

RAPPORT 1202

Svein Bråthen, Naima Saeed, Øyvind Sunde,
Jan Husdal, Arne Jensen and Edith Sorkina

**CUSTOMER AND AGENT INITIATED
INTERMODAL TRANSPORT CHAINS**

Final report to the NRC/SMARTRANS
program for the Norwegian part of
NCR project no 188387

*Svein Bråthen, Naima Saeed, Øyvind Sunde, Jan Husdal, Arne
Jensen and Edith Sorkina*

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Abstract

This report concludes the Norwegian part of the ERA-NET project CA-CHAINS (NCR project number 188387). Gothenburg University (UiG, The Logistics and Transport Research Group (LTRG) within the Department of Business Administration at the school of Business, Economics and Law) has been the lead partner in this project. Molde University College has been responsible for the Norwegian part. The main objective with this part of the project has been to increase knowledge and understanding of the initiation and development of customer and agent initiated intermodal transport chains.

Many of the findings are supported by earlier research; higher volumes and transport supply chain alignment are key success factors. The public sector has a role in coordinating and aligning the transport supply chain (coordination between ports, railway and terminal capacity and utilization, road network design and connectivity), to act as moderators where coordination needs are evident and to set correct prices and charges for use of various types of energy, and of transport infrastructure. But there are also likely areas of improvement for the transport users and providers, like aligning supply chains and carefully plan their activities more in light of the traditional logistics/operational management perspective where tradeoffs between e.g. transport and inventory costs in light of optimal lot sizes is one among several factors.

Further research into the issue of product variety in the intermodal service supply chain can perhaps be recommended to gain competitive power based on a wider scope where variables outside the core of the intermodal transport supply chain are taken into consideration. Moreover, we have focused on the shipper's willingness to choose or pay for ship transport with significant economies of scale in the discussion based on non-cooperative game theory. Carriers have only played a passive role. More specifically, if there is demand or sufficient contributions to cover the fixed costs, a ship service will be provided by a carrier. Adding carriers to the game could provide valuable insight into the market process and efficiency.

Preface

This report concludes the Norwegian part of the ERA-NET project CA-CHAINS (NCR project number 188387). Gothenburg University (UiG, The Logistics and Transport Research Group (LTRG) within the Department of Business Administration at the school of Business, Economics and Law) has been the lead partner in this project, with Prof. Arne Jensen as the project leader. Prof. Svein Bråthen, Molde University College (MUC) has coordinated the Norwegian part of the study.

The main objective of the project has been to investigate the nature of customer- and agent initiated intermodal transport chains. Chapter 1 (Introduction) outlines briefly the scope of the project.

The CA-CHAINS project is supported by the Norwegian Research Council (NRC)/SMARTRANS, the Swedish Research Council (SRC). The Norwegian part is also supported by the Norwegian Public Roads Administration (NPRA).

The distribution of work is as follows: Chapter 2 and 3 is written by Arne Jensen, UiG. Chapter 4 is written by Edith Sorkina, UiG, with an introduction by Arne Jensen. The introduction in Chapter 5 and Chapter 5.1 is done by Øyvind Sunde, Bergen University College (formerly affiliated at MUC), where Chapter 5.1 is written as a paper. Chapter 5.2 is done by Naima Saeed, MUC, written as a paper. Chapter 6 and 7 is written by Svein Bråthen, MUC. The interviews are done by Svein Bråthen, Jan Husdal (Moere Research Institute) and Edith Sorkina. The interview guide is made by Edith Sorkina and adapted to Norwegian cases by Jan Husdal and Svein Bråthen. Jan Husdal has made the transcripts of the interviews, except for the Public Sector Moderator, where Edith Sorkina made the transcript. The transcripts are adapted to maintain confidentiality for the respondents (the full versions are confidential).

We want to thank our respondents for giving us valuable insight into their operations. They know themselves who they are.

Molde, 31 January 2012

The Authors

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1. Summary

Introduction: Mechanisms for consolidating intermodal freight flows

Traditional

Volumes can be consolidated by different mechanisms. Traditionally, they have been consolidated by the market's interchange processes, where the main carrier (rail- or shipping company) or his agent is selling the main transport plus terminal handling to the next link. This link has often consisted of carriers or forwarders responsible for connecting transports and sale of the whole transport (from door to door) to the end customer.

Customer initiated intermodal transport chains

A potential for intermodal transport is based in large actors' strategic planning. Large shippers and transport coordinators increasingly take the initiatives to cooperation, or analysis of cooperation, aiming at establishing intermodal transport chains and systems. This could lead to different forms of partnerships, consortia, etc., here referred to as customer initiated intermodal transport chains. These chains will have to be specifically designed to match the collective requirements of a few big and powerful customers in terms of costs, speed, reliability, frequency, and equipment. Even if these actors in total are large and powerful shippers, each individual actor's goods flows in specific relations will often be insufficient as a base for the design of competitive intermodal transport chains.

Agent initiated transport chains

Another potential is represented by small shippers who do not have sufficient volumes and negotiating power to take initiatives of their own to coordination, but who are positively inclined towards intermodal transport, should the opportunity arise. Coordination of transports requires that different transport buyers' demands can be adjusted to make utilisation of different kinds of scale economies in the transport system possible. Consolidation of goods for this type of intermodality probably requires that projects are initiated by a suitable external "change agent" (or group of such agents) and they are run by some kind of coordinating network of goods customers and traffic operators. Agent initiated intermodal transport systems could be used as a term for establishment processes of this kind.

Aim and research questions

This project has two main aims. One is to increase knowledge and understanding of the initiation and development of customer and agent initiated intermodal transport chains. A second aim is to contribute to the development of customer and agent initiated intermodal transport chains by action driven research. This report focuses on the first aim, with the corresponding research questions:

- RQ 2: Are there factors in the market structure of the transport sector or in the shippers' markets that can make the development of customer and agent initiated transport chains difficult (development barriers)?
- RQ 3: What analytical concepts and tools could facilitate for transport policy makers and company strategists when analysing the potentials and prospects of specific cases of customer and agent initiated transport chains?

The entire set of research questions is listed and discussed in Chapter 2.

Barriers to competition and collaboration in intermodal transport

Incentives and obstacles to cooperate and the barriers connected to intermodal transport competitiveness are important topics in this study.

Barriers to intermodal transport as being competitive

Literature on intermodal transport has a vast discussion on different barriers facing the intermodal transport industry and preventing its growth. The following concrete problems have been highlighted in the literature:

- *Poor quality*, e.g. reliability, damage of goods, transport time;
- *High costs*
- *Unbalanced flows*
- *Poor information flow* e.g. missing/insufficient/non transparent;
- *Poor profitability*: small flows over short distances, expensive services;
- *Poor area coverage and infrastructure*
- *Lack of formal network/chain/system management*
- *Restriction on the type of goods*
- *Lack of standardization* e.g. unit loads, equipment etc.
- *Problem with education and staff in the industry*
- *Mentality and attitude problems of transport buyers*
- *Lack of incentives*
- *Liability and documentation issues*
- *Distribution of cost and benefits between the actors involved*
- *Strong public sector involvement*
- *Transport buyers having no experience in using intermodal transport*
- *Poor innovation ability* e.g. only few transshipment technologies are explored commercially;
- *Competitiveness highly contextual*, meaning local conditions differ largely;
- *Restricted/difficult market entry*, e.g. market contestability needs to be enlarged; regulatory and technical access should be simplified; faster liberalization to facilitate creation of genuinely European intermodal operators;
- *Prioritization of passenger traffic on rail*

Collaboration

The following general issues regarding benefits from collaboration can be found in the literature:

- *gaining competence* and eliminating high cost of duplication
- *market knowledge & access*
- *improving reputation*
- *getting access to other products and other resources of importance*
- *gaining economies of scale*
- *risk and cost sharing*
- *collective lobbying*
- *neutralizing or blocking of competitors*
- *gaining a competitive advantage*

- *increasing profit*
- *enabling to specialize on core business*
- *customers prefer to work with just few partners*

Collaboration in logistics and transport has mostly been studied within the context of Supply Chain Management. When a decision to establish collaboration with certain actors is rather a necessity than a choice, it is still important to consider certain prerequisites for successful collaboration, the potential gains from the collaboration and the possible threats.

