1. Simple transport system (a) without and (b) with an intermediary



Rather than being superfluous cost-increasing elements, these intermediaries may help giving everyone more income than they would have without this function being performed.

In figure 1 I have drawn only lines representing the simple, one-way flow of goods from buyers to sellers. Of course, in reality each buyer and seller maintains much more complex patterns of flows than those depicted above. Only rarely is there only one intermediary between the buyer and the seller. Buying and selling often happens several times as goods move from producer to the ultimate consumer.

Furthermore, in addition to the complex flow of material goods, a parallel flow has to be maintained in order to secure the integrity of exchanges and the systemic properties of the exchange processes: This is the flow of information and documentation of transactions being made. What should be carried, in what amounts, of what quality, when, by whom, for what price, with what level of reliability, etc. etc. And all the time, transactions have to be recorded and filed for in case of claims, disagreements or other types of failures.

The overall cost structure in the simple system pictured in figure 1(a) may be less than optimal, but in direct exchange the overhead of information can be managed by

each participant with relatively simple means. In complex systems, the challenges related to handling storage, loading and unloading and route planning become big issues, and in particular is this the case for the intermediaries. The information processing needs of intermediaries grows enormously, and becomes a crucial factor in running a large business effectively and efficiently.

It is not difficult to be convinced by Beniger's argument that a *crisis of control* was the necessary complement to an industrial revolution:

Increasing the speed of an entire societal processing system, from extraction and production to distribution and consumption, was not achieved without cost. Throughout all previous history material goods had moved at the speed of draft animals ... by the mid-nineteenth century the social processing of material flows threatened to exceed in both volume and speed the system's capacity to contain them. Thus was born the crisis of control, one that would eventually reach, by the end of the century, the most aggregate levels of America's material economy.⁵

When traditional methods are used for running a business, the complexity of operations and the problems related to information handling, soon becomes a crucial barrier for the growth of businesses. Firms experience *diseconomies of scale* rather than *economies of scale* with respect to information handling.

One implication of this general point appear to be that one should expect economies with traditional and manual methods for handling transport and logistics to have a transport sector of small firms with significant geographical spread. Chandler's analysis supports this hypothesis, and he argues that a veritable managerial revolution was a necessary precondition for developing larger transport systems. The railroads, because of the demands for high levels of systemicness (which are inherent in this technology as it develops from single lines to large networks), became the breeding ground for a new type of industrial organisation, the bureaucratic departmentalised corporation. This institution could incorporate effective information handling and control into the running of a large-scale business.

Even within a given technological paradigm, the fact that each firm finds it easier to make good profits staying small or medium sized does not mean that all transport

⁵ Beniger 1986: 219.

users prefer to deal with small firms. For *transport users* there might be great advantages in dealing with one carrier for large scale distribution efforts; one obvious reason being the inefficiencies that will occur when many independent operators have to work on one distribution task without having operations properly integrated. The information handling problems are greatly reduced for the transport buyer, when the buyer is able to deal with only one transport partner. This should imply that even in an economy where information handling relies on manual methods and face to face communications, one should expect to have a demand for more comprehensive transport services. Also, one should expect that a significant population of firms with large transport needs choose to handle their transport work and logistics planning in-house.

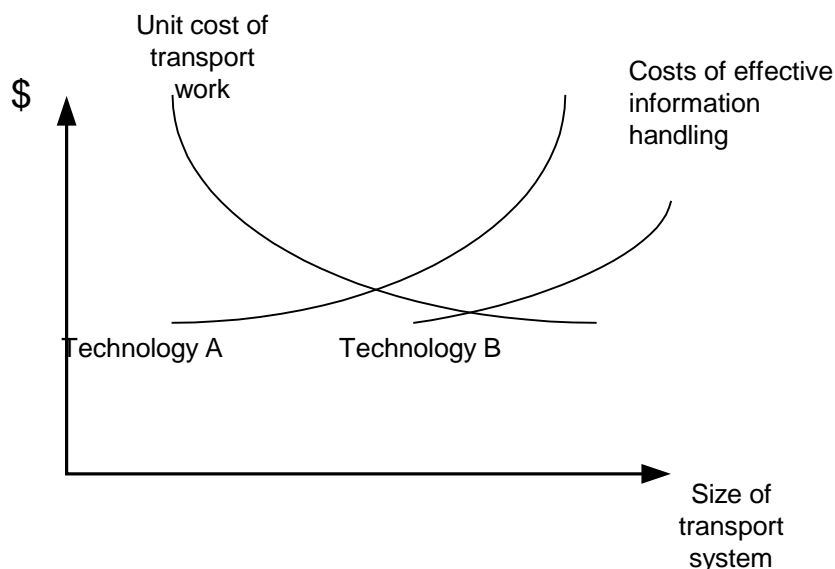
In general, transport solutions will depend both on the quality and quantities of goods being distributed, and the preferences of buyers. Some goods are sold in big volumes and similar qualities over long periods of time. Other goods are sold for a limited time because sustained product development gives a short life span to any single product category, or they have to be transported and sold quickly because they are perishable. In general, many transports, and transports with low degree of utilisation of capacity in vehicles cost more. Use of storage can help optimise capacity utilisation and reduce the number of hauls needed. But storage in itself incurs costs, and when products are perishable or tend to become obsolete quickly, such costs can very easily become critical. In a similar vein, customer satisfaction and short transport times may rely on using frequent and small transports, so that income from increased sales have to be balanced against transport costs as well.⁶

Many of the optimisation needs of transport logistics can be better solved with the help of computers. However, modern information systems can do much more than this. By integrating database functions, tracking of transports and goods, on-line voice and data communication, as well as handling of optimisation routines, information systems can help integrate transport operations (and operators) across organisations and geographies. Advanced information systems are able to solve important parts of the control and information handling problems which emerge in large transport systems, reducing the complexities and costs of the information

⁶ An interesting introduction to transport economy and logistics is Persson and Virum 1995.

handling overhead, and effectively opens up new opportunities for large systems building in transport, and the economies of scale that these systems bring.

Figure 2: A simple cost model for transport



Advanced information systems address the fundamental conflict between effective information handling and proximity to customers on the one side, and the effective, global distribution systems on the other side. Digital information systems thus represent a huge challenge for the whole transport industry, not least in Norway, where – as we shall see in the next section – the industry has remained true to its traditions for quite a long time. In spite of the fact that what has so far been introduced in the Norwegian transport industry predominantly has been small systems and partial solutions (such as online storage information systems, limited electronic document interchange solutions, etc.), there are signs that the effects of information technology is already creating a major change in the industry.

3. The structure of the Norwegian road transport business

Transport has traditionally been a maritime business in Norway. Still today, ships carry most of the load in external trade, as is seen in the following table:

Table 1: Goods transport in external trade. Mainland. Millions tons. 1985, 1990 and 1995 (share of total including air transport and floating, excluding offshore oil & gas export)

	1985		1990		1995	
Road	4,6	10,3%	5,4	9,6%	6,6	9,2%
Ship	37,8	84,9%	49,4	87,9%	63,4	88,6%
Railway	1,8	4,1%	1,3	2,3%	1,5	2,1%
Total (incl. air and floating)	44,5		56,2		71,6	

Source: TØI rapport 331/1996: *Transportytelser i Norge 1946-1995*.

Road transport performs about a one tenth of total export transport (measured in volume), slightly decreasing over the last 10 years. Ships carry large volumes of bulk produce such as paper pulp, raw chemicals, fertiliser and minerals. Lorries do transport significant volumes of timber, pulp and other wood products, but otherwise tend to carry goods with higher unit price than the goods that are sent by ship.⁷ In the perishable goods segment, as we see in table 2 for the year 1995, road transport plays a very significant role in external trade. Of fish and fish products which is by far the biggest product group within perishable goods, more than half – about half a million tons – were handled by road transports during 1995.

Table 2: Transport of perishable goods in external trade. 1000 tons. 1995

	Road ⁸	Sea	Rail	Air
Live animals, various foods	14,8	2,3	0,0	0,0
Meats, meat products	2,7	0,1	0,0	0,0
Diary goods, eggs	12,1	17,9	2,7	0,0
Fish, fish products	452,4	881,8	1,6	13,5
Grains, grain products	11,1	2,6	0,1	0,0
Fruit, vegetables	8	0,9	0,0	0,0
Total external trade volume	3.970,5	134.340,4	654,6	23,4

Source: *Statistics Norway, Oslo: Statistical Yearbook 1996, table 392*.