Theoretical framework

Non cooperative games

Paper One, Chapter 5.1 has analysed the market for intermodal transport in light of research question 2. An earlier study analyse a static non-cooperative game in which two shippers are to make a choice between two modes of transport. One mode of transport, assumed to be ship, is characterised by extreme economies of scale as there are only fixed costs. It is assumed that each shipper pays half the fixed cost if they both make use of this mode of transport, whereas a shipper must pay for the entire fixed cost if he is the sole user of this mode of transport. The other mode of transport, assumed to be truck, is characterised by constant returns to scale at the micro level as there are only variable costs. At the macro level however, truck is characterized by possibly 'diseconomies' of scale due to congestion. The shippers (players) have complete information regarding each other's payoffs (cost of transport). It was demonstrated that there may be inefficiency in such a situation.

We have modified this mode-choice game in various ways. We allow for less extreme economies of scale so that ship may have both variable and fixed costs. We assume that the cost of making use of truck is unaffected by the choices made by the two shippers; in other words, there may be congestion at the macro level, but congestion is not significantly affected by the choices made by the two shippers. Furthermore, we assume that shippers have private information regarding their (generalized freight) cost of making use of truck, the alternative to ship. In other words, there is private information regarding the willingness to pay for ship transport.

Whether or not a shipper or consolidator chooses ship transport depends on the cost of the alternative mode of transport (truck) and – as the cost is halved if both choose ship - whether the other shipper chooses ship or not. The latter is not known with certainty due to the aforementioned private information. As a result, each shipper must 'gamble' and choose between the cost of truck transport which is known with certainty, and the cost of ship transport which is uncertain (as there is uncertainty regarding whether the other shipper will share the fixed cost or not). Even if shippers are risk neutral, this causes shippers to be cautious to choose ship. As a result, even if joint transport by ship is ex post efficient, shippers may still opt for truck transport. Even worse, a shipper may turn out to be the sole user of ship transport having to pay for the entire fixed cost himself whereas the other shipper incurs the cost of shipping his cargo by truck even though the 'marginal' cost of shipping his cargo by ship is very low. Thus, the modified model confirms the earlier results that the shippers may choose modes of transport that are inefficient. But this is not

a result of conflict of interests amongst the shippers (players) as this is a pure coordination game. Rather, it is due to the lack of (or private) information.

In a pure coordination game with no conflict of interest, it seems natural to assume that players have an incentive to communicate before deciding whether or not to opt for ship transport. Such 'cheap talk' could solve the coordination problem. But if shippers can communicate in advance, it seems natural that they may also use this opportunity to bargain on how the fixed cost is to be shared amongst them. If so, there is a conflict of interest that simple communication cannot solve. In our modelling, we have therefore allowed shippers to bargain on how the fixed cost is to be shared between them. More specifically, we assume that each shipper may make contributions simultaneously and non-cooperatively. If the sum of contributions exceeds the fixed cost associated with ship transport, the shippers pay accordingly and are served by a carrier. If not, contributions are refunded and shippers choose the alternative mode of transport (truck). It turns out that the shippers true willingness to pay for a ship transport service exceeds their equilibrium contributions. In the jargon of auction theory, they 'shade' their true willingness to pay. The reason is simply that paying for the fixed cost is a kind of 'common good' and as a result, each shipper has an incentive to 'free ride' on the contributions made by the other shipper. As a result of this 'shading', ship transport may not be provided due to insufficient contributions even though the total willingness to pay exceeds the fixed cost. Thus, inefficiency may prevail despite the fact that shippers may communicate.

Could an outside agent (i.e. a public authority) improve on efficiency? If the splitting of the fixed cost amongst the shippers is not an issue, there is no conflict of interest amongst the shippers. In such a pure coordination game of incomplete information, what is needed is simply communication. An outside or external agent may initiate such communication. Each shipper would have an incentive to reveal truthfully their willingness to pay to such an agent, provided that there are no conflicting interests between the shippers and the agent (which is not obvious if the agent happens to be a profit-maximizing carrier).

If the splitting of the fixed cost amongst the shippers is an issue however, our analysis has revealed that shippers will not have the proper incentives to reveal truthfully their willingness to pay for ship transport. In such a bargaining game of incomplete information in which there is a conflict of interest, simple communication amongst the shippers will not solve the problem. In this case however, an outside or external agent may improve on efficiency by providing the shippers with the incentives to reveal truthfully their willingness to pay provided that such an agent can commit himself. For instance, such an agent could implement mechanisms known from the literature where truth-telling is a dominant strategy in order to reveal the willingness to pay for a public good (which in our case is the fixed cost associated with ship transport). However, it is well known that implementing such mechanisms will raise revenue that falls short of the cost. Thus, there is need for public funds in order to balance the budget. As public funds has a shadow price however, this implies that there is a trade-off between efficiency and (the cost of) public funds and in general, an optimal mechanism will to a certain extent sacrifice efficiency in order to save public funds.

In a dynamic setting the saving of public funds could even be detrimental to a mechanism: Suppose that the contract based on the mechanism has a limited duration. Once the contract terminates, the agent could simply propose a new contract in which each shipper is asked to make a contribution slightly less than his previously stated willingness to pay.

Each shipper will accept such a contract. As a result, the agent may save (and even increase) public funds and at the same time implement ship as an efficient mode of transport. Presumably the shippers will anticipate this up front and as a result, may be reluctant to reveal truthfully their willingness to pay in the first place. This is known as the 'ratchet effect' with the theory of regulation.

Even though these models provide us with valuable insight, there is still scope for further research. For instance, both the coordination model and the bargaining model could be extended to multi-period models. Preliminary findings from a two-period coordination model seem to indicate that choices in early rounds can tend to reinforce themselves over time (cause 'path dependence'): If the two shippers do both choose ship in the first period, they have both revealed that they have rather high costs associated with using the alternative mode of transport (truck). As a result, they will both choose ship in the second period as well. Likewise, if the two shippers do both choose truck in the first period, they have both revealed that they have rather low costs associated with using the alternative mode of transport (truck). As a result, they will both choose truck in the second period as well.

Also the bargaining game could be made dynamic. It must be admitted though that dynamic models of incomplete information tend to be immensely difficult to analyse.