In contrast to the situation in external trade, domestic goods transport is marked by a trend towards more road freight. As is shown in table 3, road transport has steadily

⁷ Grimsbo 1990, page 14; see also Statistics Norway; Oslo: Statistical Yearbook 1996, table 392.

⁸ Includes ferry transport.

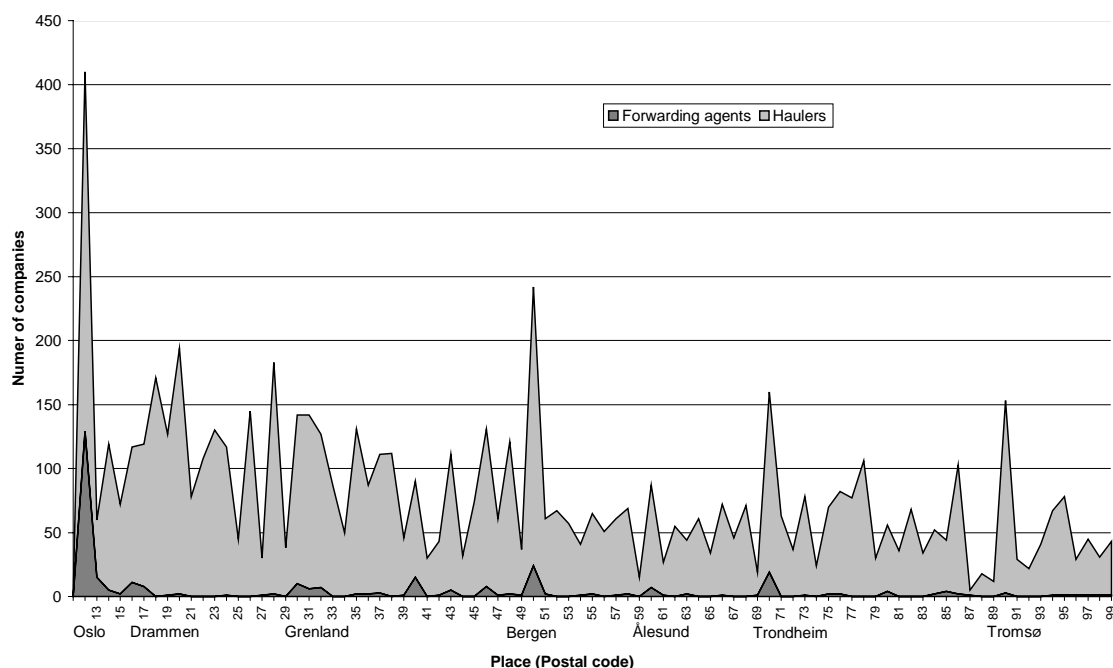
increased its share in the period 1985-1995, and 9 out of 10 tons of goods are now transported by road. The remaining is mainly carried with ship, and only about 1,7% of land goods transport is now done by rail.

Table 3: Domestic goods transport volume. Mainland. Millions tons. 1985, 1990 and 1995 (share of total including air transport and floating, excluding offshore oil & gas)

	1985		1990		1995	
Road	216,3	85,1 %	231,0	87,5 %	237,0	89,8 %
Ship ⁹	28,4	11,2 %	26,2	9,9 %	22,2	8,4 %
Railway	9,1	3,6 %	6,8	2,5 %	4,5	1,7 %
Total ¹⁰	254,1		264,0		263,8	

Source: TØI rapport 331/1996: *Transportytelser i Norge 1946-1995*.

Figure 3: Geographical distribution of firms¹¹



Source: 1994 employer-employee database, Statistics Norway.

⁹ Excluding car ferry transport.

¹⁰ Includes air transport and floating, but excludes car ferry transport and offshore oil and gas

¹¹ The chart is stacked: The “hauler area” is placed on top of and not behind the “forwarding agent area”.

The figure demonstrates the crucial role of Oslo as the hub of forwarding in Norway, and shows how the other big cities also are centres of transport activity, although of lesser importance nationally. It is equally striking, however, how evenly the transport business is spread out over the whole country. This reflects that the location of the firms that do the physical work of road transport continues to be bound to the geography of Norway.

The number of firms only gives limited understanding of the structure of the road freight business, because firm size varies a lot. To make a statistical check of the size distribution in the land transport business, an analysis of employment register data from Statistics Norway for the year 1994 has been done.¹²

These statistics are ISIC based and counts the employment situation for individuals in October for a calendar year. In the ISIC classification, the following categories were deemed to be relevant for this analysis:

Table 4: ISIC categories and category sizes in Norway 1994

ISIC	Category	N. of firms	Activity
71140	"Leiebiltransport"	6635	Road freight; hauling
71160	"Hjelpevirksomhet for landtransport"	686	Taxi-stations, transport-stations, toll-bridges etc., car rental, parking, etc.
71910	"Tjenester i tilknytning til transport"	0	
71914	"Spedisjon"	331	Forwarding, storage terminals etc.
71920	"Lagring"	113	Cold storage and terminals, storage in ports, marinas, etc.

Source: 1994 employer-employee database, Statistics Norway

As is seen, ISIC 71910 is empty. Category 71160 upon inspection of background data proved to be primarily related to transport of people and transport infrastructure. Also, 71920 is small and of little direct relevance for the present analysis. In order to retain a clear focus, it was decided to concentrate attention on only two categories: ISIC 71140 (here labelled *Hauling*) and ISIC 71914 (*Forwarding*). Thus, the population the analysis builds on is 6966 firms. Using the terminology of Statistics

¹² This database has been described in Ekeland et. al. 1998.

Norway, some of these are *establishments* which are part of *enterprises*, while others are themselves enterprises.¹³

The transport industry is full of small firms. However, there is also a large number of people who are self-employed but which do not appear in a list of firms in the industry. The 1994 data shows that there are 8005 self-employed in the transport category (71140), but only 34 in the forwarder category (71914). Counting these people - which in an overwhelming majority of cases are truck drivers - as "enterprises with 1 employee", we get the following distribution of enterprises in the transport business:

¹³ The Norwegian distinction is between *bedrift* and *foretak*.

Table 5: Number enterprises (including self-employed) and employment in the road transport business

71140			71914		
N. of employees in enterprise	Enterprises	Sum employees	N. of employees in enterprise	Enterprises	Sum employees
0 (S-E)	8005	8005	0 (S-E)	34	34
1	1492	1492	1	30	30
2	637	1274	2	22	44
3	330	990	3	20	60
4	208	832	4	20	80
5	150	750	5	20	100
6	111	666	6	12	72
7	60	420	7	7	49
8	52	416	8	10	80
9	40	360	9	2	18
10	27	270	10	7	70
11	25	275	11	2	22
12	19	228	12	2	24
13	17	221	13	2	26
14	16	224	14	5	70
15	9	135	15	3	45
16	9	144	16	1	16
17	11	187	17	1	17
18	10	180	18	3	54
19	9	171	19	2	38
20-29	41	962	20-29	18	421
30-39	16	550	30-39	7	240
40-49	11	485	40-49	5	214
50-99	13	872	50-99	6	401
100-505	7	1379	100-880	4	1910
Exc. S-E	3320	13483	Exc. S-E	211	4101
Incl. S-E	11325	21488	Incl. S-E	245	4135

Source: 1994 employer-employee database, Statistics Norway

Here, we see the number of enterprises (excluding self-employed) is much lower than the number of establishments referred to earlier. (The numbers are 3531 versus 6966.) This is obviously because several enterprises consists of a number of establishments.

Some of the crucial insights we gain from the above table are easier to see when we summarise some of the data in a simple percentage table:

Table 6: Share of enterprises (including self-employed) and share of employment in the road transport business in firms. Percent.

	Hauling segment (71140)		Forwarding segment (71914)	
	Enterprises	Employment	Enterprises	Employment
1 employee	83,9	44,2	26,1	1,5
5 or fewer employees	95,6	62,1	59,6	8,4
Less than 50 employees	99,8	89,5	95,9	44,1
More than 100 employees	0,1	6,4	1,6	46,2

Source: 1994 employer-employee database, Statistics Norway

In the hauling segment of transport, the number of enterprises with only 1 employee is extremely large, almost all firms have five or less employees and 9 out of 10 employees are working in firms with less than 50 employees. In the forwarding segment of the industry the situation is strikingly different. Almost half of the workforce (46,2%) is employed in firms with more than 100 employees, even though less than 1 out of 60 firms is this big. Only 1,5 percent of employment is in the group of firms with only 1 employee.