We have maintained the assumption of only two carriers as this simplifies the games. Adding more shippers could provide valuable insight into how the outcome may depend on the number of shippers. For instance, in the bargaining game we have detected that shippers will tend to 'shade' their willingness to pay for ship transport as paying for the fixed cost associated with this mode of transport is a kind of 'common good'. Increasing the number of shippers reduces the probability that a specific shipper is pivotal concerning whether or not the sum of contributions exceeds the fixed cost. If so, each shipper can be predicted to reduce his contribution. In other words, the tendency to 'free ride' on the contributions made by fellow shippers will increase as the number of shippers increase.

Cooperative games

Paper 2 has analysed four cases for three freight forwarders with two different means of transportation, in light of research question 2. In the first case, all players work independently and the numerical analysis obtained by solving the Bertrand model reveals that the equilibrium prices are higher for players 1 and 2 – freight forwarders with their own trucks (player 1 is big, player 2 is small, player 3 uses ships). However, despite the high price, player 1 and 2 captures the largest market share. This reflects users' preference to trucks over ship to carry their cargo, even though ships are cheaper. This could be due to the fact that trucks offer a flexible service with low waiting time. However, the frequency of ships is lower and waiting time is higher.

Furthermore, different combinations of coalitions among these players are discussed. A two-stage game was applied for the purpose of analysis. In the first stage, the three players had to decide whether to act alone or to enter into a coalition with another player. The decision at this stage should presumably be based on the predicted outcome for the second stage. Here, the second stage is modelled as a Bertrand game, with one outside competitor and the coalition. The numerical results reveal that all three kinds of coalitions

generate higher profits for the members of the coalitions, as well as for outsiders in each case. The reason for the high profit is the high equilibrium prices that players are able to charge from their users due to the creation of a duopoly after the establishment of a coalition among any two players.

Although all combination of coalitions result in higher profit for the players involved. However, the combined profit of the members of the coalition, as well as outsiders, is highest in a situation when players 1 and 3 cooperate and offer intermodal services to their users. Due to market power and improved quality of service, these players are able to charge higher prices. Therefore, according to these findings, it is more beneficial to establish a vertical cooperation between a large truck operator and a ship operator to offer intermodal services than to establish a horizontal cooperation between two players. Moreover, establishing vertical cooperation among a small trucking company and a ship operator is also not as beneficial as the previously mentioned vertical cooperation.

However, calculations of users' surplus show that these kinds of coalitions are not beneficial for users because they generate a negative payoff for them, which reflects the high prices they will have to pay to the service providers. This simulation does not capture the situation with competition between several groups of intermodal transport providers.

The case study

We have done in-depth interviews with 6 stakeholders that either have implemented an intermodal solution, or that are in the process of setting up one. Two of the stakeholders have also been involved in attempts earlier to set up intermodal solutions, attempts that did fail at the time. Since there are business models and company information involved, the transcripts in Appendix 1 are kept anonymous. For obvious reasons, we have therefore also chosen not to reveal detailed publicly available information about the respondents. They can shortly be described like this:

- A consolidator which uses intermodal transport on a general basis.
- An intermodal transport company
- A consolidator and 3 PL company
- A durable consumer goods manufacturer
- A public sector moderator
- A bulk product manufacturer

The case study interviews have been done in light of the research questions for this part of the project, listed in Chapter 3. The main theoretical basis is non-cooperative game theory, as described in Chapter 5.1.

Propositions

The following three simple propositions give the directions for presenting and analysing the findings:

P1: The customers (cargo owners) play the most important role in deciding upon whether intermodal transport should be used. A moderator is a necessary but not a decisive factor.

P2: Transport costs are the main issue when selecting intermodal instead of uni-modal transport.

P3: Information about cargo volumes and transport needs (capacity, frequency) between customers is important when setting up customer-initiated transport chains.

Main findings, conclusion and direction for future research

Customer initiated intermodal transport chains

For customer-initiated solutions, all 3 propositions are supported. A public sector moderator seems to have played a crucial role in one of the cases, in terms of (a) getting information about volumes, and (b) setting up communication with foreign ports also with the purpose of getting suitable return cargo. We can perhaps draw a tentative conclusion that the moderator has had a necessary but not sufficient role in making this intermodal solution available. In another case, momentum was lost when the consortium of customers handed the responsibility for setting up the intermodal transport over to the shipping line. It has not been possible to elicit whether this transfer were premature in the sense that binding commitment was not in place. However the common denominator behind an intermodal success boils down to competitive total logistics costs, including departure frequency and flexibility. Lack of factors like market size and available infrastructure can hardly be compensated.

Agent initiated intermodal transport chains

For agent-initiated solutions, proposition 1 appears to be partly supported. The customers (cargo owners) appears to have a less important role in deciding upon whether intermodal transport should be used in typical cases where agents are used by many smaller customers. The agent is the main decision maker, and acts as the focal firm in the intermodal supply chain. Proposition 2 is supported. As a point of departure transport costs are the main issue when selecting intermodal instead of uni-modal transport for this segment as well. However 3 PL services can extend product variety in the intermodal transport chain and hence create a kind of "strategic distance" towards more standardized intermodal solutions. Hence, one could anticipate that a bit more expensive intermodal transport chains could be competitive after all, if 3 PL services that suit the customer's supply chains are included.

Many of the findings are also supported by earlier research; higher volumes and transport supply chain alignment are key success factors. The public sector has a role in coordinating and aligning the transport supply chain (coordination between ports, railway and terminal capacity and utilization, road network design and connectivity), to act as moderators where coordination needs are evident and to set correct prices and charges for use of various types of energy, and of transport infrastructure. But there are also likely areas of improvement for the transport users and providers, like aligning supply chains and carefully plan their activities more in light of the traditional logistics/operational management perspective where tradeoffs between e.g. transport and inventory costs in light of optimal lot sizes is one among several factors.

Further research into the issue of product variety in the intermodal service supply chain can perhaps be recommended to gain competitive power based on a wider scope where

variables outside the core of the intermodal transport supply chain are taken into consideration. Moreover, we have focused on the shipper's willingness to choose or pay for ship transport with significant economies of scale in the discussion based on non-cooperative game theory. Carriers have only played a passive role. More specifically, if there is demand or sufficient contributions to cover the fixed costs, a ship service will be provided by a carrier. Adding carriers to the game could provide valuable insight into the market process and efficiency.

2. Introduction

Traditional mechanisms for consolidating intermodal freight flows

Intermodal transport systems demand large goods volumes in order to reach a competitive combination of cost efficiency, transport quality and good environmental properties. How large goods volumes that are required depends among other things on the demands for transport frequency, the current intermodal technology and the competitive power of all-road truck transports. Volumes can be consolidated by different mechanisms. Traditionally, they have been consolidated by the market's interchange processes, where the main carrier (rail- or shipping company) or his agent is selling the main transport plus terminal handling to the next link. This link has often consisted of carriers or forwarders responsible for connecting transports and sale of the whole transport (from door to door) to the end customer. This way of consolidating goods can mainly be said to represent a traditional, market based coordination mechanism, which accounts for the main part of the intermodal goods flows.

Customer initiated intermodal transport chains

A significant and growing potential for intermodal transport is based in large actors' strategic planning. These actors are either large, often internationally operating, manufacturers or trading companies with goods flows in logistics networks between manufacturing and/or distribution units or large transport coordinators (forwarders, shipping agents, ports) with large flows in international transport networks. The strategic incentives to switch to intermodal transport is the insight that environmental effects, congestion and increasing lack of energy will bring, relatively speaking, more expensive road transports of lower quality at the same time as intermodal transports slowly will increase in competitive power in different aspects.

Even if these actors in total are large and powerful shippers, each individual actor's goods flows in specific relations will often be insufficient as a base for the design of competitive intermodal transport chains. Thus, consolidation of these actors' goods flows is needed. Today, large shippers and transport coordinators increasingly take the initiatives to cooperation, or analysis of cooperation, aiming at establishing intermodal transport chains and systems. This could lead to different forms of partnerships, consortia, etc., here referred to as customer initiated intermodal transport chains. These chains will have to be specifically designed to match the collective requirements of a few big and powerful customers in terms of costs, speed, reliability, frequency, and equipment.

Agent initiated transport chains

Another potential is represented by small shippers who do not have sufficient volumes and negotiating power to take initiatives of their own to coordination, but who are positively inclined towards intermodal transport, should the opportunity arise. These buyers need support for the coordination, for instance in the form of external help to establish a coordinating network for a so called line train system. In order to implement a line train system, a strategy is required to overcome the organisational and economic barriers to entry. Earlier, attempts have been made to implement line based combined transport based on one company's perspective and the analysis indicates that more customers are required in order to generate a sufficient volume in the establishment phase. A strategy is needed where volumes, terminals and lines are opened and added to the system

successively at the same time as the quality of the transport system can be maintained. Coordination of transports requires that different transport buyers' demands can be adjusted to make utilisation of different kinds of scale economies in the transport system possible. Consolidation of goods for this type of intermodality probably requires that projects are initiated by a suitable external "change agent" (or group of such agents) and they are run by some kind of coordinating network of goods customers and traffic operators. Agent initiated intermodal transport systems could be used as a term for establishment processes of this kind.

3. Aim and research questions

Aims

This project has two main aims. One is to increase our knowledge and understanding of the initiation and development of two new segments of intermodal transport chains: Customer and agent initiated intermodal transport chains. A second aim is to contribute to the development of customer and agent initiated intermodal transport chains by action driven research. These aims can be considered as instrumental for realising an overall aim which is to contribute to increased market shares for intermodal transport nationally and trans-nationally by providing two new evolving segments of combined transports with sufficient competitive power in the market place.

Our instrumental aims are directly related to one of the prioritised research issues of the ERA-Net joint call, namely “(2) lack of efficiency in and acceptance of the intermodal freight transport system”. Indirectly, it may also address “(1) time and cost in the terminal handling” if revealed as a barrier to the two study segments.

Regarding “2.3 Topics of the joint call”, our research action addresses “Flexible and modular intermodal freight concepts” as the focal field, but may also cover aspects of the other R&D fields when relevant for the segments we are going to study.

Research questions

Both customer and agent initiated intermodal transport chains are new phenomena at an early stage of development. Therefore, it is important and possible to develop new knowledge that can contribute to understanding these processes and stimulate their future development. It is important to know how the processes start and develop, intra-organisationally as well as inter-organisationally. In this context, it is essential to identify obstacles and barriers that make a transition to customer and agent initiated intermodal transport solution difficult. Also, it is important to identify and develop factors that could constitute driving forces. The research will cover the development and design of intermodal transport chains that are tailored to the requirements of the two categories of shippers. The research may cover organisational, economical, technological, and technical issues.

One kind of obstacle that transport buyers sometimes point out in this context is the risk of goods damage and increased lead time variations. A constructive way of attacking these obstacles is to ask oneself if small changes in the shippers’ logistics systems could contribute to reducing them. The changes could concern packing, load carriers and load handling routines in order to prevent damage to the goods and certain changed planning in the logistics systems combined with more information in both directions to minimize lead time variations or to prevent their negative consequences.

In total, the project has considered the following research questions (RQs) related to customer and agent based intermodal transport chains:

- RQ 1: Why, by whom and how are customer and agent based intermodal transport chains initiated and what do the first phases of the process look like?

- RQ 2: Are there factors in the market structure of the transport sector or in the shippers' markets that can make the development of customer and agent initiated transport chains difficult (development barriers)?
- RQ 3: What analytical concepts and tools could facilitate for transport policy makers and company strategists when analysing the potentials and prospects of specific cases of customer and agent initiated transport chains?
- RQ 4: When do main carriers (railway operators, shipping companies) and other transport producers enter into the picture?
- RQ 5: How are consortia formed and contracts drawn up?
- RQ 6: How and to what extent are infrastructure owners, municipalities, regions, and catalytic agencies (national and supra-national) involved in the process?
- RQ 7: What transport quality dimensions will be more important than others for the shippers in customer and agent initiated transport chains
- RQ 8: What aspects of information system integration between critical links in the intermodal transport chains will facilitate the development of customer and agent initiated transport chains?
- RQ 9: What public transport policy measures and company strategic guidelines and decision rules can be recommended from our research?

For organising research activities and allocating research responsibilities the research questions are grouped into the following sub-projects which collectively are intended to cover the entire project:

Sub-project 1: The structure and dynamics of the development processes (RQ 1, RQ 4, RQ 5, RQ 6, RQ 7, RQ 8, and RQ 9)

Sub-project 2: Development barriers in the market structure (RQ 2 and RQ 3).

This report covers sub-project 2, which is the RQ's that has been researched by Molde University College.

4. State of affairs – a literature review on collaboration and competition in intermodal transport

Introduction: Collaboration in intermodal transport

This project deals with two new processes for the establishment and development of intermodal transport chains. These processes are different from the traditional market based processes, and they are not specifically addressed in the international state of the art as far as their key elements are concerned. This, however, does not exclude that research in a number of related areas provides some platforms that can be of help in carrying out our research.

Hansen (2002) studied the role of transportation for the furniture industry. In the Danish Salling cluster he identified a need for regional and collaborative perspectives when studying logistics systems and logistics related competitive forces (Hansen 2002). Hansen's observations support the idea that collaboration between actors can have a positive influence on the competitiveness of the logistics system and the transport chain. In his longitudinal study, Hansen (2002) stressed the importance of developing logistics capabilities beyond the scope of investments in direct physical infrastructure (Hansen 2002, p. 86):

"localised transport and logistical competence seem to be of greater importance for the competitive advantage of the local furniture industry than further improvements in the quality of the physical traffic infrastructure of the region"

Similar to Hansen (2002), Storhagen (1999) and Bergqvist and Pruth (2006) indicates that potentials of structural development in logistics exists in new forms of cooperation between firms where complementary interests are exploited.

The studies Bergqvist and Pruth (2006) and Etzkowitz and Leydesdorff (1997) are examples of research which focus on collaborative processes where the initiation have involved both public and private actors where public-private partnerships have contributed to the construction of new competitive advantages. Especially, Bergqvist and Pruth (2006) illustrate how public-private partnership can have a positive effect on the competitiveness of the logistics system.

Another Scandinavian based study is that of Hageback (2002) at Luleå University of Technology which focused on the coordination of goods flows in peripheral regions. She studies the city of Pajala and the region of Norrbotten. Her research illustrates that coordination of goods flows from many different shippers can be both cost efficient and realisable. Furthermore, she identifies that there are positive environmental aspects associated with coordination of goods flows. In accordance with the concept of customer and agent initiated transport chains, Hageback (2002) identifies the important components; leadership, transparency, dependencies, commitment and collaboration. The observations made by Hageback (2002) support the idea of cost-efficiency, environmental impact and service quality as important variables of road-rail logistics services and as main performance variables of transport systems.