The main reason for the rather remarkable distribution of enterprises in the hauling segment of the transport industry appears to be that very many operate as independent truck owners and drivers. As I have been able to verify during interviews, this is a well known fact in the sector.¹⁴ While a few firms still do own a fleet of vehicles, most of the firms in the hauling and forwarding business have chosen to divest completely of formal ownership of their vehicles. This has contributed to keeping the number of firms high, and the average size of firms very small in Norwegian road transport.

¹⁴ The point was made among others by the leader of the sector organisation *Norges Speditørforbund* – Trond Engstrøm in my interview with him December 12, 1996.

EXAMPLE 1: NORDAN SPEDISJON

- now called Frigoscandia after its Swedish mother company¹⁵ - in Oslo is an example of a firm which have followed the strategy of abstaining from ownership of vehicles.¹⁶ The firm maintains a “virtual” Nordan fleet through contracts with several truck-owning firms. Most of these own one or very few vehicles, one is significantly larger and owns about 50 vehicles. Nordan sign contracts for a limited period, say 2 years at the time, with these firms. The contract is usually exclusive. Trucks travel where and when Nordan tells them to, and do not engage in transport business with other firms.

The integration of the trucking activity with the forwarding business, which is Nordan’s current core business, thus is very close. It is made even closer by a new satellite based tracking system. With this system the movement of trucks is automatically monitored from the Nordan head office in Oslo, registrations being logged in Nordan’s transport database as often as every 15 minutes. Additionally, most of the trucks are painted with Nordan’s red, white and blue colours and clearly marked as NORDAN trucks. (The truck owner company may or may not be indicated in small type on the driver’s cabin.)

With this type of close integration, it is not surprising that although all contracts are time limited, many contracts are not subject to cancellation unless some *force majeure* motivates extraordinary action on Nordan’s side. Tacitly, co-operating firms build seniority, so that some contracts may be short term and with little commitment to be renewed on Nordan’s side, while other co-operative relationships have a long history and a high level of mutual commitment is maintained.

The mix of continuity and flexibility that Nordan obtains by subcontracting the physical part of the transport operations is crucial for the business. The flexibility helps make possible effective use of transport capacity, while the continuity guarantees that a relatively high proportion of those that do the physical transport work are *insiders* in the Nordan distribution system, with significant knowledge of customers both at the supplying and receiving ends, and with familiarity with work routines and communication system.

¹⁵ The company has changed name to Frigoscandia after I approached it. I continue to use the old name here.

¹⁶ Information on Nordan is from my visit to the company and my interview with Kjetil Jordheim, December 5, 1996.

This counters possible disadvantages of the “vertical disintegration” of the physical transport business from the organisation and administration of the transport – fragmentation, unclear lines of responsibility and inefficient communication.

One possible problem for Nordan with the system of vertical disintegration might be to give Nordan less control of the costs of transport, as the co-operating firms could be able to charge high prices for their services. This appears to be a small problem, and for two reasons: First, the distributed ownership of vehicles gives solid incentives to drivers to maintain their vehicles and run them efficiently, and this helps keeping costs down. Second, that transport firms are small, often one-man firms, increases Nordan’s negotiation power with respect to drivers, independent ownership of vehicles makes drivers even less of a cohesive group of employees. One overall effect of this is to dramatically reduce the risk of incurring large extra costs because of “overpricing”.¹⁷

The Nordan example can help us understand why it is that strong concentration tendencies go hand in hand with the tendency that very small firms flourish in the transport sector. As we shall return to later in the analysis, there is an increasing division of labour in road transport between those that plan and co-ordinate work and those that do the actual transport work. It is particularly on the planning and co-ordinating side, on the side of logistics, that concentration is taking place. It is unclear at this point whether the diffused ownership of vehicles is more typical for Norway than for other countries. However, it is clear that the concentration of firms on the logistics side is not a specifically Norwegian phenomenon. To the contrary, it is part of a broad internationalisation trend in road transport, where large units – producers, retailers, or chains of either with varying degree of integration with the firms they represent – distribute goods in large geographical markets, and use large transport and logistics firms which can integrate large areas in one distribution system.

In such constellations, the crucial hub for transport to Norway doesn’t need to be Oslo, or in Norway at all. For example, Gothenburg or Hamburg might be better choices for car part distribution or fashion clothes.

It is indicative of the situation that of the largest transport firms in Norway; Linjegods, Tollpost-Globe, Nordan and Nor-Cargo, (all located in Oslo) only the latter company is an independent Norwegian company, while the others are subsidiaries of Swedish and Danish firms.¹⁸

4. The cultural dimension of road transport

Mapping the structure of the transport business can help us explain what changes occur, but it does not put us in a position where we can draw solid conclusions. Ultimately, innovation is about social change processes where new artefacts, methods and ideas penetrate a social system (or part of such a system).¹⁹ To aptly analyse innovation in road transport, we need to consider what this business is in cultural terms – we need to take the institutional context and the ideas and “local theories” of the people into consideration.

We have already noticed the diversity of the transport firms. The large number of firms which are truck driver/owner constellations make up the operating core of the road transport business – the actual flows of goods. Truck driving is a practical skill, it is hard work with long days, lots of routines and a lot of small scale problem solving.

This activity is a service not only in the sense that it doesn't produce tangible products, only handle them on behalf of others. It is a “service” also in the sense that those who handle the goods do not “run the show”. Moving of goods is a function that needs to be performed in a system where other elements may be seen as the main pieces of a stone wall, and transport is the filling of cement that makes the pieces fit nicely together.

Truck drivers travelling abroad do long hauls and most of the time work alone, but they have a milieu and a culture which give them an identity as members of a social group. A few transport workers may be unionised. However, the solitary nature of

¹⁷ As we shall see later, the fact is that drivers are among those that have had to carry the most of the cost cutting that has happened in the road transport business over the last 20 years.

¹⁸ Interview with Trond Engstrøm, December 12, 1996.

¹⁹ Van de Ven et al. 1989.

the work and the extremely brief nature of encounters with colleagues does not lead naturally to the establishment of collectives which could increase the scope for industrial action and secure significant bargaining power.²⁰ The fact remains that the overall co-ordination of transport is done by others than those who do the physical transport work.

Transport is traditionally not a business you go to school to learn – it is a business you learn on the job. The oldest and most significant firms in Norwegian road transport have their organisational and cultural roots in shipping, and as is typical for the many family owned shipping firms, there has been very limited influx of new people with updated “theoretical” understanding of business. The transport business is a place you are born into, or “happen to end up in”, as one expert I talked to, put it.²¹ This situation makes the internal culture and existing institutions extremely important, as these continue to shape activities and outlooks of people working there.

Table 7: Male and female employment in hauling and forwarding

	N. of employees	Men	Women	Women share of total
71140	21566	19828	1738	8,1%
71914	4135	2775	1360	32,9%

Source: 1994 employer-employee database, Statistics Norway

This culture has not only been marked by self-taught, practically oriented men with little concern for formal training and theoretical concepts. As is clearly demonstrated in table 7 above, it is also a very male dominated business. In the hauling segment of the activities only 8 out of 100 employees are female. In the forwarding segment, which is more office work, about one third of employees are female.

Results count, and control over the means of production is felt as important. This means that a lot of attention is paid to machinery. The worker handling the biggest forklift is the worker with the most seniority. What truck a driver is using, how many tons of load it can carry, how long it is, the horsepower of the engine, the number of

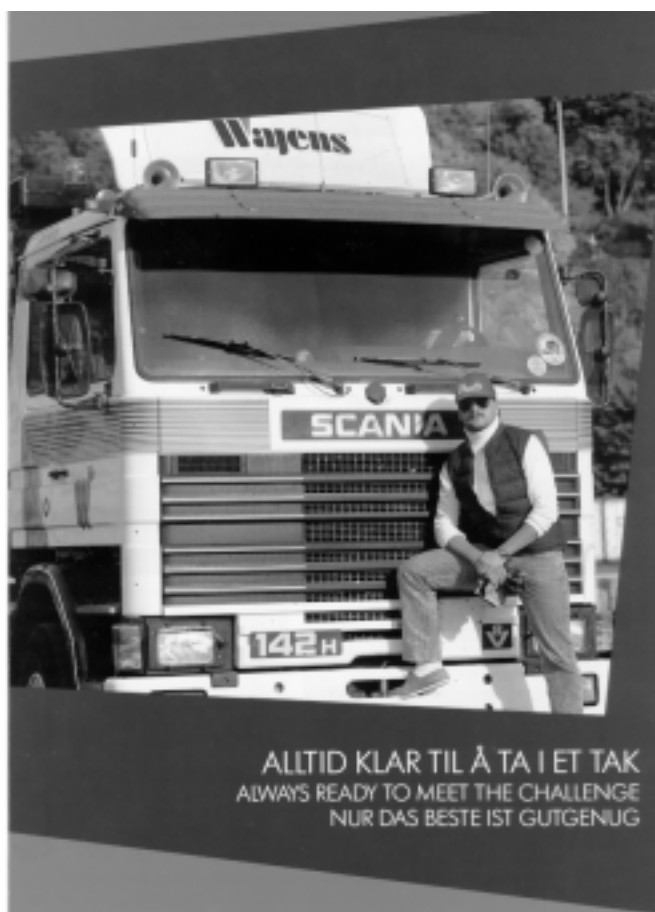
²⁰ According to Alf Ragnar Karlsen in *Transportarbeiderforbundet*, only about 10% of road transport workers are unionised. (My interview with Karlsen, September 18, 1997.)