Collaboration in logistics offers an opportunity for improving logistics competitiveness. Not much focus has been put on the combination of different actors interests and collaboration in logistics, i.e. customer initiated logistics solutions. Another significant aspect is the need of analyses that focus on the dynamics of collaboration (Hageback 2002). This is essential in order to observe and analyse dynamic aspects of collaboration in logistics. The analysis of dynamics is especially interesting in a international setting, since there are political aspects incorporated into the logistics system and structure, which may affect the collaborative process in a number of ways.

Collaboration in developing and delivering intermodal transport solutions appears to be a necessity, but that does imply that it cannot be a potential source of competitive advantage and bring benefits to the actors involved. Thus, business and organizational literature on collaboration has high relevance to the subject.

Various definitions of collaboration concepts exist; often collaboration is used interchangeably with other concepts such as coordination, cooperation, networking, partnerships, integration etc. Defining the differences in exact meanings of the concepts mentioned is not considered essential for the purpose of this article. What is important is the principle of working together. It is also recognized that extent of collaboration-/cooperation may strongly vary; however, the term collaboration is just used to signify relationships different from market based transactions.

The following discussion will introduce the main findings from the literature on collaboration. Issues that will be discussed include: different types of collaboration, why to collaborate, how to success and potential reasons for conflicts. Finally, this section also presents findings from research specific to collaboration in logistics and transportation.

Barratt (2004) identifies several types of collaboration that may exist (see Figure 1 below), specifying that collaboration may take place on different levels: strategic, tactical, and operational. Within Customer initiated chains all the different types of collaborations can also be identified.

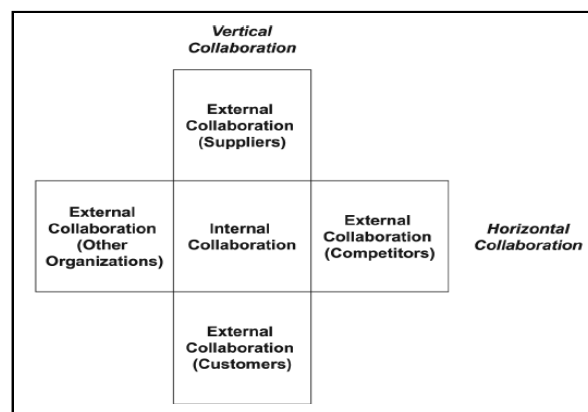


Figure 3.1: Types of collaboration (Barratt 2004)

As noted by Engström 2004, it can be difficult to distinguish between vertical and horizontal collaboration in the transportation industry. Engström defines vertical collaboration as *“two or more carriers, performing complementary services in the stages of the freight transport channel”*, while horizontal is *“two or more carriers performing substitutable services”*. However, as discussed before, collaboration in intermodal transport chain is not only about carriers, but various actors are involved, not all of them directly part of the transport industry. Thus, a wider definition is required and current

paper adopts the definitions proposed by EC (2001), where horizontal cooperation is defined as “*concerted practices between companies operating at the same level(s) in the market*”.

The following discussion will not so much discuss the issue of vertical collaboration, as it is the main focus of SCM literature and will be discussed in the next section. Horizontal cooperation is of special interest, as it is much less studied area. Several authors note lack of research on horizontal collaboration, e.g. Bernal et al. (2002); Bengtsson & Kock (1999); Cruijssen et al. (2005), especially in relevance to logistics and transport. Horizontal cooperation is of special interest for both customer and agent initiated projects in general as it seen as one of the main problems in achieving economic viability of intermodal transport solutions. For instance, collaboration between shippers is a key to achieving sufficient and balanced freight flows. In that context horizontal cooperation can take place both between direct competitors as well as unrelated firms that have compatible freight or destinations. Depending on the situation different conflicts may arise. There is much research on the conflicts and hardships of achieving successful vertical collaboration between firms. Typical reasons are opportunistic behaviour, unwillingness to share information, conflicting goals etc. Thus it is obvious, that in case of horizontal collaboration, where “competing” (extent may differ) firms need to work together, these problems are even more likely to occur. However, horizontal collaboration is still viable can often be highly beneficial to the firms involved. According to Bengtsson & Kock (1999), who analyze different relationships between competitors, visibility for the customer is the most important characteristic in determining whether competition or cooperation should take place. Similarly, Cruijssen & Dullaert (2007) cooperation is beneficial to take place for the non-core activities, while competition should remain unchanged for core activities. Thus, the main idea is that beneficial horizontal cooperation is possible in the non core activities, which includes transportation.

Collaboration literature also puts much focus on explaining why companies initiate partnerships and what are the benefits gained through these relations. The following issues regarding benefits from collaboration can be found in the literature:

- *gaining competence* (Bengtsson & Kock 1999; Barringer & Harrison 2000; Bernal et al. 2002) and eliminating high cost of duplication (Cruijssen et al. 2005)
- *market knowledge & access* (Bengtsson & Kock 1999; Barringer & Harrison 2000; Bernal et al. 2002)
- *improving reputation* (Bengtsson & Kock 1999)
- *getting access to other products and other resources of importance* (Bengtsson & Kock 1999; Bernal et al. 2002; Cruijssen et al. 2005; Kumar & Van Dissel 1996; Engström 2004)
- *gaining economies of scale* (Barringer & Harrison 2000; Bernal et al. 2002)
- *risk and cost sharing* (Barringer & Harrison 2000; Kumar & Van Dissel 1996; Cruijssen et al. 2005)
- *collective lobbying* (Barringer & Harrison 2000)
- *neutralizing or blocking of competitors* (Barringer & Harrison 2000)
- *gaining a competitive advantage* (Bernal et al. 2002)
- *increasing profit* (Engström 2004);
- *enabling to specialize on core business* (Engström 2004)
- *customers prefer to work with just few partners* (Engström 2004).

Several authors within the collaboration literature have discussed the issue of how to succeed in partnerships or create beneficial collaborations. According to Barratt (2004), for

the collaboration to be successful, internal collaboration must be aligned with external, implying that internal and external collaboration do not stand separate and one may influence the other. The author proposes the following collaboration elements that contribute to successful partnerships: collaborative culture, external and internal trust, mutuality (benefits & risks) (Barratt 2004). In addition, Tate (1996) highlights such elements as compatibility; deep understanding of partner's business needs; commitment; flexibility. The most commonly mentioned success factor is communication and exchange of information (e.g. Barratt 2004; Bowersox 1988; Tate 1996).

Bengtsson & Kock (1999) suggest that while it is important to build relationships upon trust, the relationships need to be "glued" together through adaptations and investments into bonds (technical, planning, knowledge, social and legal/economic). These adaptations and investments create certain mutual dependence and thus help to align the interests of the parties. The idea is supported by Barratt (2004), who also talk about resources and commitment as one of strategic elements in cooperation.

Barringer & Harrison (2000) also note that collaboration implies certain risk taking and thus the potential difficulties associated with collaboration are: loss of proprietary information, management complexities, financial and organizational risks, risk of becoming dependent, partial loss of decision autonomy, partners cultures may clash, loss of organizational flexibility, antitrust implications.

Collaboration in logistics and transport has mostly been studied within the context of Supply Chain Management, which relates to vertical collaboration not received much attention in the literature either. As mentioned, there is lack of research on horizontal collaboration. For instance, Cruijssen et al. (2005) note that no formal large-scale research has been done on the views of shippers about horizontal cooperation with regard to their logistics activities. Hageback & Segerstedt (2004) also acknowledge the need to study more cooperation between shippers, e.g. on co-distribution. Relevant studies on collaboration in logistics identified through the literature search include:

- Hageback & Segerstedt (2004), who study the potential of co-distribution in an isolated region in Northern Sweden. Findings suggest that an important problem with launching co-distribution seem to be the unfamiliarity of the companies' managers with innovative logistics concepts and sometimes even with the logistics market in general.
- Cruijssen et al. (2005), who propose the concept of *insinking* as opposed to outsourcing. In case of insinking, the Initiative of the contract lies with the Logistics Service Provider and thus the advantage is that insinking enables Logistics Service Providers to gain maximum synergetic effects by tendering for multiple shippers, whose distribution networks can be merged very efficiently. The study is found relevant as it discusses the importance of compatibility in shipper collaboration and also suggests that 3rd party is needed to ensure this compatibility.
- Bergqvist (2007) explores public-private partnerships for developing Regional Logistics Capabilities. Study highlights the important role public partners play in developing logistics cooperation. Results show that for the partnerships to succeed, public and private actors must have aligned goals and commitments. Through the collaboration following benefits can be gained: increased utilization of transport resources; coordination and consolidation of freight flows; increase in environmentally-friendly modes.
- Caputo & Mininno (1996), who study different types of collaboration in the Italian grocery distribution. Authors identify various policies that competing companies can adopt to reduce total logistics costs are examined, e.g. standardized pallets

and cartons, multi-supplier warehouses, multi-distributor centres, coordinated routing, and joint outsourcing.

When a decision to establish collaboration with certain actors is rather a necessity than a choice, however, still it is important to consider certain prerequisites for successful collaboration, the potential gains from the collaboration and the possible threats mentioned above. Review also reveals lack of research on horizontal collaboration, including in logistics and transport.

Competitiveness of intermodal transport

Competitiveness of intermodal transport can be discussed from different perspectives. For instance, one can talk about general competitiveness of intermodal transport as one of the potential alternatives in modal choice for transport buyers. On a very general level, discussion would focus on the competitive position of intermodal transport compared to other modes; factors affecting its competitiveness; and target market (in terms of types of goods and service requirements). Another view point is comparing concrete individual solutions and competitiveness and profitability can be assessed. Following discussion will explore both perspectives.

General industry issues

Goods transportation in European Union (EU-27), measured in tonne-kilometres, has been growing at 2.8 % yearly in the period 1995-2006, with road having a dominant position: 46% of total goods transportation according to 2006 statistics (Eurostat 2009). As noted by Floden (2009A), in general, the increase in transport demand in EU in the past 15 years has mainly resulted in increased road transportation. Transport market is very competitive and competition with road is especially difficult, as road transport is very enterprising, flexible and price-competitive sector, in addition to truck manufacturers putting much effort in limiting the environmental impacts that is considered the advantage of intermodal transport (Bontekoning & Priemus 2004). Moreover, as highlighted by Engström (2004), competition in the freight transport sector is somehow special, as it is controlled and restrained by public policy. Though liberalization of the market has contributed substantially to the increase of competition, certain industry structures (e.g. government-owned railways) still impact the competition between modes and distort the competition between modes.

Literature on intermodal transport has a vast discussion on different barriers facing the industry and preventing its growth. Following concrete problems have been highlighted by the literature:

- *Poor quality* (PROMIT 2007; EC 2003; Wichser et al. 2007; Krueger 2005; Amrie 2004; Kreutzberger 2001) e.g. reliability, damage of goods, transport time;
- *High cost* (PROMIT 2007; EC 2003; Krueger 2005; Amrie 2004; Kreutzberger 2001)
- *Unbalanced flows* (PROMIT 2007; EC 2003);
- *Poor information flow* (PROMIT 2007; Woodburn 2006) e.g. missing/insufficient/non transparent;
- *Poor profitability* (PROMIT 2007): small flows over short distances (SFSD), services;
- *Poor area coverage and infrastructure* (PROMIT 2007; EC 2003; Wichser et al. 2007);

- *Lack of formal network/chain/system management* (PROMIT 2007; Woxenius 1998);
- *Restriction on the type of goods* (EC 2003; Amrie 2004; IQ 2000);
- *Lack of standardization* (EC 2003; Bontekoning & Priemus 2004) e.g. unit loads, equipment etc.;
- *Problem with education and staff in the industry* (EC 2003; Bärthel & Woxenius 2004);
- *Mentality and attitude problems of transport buyers* (EC 2003; Evers et al. 1996);
- *Lack of incentives* (EC 2003);
- *Liability and documentation issues* (EC 1998 & 2003);
- *Distribution of cost and benefits between the actors involved* (Bontekoning & Priemus 2004);
- *Strong public sector involvement* (Bärthel & Woxenius 2004);
- *Transport buyers having no experience in using intermodal transport* (Danielis & Marcucci 2007; Woodburn 2003; Larsson & Kollberg 2009);
- *Poor innovation ability* (Bärthel & Woxenius 2004; Bontekoning & Priemus 2004; In.Ho.Tra 2003): e.g. only few transshipment technologies are explored commercially;
- *Competitiveness highly contextual* (Bärthel & Woxenius 2004), meaning local conditions differ largely;
- *Restricted/difficult market entry* (IQ 2000) e.g. market contestability needs to be enlarged; regulatory and technical access should be simplified; faster liberalization to facilitate creation of genuinely European intermodal operators;
- *Prioritization of passenger traffic on rail* (IQ 2000).

Another interesting approach to look at the barriers is how different authors categorize them, as categorization can provide a clear structured overview. For instance, PROMIT (2007) project distinguishes between barriers occurring on a chain level, on the main haul and pre- and post-haulage (PPH). Moreover, Wichser et al. (2007) divide key problems of intermodal transport into quality related and coverage area/network density related. Stone (2008) highlights two barriers for intermodal transport: interconnectivity and interoperability between the modes. Furthermore, Miler-Hooks et al. (2007) consider following barriers: political technological, administrative, social, legal and business barriers. Finally, Storhagen et al. (2008) take an attempt to create a clear structure in the barriers facing intermodal transport. Authors suggest (Storhagen et al. 2008) that both the barriers and incentives fall into the same categories, which in different circumstances can act as barriers or incentives. These categories include: market conditions; organizational; IT, administrative and planning conditions; infrastructural; production and operations; regulative; technical; societal. Finally, authors also note that it is important to recognize that barriers are changing over time (Storhagen et al. 2008). The latter is an important characteristic to recognize, not only in the meaning that barriers are changing as market and environment are changing on macro level, but barriers also change for individual actors depending on which stage of the development process they are (initial decision to switch to intermodal; planning; implementation etc.).

In addition to recognizing these different categories of barriers and incentives, it is important to see the interdependencies between them. Moreover, the mentioned “mentality and attitude” and “lack of experience” problems are likely to have an important impact on the perception actors have of the different barriers and incentives. Latter meaning that lack of real experience and existing perceptions may induce creation of “perceived barriers” that may not reflect the real conditions.

An essential part of competitiveness of intermodal transportation lies in the definition of the market it targets to capture and understanding the demands of that market, in terms of quality and characteristics of the service demanded (e.g. Krueger 2005). As noted by Woodburn (2003), a vital issue in overcoming the barriers to intermodal transport is taking consideration of the general logistics trends (e.g. Just-in-Time; outsourcing, Supply Chain Management (SCM), etc.) to be able to meet the current logistics demands.