²¹ Interview with Engstrøm, December 12, 1996.

wheels on the vehicles, all of these aspects are significant in a way that might be surprising to outsiders. Actually, the motivation of many young drivers which leads them to the transport business is interest and fascination for big and advanced trucks. They build a professional identity around the truck; driving it, maintaining it and, ever more often, owning it.

Figure 4 is an illustration of this point. The picture is from the cover of an advertising brochure that I got when visiting a relatively small and transport company in Oslo. The picture can be taken as a self-expression of what the company and people there want to be and how it wishes to appear in the eyes of others.

Figure 4: Drivers in Norway tend to build their identity and status with the help of the vehicle they own and operate



The patterns of recruitment, the tradition bound cultural base, and the fact that control and professional identity has been associated to a large extent with machinery which in reality has become ever more standardised and simple to operate, all these are factors that have reinforced an effective barrier against *knowledge based*

professional control, and thus *real professionalisation* in the transport business. The low degree of professionalisation has put a clear mark on the way of working of transport firms, also on the level of management. Business leaders do usually not have higher education, but know their business and the tricks of the trade as they have learnt them in years of work. Some have inherited their business, others have climbed the internal career ladder up to top management positions. In both cases, management and ownership are functions handled by the same man (or group of people). Thus, top managers tend to take part in the running of daily operations, and have a practical attitude to their management role. They are busy solving difficult day to day problems, and pay less attention to long term perspectives, competitive analysis and strategy formulation. They might be very creative people, finding good solutions to complicated problems that crop up repeatedly in the efforts to plan, organise and execute transport services in an increasingly complex overall transport system. They are usually extremely active networkers within their business sector, as this is how opportunities are found and deals made. But they have no contacts with people in academic institutions or independent research institutes. They are convinced that “no one knows more about forwarding and logistics than the forwarders themselves” and most of them do not consider this a problem at all. A few leaders see the situation as a problem which in part reflects a low level of interest and competence in research milieus for business in general and transport in particular, and in part reflects what amounts to a cultural chasm between academic scientists and people in the transport sector. There is not only lack of knowledge of each other; there is antagonism. However, there are signs of improving relations over the last few years, as academics have initiated research more relevant for business, and people in transport firms have began feeling the lack of a professional knowledge base as a problem.²²

The lack of control over a formal knowledge base and the low degree of professionalisation have given the transport business a weak *institutional position* in Norway. It might be indicative of this that the organisation with the most impact on transport policy issues in Norway currently, is the transport *user* organisation; *Transportbrukernes Felles-organisasjon*. More significantly, the weak institutional

²² An interesting account of the situation was given to me by the director of Intersped in Oslo, Olav Gunleiksrud, November 2, 1996.

position has given room for extensive and intense competition, between firms in Norway and now increasingly from firms with head-offices abroad. As national regulation of transport in Europe gradually is replaced with a set of common European rules, and international transport is facilitated further through infrastructure improvements and new technology, the competitive pressures increase. The improving infrastructure inside Norway – better roads and faster and richer information exchange systems – has already weakened the formerly clear cut regional divisions of the national transport system. Both the northern, central, western and eastern regions are increasingly catered for by one and the same firm – a firm that often is located in Oslo.

Both these issues are a concern of the organisations in the transport sector – among them *Norges Speditørforbund* – The Norwegian freight forwarders association. This is a branch organisation owned and financed by forwarding, transport and logistics firms in Norway, it is a forum for collegial meetings and discussions, and it seems to be an organisation that actively encourages the development of networks and a sense of common interests and common fate among the firms. The organisation has also been active trying to foster a limited common and codified knowledge base for transport firms. It has run *Speditørskolen* – “the forwarding school” – during the last 25 years, and has offered courses for employees in transport firms on issues related to insurance, public rules and regulations, customs procedures in external trade, etc. Very recently, courses have been offered in management, organisation and practical use of information technology.²³ There is perception of a strong need to enhance management skills and raise levels of competence in order for Norwegian forwarding firms to survive in an increasingly internationalised marketplace.

However, until very recently, the weak institutional position also led transport to be an area where very little public money was spent on research with relevance for the transport and forwarding industry. This is a point we shall come back to later.

²³ Informative material on the Forwarders association and the course offerings was supplied by Mr. Engstrøm (12.12.96).

5. Road transport in a transforming production system

Among the most striking facts about today's road transport business is that it is under pressure from many sides, and change is happening rapidly. What is changing, and why is change happening? In the following, I will first consider the basic functions performed by the road transport business. Thereafter, I will discuss some of the main forces driving change in the business. Among these are changing demands, institutional innovation and technological innovation.

5.1. The basic functions of the road transport business

How can we summarise which the basic functions are that the road transport business is performing?

Firstly, and most obviously, transport is the realisation of potential user value in goods by the moving of goods, getting them at the right time, storing them when necessary, and delivering them at the right time.

Secondly, transport is the working out of efficient schedules and routes, handling of information flows associated with the flow of goods, and document transactions to ensure accountability. Through such means transport firms should optimise the use of available capacity, satisfy the demands of senders and receivers of goods, and help reduce overall transport system complexities by acting as intermediaries, and by taking over the handling of complex logistic issues from the customers they serve.

Thirdly, and maybe least obviously, transport functions as a cushion between transaction partners that cannot always fulfil the demands that the other part makes on them. Transport is a "friction reducing" and "cushioning" buffer which help maintaining the systemic properties of the economy.

The road transport business performs all these functions by handling enormous complexity on a day to day basis, sorting out problems as they arise. Transport and forwarding in the traditional form is far from an "exact science". Difficult compromises and priorities have to be made, customers have to be managed in the right way to make them accept the "approximations". Solutions have to be found to pressing problems without getting distracted by ideas about making the overall

system perfectly systemic and coherent, without futile striving for perfect solutions. Actions and strategies tend to be short-term - business is done “one day at the time”. Routines and evolution of the way business is handled create a certain level of efficiency over time, an efficiency that it might be surprisingly difficult to match by even the most worked out rational and planned systems.

The basic mode of operating has been compared to the way of functioning of a marketplace in a town.²⁴ There are many independent operators in the business. As transport tasks materialise, transport firms offer their services, and those needing transport have the opportunity to accept whatever offer seems to suit their needs best. Local optimisation of transport capacity is sought by independent transport companies and transport users, but under a lot of uncertainty.

Given an environment where manufacturing firms are relatively independent units in terms of operating procedures, this may be a sensible way of arranging transport in an economy. The use of batch production and storage facilities make transport decisions into issues that the manufacturing firms can decide on with significant autonomy. But there will be a couple of potential threats to the efficiency of the overall system: If overall transport streams are more predictable than operators perceive, local optimisation may lead to global sub-optimality. (In practice, this may mean that transport firms strive hard to solve day to day problems and to produce short term efficiencies, but ignore opportunities to reconstruct the overall business in a way that would create much bigger efficiencies over time.) The other is that some kinds of transport and logistics problems might be better solved by transport firms and constellations of such firms that operate comprehensive transport and distribution solutions. The atomised nature of much transport business in Norway opens up for competition from larger firms abroad which are bigger and better integrated and can offer customers much more comprehensive solutions for distribution of goods.