Regarding the markets, usually intermodal transport is associated with economies of scale from employing certain modes of transport, however not only the size of the flow is considered important, but also the distance on which it becomes price competitive. Thus, large body of literature sees intermodal transport being profitable only over long distances, with distance normally longer than 500 km (Floden 2007), while calculations by Jensen (1990) show that combi-traffic could even be profitable on distances 250-275 km (distance between rail terminals). There have been several attempts to model systems that would make intermodal transport viable with SFSD (Woxenius 1998; Bärthel & Woxenius 2003; Bärthel & Woxenius 2004; etc.) e.g. for perishable and high-value commodities; shipments with high demands in terms of speed, flexibility and reliability. The motivation behind the latter studies is the fact that the demand for transport of freight is greatest over short distances (Woxenius 1998), and if intermodal transport is able to meet such requirements, the market potential for intermodal solutions could be considerably increased. However, as noted by Woxenius (1994), the shortest distance over which intermodal transport becomes competitive actually depends on variety of factors, including demanded transport quantities, transport quality, transport infrastructure, transshipment technology applied, consignor and consignee location, regulations in competing modes of transport, type of transported goods, transport flow intensity etc.; and thus cost calculations should be made for a specific case to evaluate the potential of the solution. According to Bontekoning & Priemus (2004), intermodal transport needs different strategies for competing in different markets. Long distance market needs quality improvements, while the short-distance market needs improvements both in quality and cost. Authors argue that incremental changes in improving existing services, will not achieve the necessary quality leap what is needed in "*breakthrough innovations*", both in technological and organizational aspects (Bontekoning & Priemus 2004).

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5. Theoretical approach to understanding the dynamics of intermodal transport

Point of departure

A formal mode choice model is provided in Sunde (2002), where the market for road haulage and multimodal freight transport is studied, taking into account the behaviour of both carriers and shippers. On the demand side there is a large number of shippers, each dispatching a rather small cargo volume. As a consequence, shippers are assumed to behave atomistically (rather than strategically) treating freight rates and service frequencies as exogenous. On the supply side, there is free entry. It turns out that there are multiple equilibria of which some are stable and some are not. If the market equilibrium is to involve multimodal freight transport, such services have to attract a sufficiently large volume of cargo. In other words, there is a 'critical mass' of cargo volume that must be surpassed.

In the model presented in Sunde (2002), multimodal freight transport may not exist due to lack of coordination or cooperation amongst shippers and carriers. It is argued that this lack of coordination and cooperation may call for public intervention. More specifically, it is argued that some kind of 'obstetric aid' is warranted in order to establish multimodal freight transport services and to make them survive the 'infancy' period.

However, the incentives for shippers (and carriers) to coordinate or cooperate are not taken explicitly into account in Sunde (2002). In this respect, the model presented in Haugen and Hervik (2004) is relevant as it explicitly considers the incentives for shippers to coordinate their transports. They consider the choice between road haulage and a public freight transport service from the perspective of the shippers. Although they do not consider multimodal freight transport as such, the public freight transport service may be interpreted as a (part of) a multimodal freight transport service, i.e. a liner service. There are significant economies of scale involved in public (multimodal) freight transport whereas road haulage is characterized by congestion. As there are only two agents involved, the shippers' mode choice decisions are assumed to constitute a (non-cooperative) game. It turns out that in general, there are multiple equilibria of which some may involve public (multimodal) freight transport and some do not. For some parameter values for instance, the public (multimodal) freight transport service is not in an equilibrium (or at least not a unique equilibrium) even though it could bring about lower costs than the equilibrium outcome being pure road haulage; this is an example of a 'prisoners dilemma' type of equilibrium. Thus, even with as few as two shippers involved, it is not trivial to obtain coordination amongst them that will bring about public (multimodal) freight transport. Introducing uncertainty (regarding the demand for cargo transport) reinforces this problem (and may in fact cause the public / multimodal freight transport to be pareto-inferior).

Development barriers in the market structure – model extensions

The above mentioned models are starting points for a further study on the issue of cooperation and coordination between shippers. The basic non-cooperative game theoretical model could be made more realistic in a number of ways. For instance, the model presented in Haugen & Hervik (2004) could include a more explicit formulation of multimodal freight transport. The game could also be extended to include more players

such as more shippers, carriers and possibly intermediate agents (ie. forwarders). Such modifications could shed some light into the robustness of the results produced so far.

When games produce equilibria that are not pareto-optimal (i.e. "prisoners dilemma" type of equilibria), the agents have incentives to coordinate their behaviour. This could be achieved through formal agreements (contracts) which specifies how their actions should be coordinated and how the surplus from doing so should be divided amongst them. This makes cooperative game theory and theories of bargaining relevant as a supplement to the non-cooperative game theoretical models.

In cooperative game theory, it is (implicitly) assumed that the contracts can be enforced at no cost, prohibiting "free-riding". In practice, this is often far from trivial. This is especially true if there is asymmetric information involved so that merely detecting any deviations from what has been agreed upon is hard or perhaps impossible. If such problems are prominent, it may be impossible to reach an agreement which is credible. More generally, any "transaction costs" may be prohibitive.

Even if a contract could be enforceable at less than prohibitive enforcement or "transaction" costs, asymmetric information could still prevent such contracts from be reached. The reason is that the split of the "pie" may depend on the information that the agents claim or reveal about their benefits from entering into such a contract (or rather their well-being if no such contract is agreed upon). Realising this, agents may be reluctant to reveal truthfully their real benefits as this could be detrimental to their split of the "pie". If all or most agents conceal their true benefits, the result may be that no agreement would be reached. In fact, taking the initiative to the establishment of a multimodal freight transport service may act like a signal that one's own benefits from such a service would be significant (or else one would not take the effort). As a consequence, agents may be reluctant to take any initiative (first mover disadvantage).

An important extension is to introduce multiple periods, effectively turning the game into a dynamic game. The outcome of a dynamic game may differ significantly of that of a static (one-shot) game. A dynamic game with sequential moves introduces the possibility of strategic behaviour in early periods in order to manipulate the outcome of the game in later periods (an already mentioned example is the case where agents conceal their benefits in order to obtain a more favourable (larger) split of the "pie"). Perhaps even more important in this respect is the fact that dynamic games does also make cooperation more likely in circumstances in which it may be individually rational for players to deviate from what has been agreed upon. The reason is that this introduces the possibility of punishing agents in the future for behaving opportunistically at present. If this threat of punishment is credible, an agreement may be self-enforcing despite being legally non-enforceable.

The mode-choice games are elaborated in the following section.

5.1 Paper 1: Mode-choice games with economies of scale and incomplete information

by
Øyvind Sunde

Abstract: We analyse a game in which two shippers can choose between two modes of transport. One mode (truck) is characterised by constant returns to scale, the other (ship) by economies of scale in terms of large fixed costs. The shippers have private information regarding the generalised or logistical costs associated truck and thus, the attractiveness of ship. Due to the large fixed costs, the shippers must share these fixed costs if ship is to be preferred to truck. We consider two models. In the first model, the pure coordination game, the shares are assumed to be exogenous whereas in the second model, the bargaining model, the shippers choose how much to contribute in order to pay for the fixed cost. In both models there is ex post inefficiency, albeit for different reasons. In the pure coordination game, ex post inefficiency is due to lack of coordination amongst the shippers which in turn is due to lack of information and communication. In the bargaining model however, ex post inefficiency may arise due to the fact that paying for the fixed cost is a kind of 'public good' and each shipper will to a certain extent try to 'free-ride' on the contribution made by the other shipper. As a result, the total willingness to pay may exceed the fixed cost but the sum of contributions may fall short of the fixed cost. An outside agent (ie. public authority) may improve on efficiency by providing communication (in the pure coordination game) or by providing incentives and public funds in order to make the shipper reveal truthfully their willingness to pay (in the bargaining game).