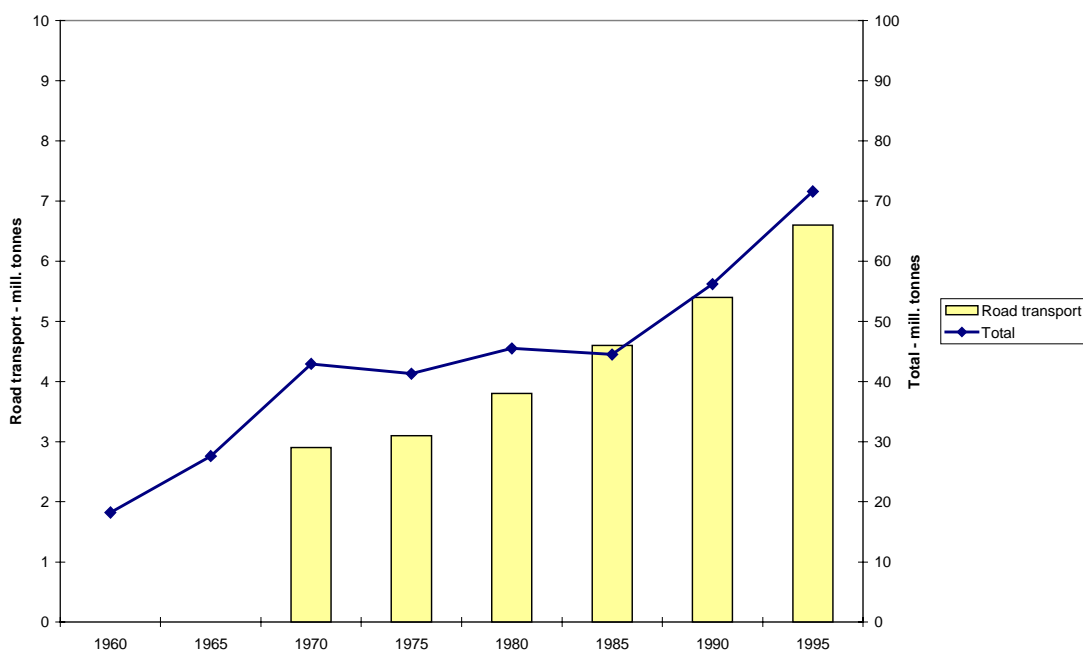
We will see the significance of these issues clearer when we consider how transport demands are changing in modern economies.

²⁴ My interview with Terje Vadset, Tollpost-Globe Thermo, Ålesund September 18, 1997.

5.2. Changing demands

There has been sustained and strong growth in goods transport in Norway, as in all other industrialised countries in the world. The development for Norwegian external trade (import and export) is illustrated in figure 5 below.

Figure 5: Goods transport in Norwegian external trade. Millions tons. 1960-1995.



Source: TØI, Oslo: *Transportytelser i Norge 1946-1995* table 7, except figures for 1960 and 1965 which are from SSB, Oslo: *Historical Statistics 1994* table 20.4.

Growth in transport obviously increases the complexity of the overall transport system, and this in itself is a challenge for the transport business. However, not only is transport demand continuing to grow: Also the structure of demand is changing.

To clarify this point, it may be useful to conceptualise the development of transport needs as a succession of distinct stages.

Transport needs in the most simple form are related to situations where production and consumption tend to be collocated and transport needs are limited. Markets are local, trade over longer distances usually happen only with especially scarce and valuable goods.

When industrial production emerges in an economy, this puts increased emphasis on transport, and makes transport and distribution into an integral part of the overall economic (and social) system. Industrial production means concentrating

transformation of inputs to outputs in centres drawing on external sources of energy and specialised forms of skills and knowledge. The larger the scale of production - the more “Fordist” production becomes²⁵ - the more transport and transport co-ordination is needed, and the more there will be a development towards integrated *distribution systems*. The art of transport planning and co-ordination – *logistics* – becomes a key issue.

While we still have some level of localised production and consumption in Norway (such as households that fish themselves for family consumption), a much more significant part of the economy resembles the Fordist mode of industrial production. Norwegian export trade is concentrated in areas such as chemicals (fertiliser), metals (aluminium, metal oxides) and paper pulp, and is transported in bulk – predominantly by ship, as we saw earlier, but some also by road.

The pattern of industrial organisation has not culminated with “Fordist” mass production, however. Although this kind of large scale, inflexible production is still very important and may be economically optimal for products and markets that are relatively stable, there are other product areas where fixed capital investments must be spent in a different way for production to be economically viable. A large number of goods today go through frequent and rather dramatic changes over time. Product lifecycles in several technology areas are getting shorter and shorter: In electronics and information technology product life cycles may be as short as a few weeks or months.

Two of the conditions that need to be fulfilled for this kind of production system to be viable are the following: First, production parameters cannot be hardwired into the production machinery, because the costs to build new plants for each new generation of product are prohibitive. Second, sales of the products have to be made in large markets, driven ahead by effective mass marketing. Economies of scale are hampered by short product life cycles, but this can be more than compensated for by effective mass marketing *and effective and economical distribution systems*. Marketing can help *create* and *time* effective demand, and effective and

²⁵ The concepts of Fordist and post-Fordist production systems used in here is primarily based on the discussion in Piore & Sable 1984.

comprehensive distribution systems make it possible to have products available in the short periods when there is significant demand for them.

Road transport has distinct advantages in a flexible mass-production system of the type I have touched upon here. Trucks are independent units moving more or less freely around – they can be *where* they are needed *when* they are needed and on short notice. Loads do not need to be huge for road transports to be economically feasible.

This helps explain why road transport has become increasingly important both on the input and the output side in modern economies. The flexible mass production system can only with difficulty accommodate the use of large scale storage - there is a constant risk of products becoming obsolete in very short time. Timing issues become crucial concerns. Plants need input *just in time*, in smaller portions and more frequently than typical plants in a Fordist mass production system do. The situation is parallel when it comes to distribution of end-products: Markets are ready for them and pay good prices for them only in short periods of time. Sales volumes occur in bursts. Again, transport must be frequent and it must be carefully timed.

To sum up this argument: While storage in the Fordist mass production system helps securing the possibility to produce in large scale and thus to secure significant economies of scale, the flexible mass production system uses information technology and automation to realise the benefits of mass production also in cases where the production cannot go on for extended periods of time. But this puts new demands on the system of transport and distribution. Flexible mass production will move towards very limited use of storage facilities: Storage becomes more a question of gathering and reordering flows of goods and less of storage as such. Storage houses will often be transformed into advanced terminals where sorting, packing, electronic logging and differentiated storage is integrated into one complex “organism”. Flexible mass production will also concentrate on developing a global business, and on being able to reach global markets in very limited time. Thus, the needs for comprehensive and well integrated distribution systems are becoming more and more pressing.

In the “old world” of transport there were major obstacles for transport to be able to address such needs. Institutional arrangements in and between nations and regions represented one such barrier. The ability to handle the rapidly growing needs of

effective information handling and processing was another bottleneck. In both these areas dramatic changes are occurring which gives the transport business both new opportunities and new stimuli for changing their ways of doing business and for growing.

5.3. Institutional innovation

A most significant trend in the post war period with direct and significant consequences for road transport is the trend towards trade liberalisation and continuing growth in external trade. The liberalisation of the legal framework since the war has gone in several steps. Some of the landmark events are the following: The establishment of the Organisation for European Economic Co-operation (OEEC, 1949), the signing of the Treaty of Rome and the establishment of the European Economic Community (EEC, 1958), the European Free Trade Association (EFTA, 1960), the establishment of the European Union (1993) and the establishment of the Extended European Area (EEA, 1994). The EFTA and the EEA may be the single institutional innovations with the most direct impact on external trade between Norway and other countries.

There has also been a sustained efforts more specifically directed towards the integration of the European transport market, which has been heavily regulated and where national transport systems have largely separated from each other. Market access has been improved as entry barriers have been removed in national transport markets, and as quotas have been established and gradually increased for foreign firms; third country transport has been institutionalised, as is *cabotage* becoming a reality during the years 1997-1998.²⁶ At the same time, rules and regulations concerning other sides of the transport business have become more standardised.

The changes have made trade possible in new market segments, and have made trade more profitable by reducing the overhead in customs, taxes and other fees associated with international transport. Additionally, with the establishment of common border controls in the EU, road transport has experienced a great simplification of the “bureaucratic overhead”: Border controls have been greatly reduced in number and

²⁶ *Cabotage* is when a carrier can do transport work inside another country than the country where the vehicle is registered.

duration. All this has made the actual transport job easier to do and easier to plan and program with accuracy.

5.4. Technological innovation

Hand in hand with policies of liberalisation and the establishment of an open international system of trade, there has been public efforts to develop infrastructure with capacity to handle increased trade. Road transport has been facilitated by huge investments in the building of highways, tunnels and bridges, and also the local road systems have been greatly improved over time.

Furthermore, it is obvious that advances in vehicle technology have contributed to facilitating road transport: Trucks with high load capacity, low fuel consumption, low maintenance costs, high reliability, long reach and long life has helped making transport cheap and easily available.

In a similar vein, technical advances in cooling have increased the possibilities to transport special products – perishable goods and liquefied gases, for example. The same can be said about packaging and conservation technology in general: Although these are not specific transport technologies, they greatly have increased the opportunity to industrialise production of goods and spread them through large scale distribution systems.

As a final example, containerisation has contributed in an extremely significant way to reducing the cost of transport, and although the effect of this has been most notable in sea transport, repercussions have also been felt in distribution systems on land (in stevedore businesses) and in road transport.

The preceding sketchy notes on technical change is only a limited part of the story of innovation in transport, however. They concern changes in the way *physical transport work* is being done.

At least as important as these changes are changes that concern the planning, co-ordination and control of transport and the handling of information. Flexible mass production could not exist without new production technology and without the new and effective information technologies, which both are part of the production

technologies themselves, and which carry the huge information overhead which is associated with any system of flexible mass production.

While *telegraph* and *telex* greatly helped the development of regular sea and rail transport, it appears that *telephone* has been associated with the development of more flexible road transport services. Together with technical improvements in infrastructure and vehicles, the establishment of telephone networks increased the opportunities to handle the information overhead of road transport both on short and long distances.

With the advent of fax machines and of computerised information exchange systems, opportunities for more growth and further specialisation again emerged. With access to fast, accurate and safe low-cost transport of information, firms can viably bypass the *social interaction based* information exchange in more and more situations.

Transport and logistics becomes more clearly separated, and firms can specialise on the acquisition and processing of information which has so far been done by the selling, buying and carrying parties in complex, time consuming and often precarious and opaque negotiation processes: Finding the transport route, “building” the content of the goods compartments, scheduling loading and deliveries, handling insurance and customs issues, deciding on levels of quality and regularity, etc. That is to say: With new communications technologies, the construction of comprehensive and integrated transport and distribution systems have become feasible, and also so-called *third party logistics* have become a possible new way of operating in the transport business.

Even though technological innovation invariably is an interactive process between several parties, it appears to be fair to say that the development of information technology for transport only to a limited extent has been the result of efforts done by transport firms themselves to develop new technologies. Transport and storage was very early recognised as a potential market for the emerging information technology industry. One early application was electronic databases keeping track of the storage and moving of goods. Another was in solving optimisation problems related to the economics of transport. (Deciding optimal transport frequencies in a military context, for example.) Also, modern information technology made possible systematic tracking of materials in a way that earlier had been impractical due to the amount of

work that needed to be done in order to compile and to update data. A third and more recent application is online data communication in companies and between companies in the form of electronic document interchange. In Norway, one of the most important examples of this type of application currently is the TVINN system, which is an electronic document interchange (EDI) system for electronic handling of customs clearance formalities between firms and the Norwegian Customs authorities.

Another strand of development which now is having enormous impact on transport business is digital mapping. The applications of this technology are many and significant. Using satellites, it has been possible to produce comprehensive multidimensional maps in the form of “layered” electronic databases. Satellites have also made it possible to develop systems for determining the exact geographical location of objects, and international and global communication has been made possible in completely new ways.

Public money has gone into the development of this information technology infrastructure, and the opportunities posed by this infrastructure for the development of new information technology applications have not gone unnoticed by the information technology industry.²⁷ Systems for tracking of trucks, data communication between vehicles and logistics companies and route planning systems have been brought to market, but are still in an early phase of development. The full impact on the transport business is as yet unknown, but it is quite obvious that it will be very significant.

In all these cases, road transport seems to have been selected by others as a potential user of new technology. The road transport business has influenced development. It is for instance a fact that most IT systems used for materials administration purposes have to be strictly tailor-made to individual businesses. Thus, transport and forwarding firms have clearly had direct influence at this level of development. However, in terms of developing the tools, the fundamental techniques and

²⁷ An analysis of the Norwegian geographical information technology (GIT) sector is found in Samuelsen (1998).

infrastructures it appears that neither transport firms nor branch organisations have had significant impact.²⁸

6. Transport in the innovation system

I have earlier described the traditional, atomised mode of road transport, and argued that this structure represents an effective way of organising the business when transport streams are difficult to predict and the need for flexibility is high.

In a mass producing economy, much transport will consist of relatively stable flows, and this may explain the relatively high degree of in-house transport capacity in Norwegian industry. The large process industries have high and predictable volumes of products and raw materials to take care of, and the transport problem has been efficiently solved by the firms themselves.

As the demand structure for transport changes in the direction of flexible mass production, the need for global reach and high capacity for shorter intervals becomes more clearly felt. Under such circumstances, there is a need to build *integrated transport systems* in order to solve the transport problem in the best possible way.

The development of large forwarding firms by merger and acquisitions across regions and nations is a response of these emerging needs. The trend towards divesting of vehicles, but integrating independently owned trucks into closely knit transport systems has the same roots, in concurrent need for flexibility in terms of capacity, but integration of function and global reach.

The basic premise for the development is a tendency for firms to work increasingly close to each other: To form networks and to form clusters. They need to do so because they need to innovate, and working together, specialising and aiming at

²⁸ Skog-Data A/S may be an interesting illustration of this point. This company is owned by the main associations in the forest owner and wood industry in Norway. The company develops IT systems for the wood industry. It started more than twenty years ago, and has built MA systems and wood-estimation systems for use by forest owners and wood processing businesses. These days, the company is working on a tracking and document-handling system, with the ambition to develop a better mapped and better controlled transport system for the wood industry. However, transport firms are not included in the picture. Independent truck-owners do the actual transport, but play little role in deciding how it is to be made. (Interview with Sven Bøhler at Skog-Data A/S, September 18, 1997.)

flexible mass production is what it takes to sustain the generating of new products and improving existing products - to be innovative.

It is obvious that if the development towards flexible mass production continues, then the role of transport in the system of innovation becomes increasingly important. Not only: The kind of transport organisations called for, changes as well.

In the mass production system, transport has as one of its main functions in being an “elastic bridge” between economic agents: Buffering activities that only in a limited degree are synchronised. In the networked and clustered production system the role of transport becomes much clearer defined. The function becomes much more “machine” like and less “fussy”. Operations have to be more exact, in volumes, in quality as well as in time. This is why transport will become more and more of a systems building effort over time.

There appears to be at least two distinct ways in which this systems building effort can take place: The transport system can be externalised from the production system, or the transport function can be integrated in the overall activities on the originating or on the receiving side of the transport stream.

It is not obvious which of these solutions will become the preferred one. It may be that both have their virtues, and that what solution is chosen depends primarily on the context in which it is applied.

6.1. Integrated third party transport services

A recent study of third party logistics agreements concludes that

Theoretically, the TPL alliance is a promising and innovating way to organise the inbound and outbound logistics function, both because of a better utilisation of the actors’ resources and more sophisticated logistics system which leads to competitive advantages. However ... TPL is demanding and it is hard to achieve a successful alliance, both from a cooperative and economic point of view. Thus, it is not sure that TPL is suitable for all kinds of companies. Success depends primarily on the actors’ attitudes and good will, and secondly on the physical logistics problems.²⁹

²⁹ Dreyer 1997: xii.

First and foremost, the size of the firm may be an important factor. Small firms will not have the option to construct their own transport system with global reach. For such firms, the existence of third party transport and logistics operations could be of great importance. The availability of excellent transport solutions could become a major competitive factor.

EXAMPLE 2: THE CASE OF EKORNES

One example of a relatively small firm with the need for third party transport services is the Ekornes Group located in Sykkylven on the west coast of Norway. This company (actually a cluster of co-operating furniture factories concentrating on marketing a small number of brand-named and copy protected furniture models) is working hard to develop mass production of modularised products. The *Stressless* armchair is made of a few standardised elements, and simple variations of the components make it possible to sell a remarkably high number of versions that appear to be quite different chairs. The production is “on order” and the products are shipped with regular intervals with container ships to overseas (to the UK, USA, Japan, Hong Kong and other destinations), with large trucks from a Danish and a Norwegian transport firm to European destinations, and with Nor-Cargo (truck or ship) to Norwegian customers.

Traditionally, the furniture factories have relied on transport firms externally, and this is still going on. But work is under way to strengthen the transport system of the Ekornes Group. The firm is trying to build up an in-house logistics competence, and the firm sees an improved transport system as an important factor when the company continues its effort to grow in existing and new markets.³⁰

While there it is obvious that small firms may be depending on third party transport services, it is less obvious that outsourcing the transport and logistics function is an advantage for larger firms. There are some great advantages in the system of internal organisation, of which two are the following:

- (1) Internal organisation of transport and logistics can help securing the necessary flow of information which secures the efficiency and efficacy of the transport operations. It does this by integrating the transport people in the social system of the organisation, thus giving space for social interaction and communication of messages from person to person. It also does this by integrating transport in the more formalised business of the organisation, letting form based,

³⁰ Information from visit to the factory and interview with Erling Opdahl, September 15, 1997.

structured messages flow in controlled ways, and in ways that can be accounted for “ex-post”.

- (2) When transport is an integrated element of the overall production and innovation system in a business (a firm, a network or a cluster of firms), the management of this part of the organisation is as important as the management of the other parts, and it may be reduce the freedom to take actions and formulate strategies if this function is sourced out of the core business.

In technologically simple production and distribution systems, social interaction is the fundamental means by which the flow of information associated with the basic flow of goods is taken care of, and the internal mode of transport can greatly facilitate effective communication. This advantage seems not to get completely lost when industrial production and distribution systems develop. Internal transport solutions continue to exist in parallel with the growth of a specialised transport business. The complexities in exchanging pertinent information regarding what transport needed to be made when, will probably be a lasting incentives to arrange internal transport solutions.

However, technological innovation, as discussed earlier, has the opposite effect. The overall impact of the institutional and technological developments which are taking place is that ever higher levels of complexity in transport systems can be handled effectively and efficiently. Online systems, database systems, tracking systems and electronic documentation systems not only have the effect of reducing the impact of the rapidly increasing information overhead that results when integrated transport and distribution systems grow in size. They also make it much easier to share the pertinent information between partners, and this ability represents an added opportunity for innovative transport firms to take over transport and logistics operations from manufacturers or retailer.

What this means is that transport now could have an opportunity to become *a more equal partner* to manufacturing and retail firms. Transport can become knowledge intensive in a new and more professional way. Tendencies to recruit people with higher education, and emerging business studies in *material administration* and *logistics* may be signs that such a development is underway.

EXAMPLE 3: THE CASE OF WAJENS³¹

In what I have in this paper called traditional economic systems, goods are distributed via chains of transactions between buyers and sellers. For example, goods are bought from manufacturers by wholesalers, who take full ownership of the goods before they proceed to sell the goods to retailer. These in turn take ownership of the products before they are sold again to consumer or end-users.

With new technology and new institutional arrangements a different solution to the distribution system is made possible: With increased information processing capacity, a transport firm can take over the role of distributing goods on behalf of manufacturer or wholesaler, and can do this job without having to take over ownership of the products. With electronic database systems and online communication, the transport and forwarding company can handle much more complex transport schemes and combinations, and the systems makes it possible for the customer of the transport firm to monitor the stock in storage, and to send transport orders which take into account the storage situation.

Wajens is a local stevedore, storage and transport company established in 1957 in Oslo. The stevedore part of the operation is located in the Oslo harbour, while the company has established several storage and terminal facilities in the vicinity of Oslo. It's primary role is as distributor of imported goods that arrive in Oslo in containers on ships. Wajens operates several terminal and storage facilities in Oslo and its surroundings, and take care of unloading, storage and distribution for large manufacturing firms abroad. It has a tailor made electronic database and document handling system that has been developed by an independent software expert/consultant in close collaboration with the firm. This system replicates the operations earlier done manually with paper and pen and face-to-face communication. The business idea that Wajens is publicising is to offer storage and distribution at a lower cost than individual firms would have to pay doing the same operations in-house. Wajens does not aim at growing a nation-wide distribution system, but wish to limit the scope of the operation to the Oslo area.

Does a firm such as Wajens play a role in the efforts of other firms to innovate? In a limited sense, it would appear that the answer may be "yes". If a manufacturing company chooses to divest of storage facilities and a distribution operation, because it reduces overall costs and gives a clearer focus on what the firm considers its core

³¹ Information is from a visit to Wajens and my interview with director Jan Strøm September 10, 1997.

business, then this is certainly an innovation, and Wajens can be the one that triggers the decision, by approaching the company and giving them an offer on taking care of these parts of the business.

However, Wajens does not seem to be integrated very closely into the production or innovation chain of their customers. The term *third party logistics* - which is a buzzword in the current transport business - is used by the company, but I find this an imprecise description of the company's business. I would reserve the term for firms which do not only do storage and distribution according to full specifications given by customers (as it would appear is typical for most of Wajens' business), but which do more complex route planning and scheduling operations on behalf of their contract partners. The firm *Nordan Transport og Spedisjon* seems to fit this description at least in some of the business that it is doing

EXAMPLE 4: THE CASE OF HYDRO SEAFOOD AND NORDAN TRANSPORT OG SPEDISJON³²

For small scale transport business, third party logistics will offer few benefits, and third party logistics firms will need to focus on large customers to be competitive. However, also in large scale business, externalising the logistics function while offering distinct advantages, also does pose new problems. This can be illustrated with reference to Nordan (Oslo) and Hydro Seafood (Bergen), which have established this kind of co-operative arrangement. Hydro Seafood is the worlds biggest producer of salmon. The firm has decided to let Nordan handle all detailed logistics and transport. Hydro Seafood handles contacts with customers in Europe and overseas, and co-ordinates the activities of a group of production units of which some are wholly and others are partly owned by Hydro. Hydro Seafood takes care of long term strategy, planning and coordination for the system as a whole. This means that the information acquisition and processing is a crucial concern in the organisation, but it also means that a lot of the detail of transport is left to Nordan to deal with.

Hydro Seafood Sales people currently deal with customers using phone and fax machines, and deals with the production units deciding week by week when and what to slaughter. Information from the producers is transmitted to Hydro Seafood with an internal and proprietary electronic link.

Plans are made for long term development, for the year, and for shorter periods, and production and sales must all the time negotiate to balance supply and demand – no trivial task in itself, and made only more difficult by the fact that the products are live fish.

The demands on the transport system are very high: Transport needs to be optimised with respect to timing and cooling in the course of the transport. Using Nordan, with its large fleet of trucks and flexible organisation can give Hydro Seafood adequate transport capacity at a lower cost than the price Hydro would have to pay for an in-house transport system.

The problems with the arrangement are primarily in communication and possibilities of control. How can Hydro Seafood get messages across, how can arrangements be made when Nordan cannot deliver what Hydro would ideally like to have? In the complex web of production opportunities and limitations, customer needs and preferences, sales and transport, compromises have to be made all the time. Interests have to be balanced, priorities made. Transport is but one element in the overall picture. How do you make the negotiations on transport arrangements when there are two firms involved which are located in two different cities? How can Hydro Seafood know that Nordan is doing a reasonable job, and how can the actual performance of the logistics services be controlled and benchmarked?

Fax and phone goes some of the way, electronic document exchange contributes, and tracking of goods in a satellite based navigation and tracking system could make it even easier for Hydro Seafood. But in spite of all the technology, of which the most advanced features are very recent (EDI) or not yet introduced (tracking of goods), for Hydro Seafood to get what it needs, there is no escape from having a good working relationship with Nordan, marked by

³² Information is from visits to the companies and interviews; with Tove Berge in Bergen and with Kjetil Jordheim in Oslo.

trust and open communication channels also in the social sense of these terms. This kind of working relationship must be built by working together, and to facilitate the process Hydro Seafood actually has one Nordan employee as a “liaison officer” in their offices in Bergen. Paid by NORDAN, reporting to her boss in Oslo, but working together with the people of Hydro in Bergen.

Again we can ask to what extent the transport firm - Nordan in this case - is part of an innovation taking place elsewhere. This time, the answer is: As a contributing and collaborating partner. Nordan is there to support the efforts going on in the salmon exporting company to structure the business effectively, to recruit new customers in new geographical areas, and to serve existing customers well. By developing tracking systems and aiming at introducing bar codes in their operations, Nordan helps building control and accountability into the distribution system. The company builds a system for information handling that far surpasses the information handling capacities of manual systems. Nordan can take control over the practical issues of transport and most of the logistics, Hydro Seafood handles salmon production and dealings with customers.

6.2. Retailers, wholesalers and manufacturers as integrated distributors

Information technology facilitates the outsourcing of transport and logistics services, however, there is little doubt that the same technologies can be used to make in-house systems more effective too. In large, segmented organisations effective communications systems can make a big difference for the ability to manage effectively the overall distribution system.

While the examples mentioned above are of firms and constellations where manufacturers choose to define distribution as mainly outside their core business, other firms choose differently. There are examples of firms which integrate distribution, wholesaling and retailing (such as supermarket chains) and of firms which integrate all the main links of the value chain: Production, distribution and retail. *Benetton* of Italy are one of the pioneers in this segment. The firm’s strategy is that it is based on (1) holding a global product portfolio; (2) a common market approach; (3) a world-wide standardised shop image; (4) global financial management; and (5) a global communications strategy. The company operates

several factories, designs its own products, and entertains a large chain of exclusive retail outlets. It also operates a huge distribution system, and integrates transport firms into the operations to carry the flow of goods from production to sales points.³³

Logistics as a competitive factor is also clearly visible in another type of company, namely in large supermarket chains. These firms may have started out as a number of diverse supermarkets and wholesalers, but have become integrated in a complete system for distribution and sales of fast-moving consumer goods.

One example in Norway of this type of company is *Hakon Gruppen*.³⁴ The company has integrated into the core of the company business transport from producer's door all the way into their own supermarkets and all the logistics associated with operating this transport system, in effect transforming itself from a cluster of retail outlets into an integrated distribution business. Thus, while many of the traditional virtues of qualified speciality stores (manually cut and packed meat, fish, cheese, personalised service, etc.) and the knowledge of products among employees in the shops have been completely disbanded, a lot of attention is paid to cutting costs and securing freshness by building up a fast and reliable distribution system for industrially produced and packaged foods. Information technology and just-in-time skills are essential for this effort.

Now, if we can be allowed to label a firm such as Hakon Gruppen a company for integrated distribution of consumer goods, one could make a credible claim that this company is an example of a transport company really promoting innovation in a way that is nationally significant. Benetton no doubt is an even clearer example of a company where the innovative handling of the information aspect of transport becomes a major competitive factor and systems building facilitator. In this case the potential innovative impact of advanced transport is salient. In this type of company, people with education in information technology, logistics and transport appear to be more sought for than people who have grown up in the road transport business.

³³ Information on cloth distribution and on the Benetton system was given by Olav Gunleiksrud, in the interview I had with him at November 2, 1996 in Oslo. Additional information was found on the internet on the address: <http://www.benetton.com/benetton-web/benetton/network.htm>.

³⁴ Information on Hakon Gruppen is mainly from my interview with Knut Arnet at the company's distribution centre in Skårer outside Oslo on December 13, 1996.

7. Policy issues

Transport services are being transformed under the influence of institutional innovations, technological innovations and changes in the demand structure in industrial economies moving towards more flexible mass production systems. Among the significant changes taking place in road transport is (1) the growth of integrated transport systems where transport flows and information flows are controlled and managed with the use of advanced information and communication technology systems. Also, in order to reduce costs and lead times, (2) containerisation will continue to spread into other segments of the transport business, and (3) transport systems will increasingly become integrated systems of diverse means of transport.

The policy issues related to these developments are many and challenging.

Environmental issues.

Transport is essential in the effort to make European industries more cost-effective and more innovative. However, the transport system is among the activities that have the most direct and adverse impact on the environment. Balancing the needs for frequent and fast transports against environmental interests will continue to be an important policy challenge. Rules and regulations only aiming at curbing activities to reduce pollution will conflict with policies aiming at stimulating growth and innovativeness in economic activities. Transport continues to be a fundamental precondition for economic development, and is an integral aspect of the ongoing transformation of economic activities and institutions.

Infrastructure.

Infrastructure developments in the post war period have been remarkable. In the future, the continued expansion of the physical infrastructure will increasingly come in conflict with well organised environmental interests. Rather than building more infrastructures, the task will be to find ways to utilise the already existing physical capital. One way to do this is to integrate facilities for different transport systems. There could be important gains to be made by coupling rail, air, road and sea transport into comprehensive transport systems. However, the marginalisation of rail freight shows how hard it is for railways to cope with the new demand structure and

the needs for many and relatively small transports. Integration with other means of transport into integrated transport systems may be one of the few possibilities to make use of existing rail freight capacity. Ultimately, it is probable that only new transport technologies can resolve the fundamental issues: The economies of scale inherent in large transport systems (such as railways) must be combined with the cost effective flexibility of individual mobility which is inherent in car and truck transport. New powersystems and safe infrastructure arrangements appear to be among the crucial goals which new technology may help realising.

Information and communication technology.

The integration and expansion of transport solutions into comprehensive systems increases the need for effective data processing and communications. Such systems can: (1) improve the capacity for route planning and transport scheduling, (2) allow data to be gathered and analysed which can improve running operations of manufacturers, distributors as well as retailers, (3) improving accountability by making it possible to document the transactions being made, and also (4) facilitate the co-ordination between different agents in the materials flow chains (inside firms and between firms). Public efforts are called for in order to help standardisation in these areas of technology, and in order to build up infrastructure in the form of networks and in the form of public databases essential to the efficiency of the overall system. (Road databases and mapping data are examples of such resources.)

Human resources and skills.

With the growth of integrated transport systems comes the need for people with more formal knowledge and skills. In order to build strong firms, development of adequate education is important. Education in logistics seems to have become more common in Norway over the last years, and policy makers must help developing these offerings further, both in the school and university system.

Also research is called for. There has been significant funding of technical research with relevance for traffic regulation, safety and welfare economic aspects of investments in transport infrastructure. But there has been a lack of research focused more specifically on issues of potential interest of companies in the transport business, and in particular research which builds on collaboration between research groups and firms, and which can stimulate both the research effort itself and the

process of competence building in the industry. To some extent, this has been due to a lack of interest for research inside business itself. However, with the tendency to recruit people with higher education and the new efforts to build a professional knowledge base in the transport business, this situation may be changing rapidly. It may be a sign that the situation is changing that the Norwegian research council, whose predecessors financed little or no research of this kind, during the 1990s has stood behind the PROTRANS programme, and currently is behind the start up of LOGITRANS. Both programmes are business oriented efforts.³⁵

The liberalisation of the transport business and the rationalisation of operations with the help of technology has much transformed the reality of the jobs in the system. While a new group of professionally trained personnel is entering into the transport business, others experience de-skilling and a loss of job content. Among the big losers over the last decade or two are no doubt the drivers. They have less influence on their job situation, less freedom and less issues to take care of besides the actual driving of vehicles. There are unresolved issues which could benefit from political initiatives in this area, for example with respect to work hour regulations and salary systems.

³⁵ For an overview of research projects targeted at the service sector, consult Braadland 1998b.

8. Conclusion

In this paper the analytical focus has been set upon road transport of goods.

Transport is extremely important in any economy, and the development in transport and distribution is closely connected to the overall development of an economy.

While the loading and moving of goods have much in common with what transport was about 50 years ago, there are big differences in equipment, in speed and in the way cargo is organised. Even more striking are the differences in what goes on *behind the scene* in terms of information management. The innovations currently taking place, which include the utilisation of digital information systems, may be creating a whole new road transport industry. In fact, the innovations in transport are closely coupled with the overall innovation efforts in the productive fabric of modern economies. This poses a huge challenge for the quite traditionally oriented, culturally specific and small-scale Norwegian road transport business. It also poses a challenge for policy makers, as the development or lack of development in road transport will have a great deal to say for the possibility to sustain value-adding work places in this sector of the economy, and as the development in the transport sector actually will impact significantly on the overall innovative performance of the Norwegian economy in the future.

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Storgaten 1, N-0155 Oslo, Norway
Telephone +47 2247 7310
Fax: +47 2242 9533
Web: <http://www.sol.no/step/>



STEP-gruppen ble etablert i 1991 for å forsyne beslutningstakere med forskning knyttet til alle sider ved innovasjon og teknologisk endring, med særlig vekt på forholdet mellom innovasjon, økonomisk vekst og de samfunnsmessige omgivelser. Basis for gruppens arbeid er erkjennelsen av at utviklingen innen vitenskap og teknologi er fundamental for økonomisk vekst. Det gjenstår likevel mange uløste problemer omkring hvordan prosessen med vitenskapelig og teknologisk endring forløper, og hvordan denne prosessen får samfunnsmessige og økonomiske konsekvenser. Forståelse av denne prosessen er av stor betydning for utformingen og iverksettelsen av forsknings-, teknologi- og innovasjonspolitikken. Forskningen i STEP-gruppen er derfor sentrert omkring historiske, økonomiske, sosiologiske og organisatoriske spørsmål som er relevante for de brede feltene innovasjonspolitik og økonomisk vekst.

The STEP-group was established in 1991 to support policy-makers with research on all aspects of innovation and technological change, with particular emphasis on the relationships between innovation, economic growth and the social context. The basis of the group's work is the recognition that science, technology and innovation are fundamental to economic growth; yet there remain many unresolved problems about how the processes of scientific and technological change actually occur, and about how they have social and economic impacts. Resolving such problems is central to the formation and implementation of science, technology and innovation policy. The research of the STEP group centres on historical, economic, social and organisational issues relevant for broad fields of innovation policy and economic growth.