Introduction

Shippers can usually choose between several modes of transport in order to ship their cargo. For some modes of transport such as truck, the capacity of each vehicle is (for technical reasons) limited so that each vehicle can transport a limited volume of cargo, say a unit cargo. In that case, a shipper's transport cost tends to increase proportionally with the volume of cargo (although at the macro level, it may increase more than proportionally with the total volume of cargo due to congestion). For other modes of transport such as ship, the capacity of a vessel allows for a large volume of cargo. Furthermore, such modes of transport have typically large fixed costs whereas the marginal cost is rather low. Thus, there are significant economies of scale. In order to exploit this capacity and the inherent economies of scale, the cargo of several shippers must typically be consolidated. As a consequence, a sufficiently large number of shippers must choose such a mode of transport if such a service is to be economically viable and efficient. This means that the shippers choice of transport mode are mutually dependent and thus constitute a game.

Haugen & Hervik (2004) analyse shippers choice of freight transport mode in terms of a static game between two shippers. Each shipper has to make a (binary) choice between a mode characterized by extreme economies of scale (fixed costs only) and a mode characterized by possibly congestion ('diseconomies' of scale). Shippers are identical (in terms of payoffs) and have complete information. If a single shipper chooses the former mode of transport, it will have to cover the entire fixed cost by himself. If they both choose this mode of transport, the fixed cost is split evenly amongst the two shippers. The two shippers make their choices simultaneously without any communication, and the game is played only once (that is, the game is not repeated). Haugen & Hervik (2004) demonstrate

that the game may have multiple Nash-equilibria in pure strategies (in addition to Nash-equilibria in mixed strategies). Furthermore, some Nash-equilibria may be Pareto-inferior. The assumptions made in Haugen & Hervik (2004) are not trivial though. In this paper we therefore reconsider the mode-choice game by modifying or relaxing some of the assumptions that are either explicit or implicit in Haugen & Hervik (2004). After presenting a somewhat restated version of the Hervik & Haugen (2004) model, we first argue that although congestion may be significant at the macro level, it is less obvious that it is significantly affected if one of the shippers choose not to ship its cargo by truck (as is assumed in Haugen & Hervik, 2004). If so, the game is a pure coordination game. After having presented (a slightly restated version of) the model in Haugen & Hervik (2004), we present and analyse the coordination game in section 5.2. Below we modify the game by assuming that the shippers have private information regarding their payoffs. Furthermore, we analyse the effect of relaxing the assumption that shippers split the fixed costs evenly and allow them to bargain on how the fixed cost is to be shared amongst them. The final section concludes and discusses how an outside agent (ie. a public authority) could improve on efficiency by easing communication amongst the shippers, by providing incentives for shippers to reveal their willingness to pay for ship transport and by providing outside (public) funds. The final section also discuss some extensions of the models.

The Hervik & Haugen (2004) mode-choice game

Let us start by considering a slightly restated version of the mode-choice game to be found in Hervik & Haugen (2004). There are two shippers – 1 and 2. Each shipper may choose between truck and ship. If one of the shipper's chose ship he will have to pay for the entire cost C associated with this mode of transport. If both shippers choose ship however, they will split the cost evenly and thus pay $C/2$ each. If one of the shippers choose truck, his cost is βC where $\beta > 0$. If they both choose truck however, each shippers cost is αC where $\alpha > 0$; $\alpha > \beta$ implies that the shippers choice of mode has a significant effect on congestion. The corresponding game is illustrated in the figure below.

| | | Shipper 2 | |
|-----------|-------|------------|-----------|
| | | Truck | Ship |
| Shipper 1 | Truck | αC | βC |
| | Ship | C | $C/2$ |

Figure 5.1: Payoff matrix for Hervik & Haugen (2004) game

Before analyzing this game, we notice that the total transport cost is $2\alpha C$ if they both choose truck, $C + \beta C = (1 + \beta)C$ if they choose different modes of transport and C if they both choose ship. As $(1 + \beta)C > C$ as $\beta > 0$, this implies that choosing different modes of transport cannot be efficient. Thus, in this model efficiency demands that both shippers

choose the same mode of transport. Both shippers choosing truck is efficient if $2\alpha C < C$ or $\alpha < \frac{1}{2}$ whereas both shippers choosing ship is efficient if $\alpha > \frac{1}{2}$.

This static game has the following (pure-strategy) Nash-equilibria:

- If $\alpha < 1$ and $\beta < \frac{1}{2}$: Both shippers choosing truck is a unique Nash-equilibrium. In this case, the equilibrium is efficient if $\alpha < \frac{1}{2}$. If $\alpha > \frac{1}{2}$ however, then the Nash-equilibrium is inefficient. In the latter case, the game is a ‘prisoners dilemma’ game.
- If $\alpha < 1$ and $\beta > \frac{1}{2}$: The game is a ‘stag hunt’ game with multiple (two) equilibria being both shippers choosing truck and both shippers choosing ship. In this case, only the equilibrium involving ship is efficient as $2\alpha C \geq 2\beta C > C$ as $\alpha \geq \beta > \frac{1}{2}$.
- If $\alpha > 1$ and $\beta > \frac{1}{2}$: Both shippers using ship is a unique Nash-equilibrium. This equilibrium is efficient as $2\alpha C > C$ as $\alpha > 1$.
- If $\alpha > 1$ and $\beta < \frac{1}{2}$: The game is a ‘chicken’ game with multiple (two) equilibria where the two shippers choose different modes of transport. As previously argued, it is inefficient that the shippers choose different modes of transport.

A pure coordination mode-choice game

Congestion may be a realistic assumption for some modes of transport such as truck. However, the level of congestion is determined by the total volume of traffic on the roads. If two shippers located at say the west coast of Norway choose to ship their cargo to some destination in Europe by truck, the traffic and thus level of congestions is not expected to be significantly affected. This means that it is not very likely that the level of congestion is affected significantly by the choice of mode made by two shippers. If so, $\alpha = \beta$ in the model and the corresponding payoff matrix is depicted in the figure below.

| | | | |
|-----------|-------|-----------|-------|
| | | Shipper 2 | |
| | | Truck | Ship |
| Shipper 1 | Truck | βC | C |
| | Ship | βC | $C/2$ |

Figure 5.2: Payoff matrix for pure coordination game

Before analyzing this game, we notice that the total transport cost is $2\beta C$ if they both choose truck, $C + \beta C = (1 + \beta)C$ if they choose different modes of transport and C if they both choose ship. As $(1 + \beta)C > C$ as $\beta > 0$, this implies that choosing different modes of transport cannot be efficient. Thus, in this model efficiency demands that both shippers choose the same mode of transport. Both shippers choosing truck is efficient if $2\beta C < C$ or $\beta < \frac{1}{2}$ whereas both shippers choosing ship is efficient if $\beta > \frac{1}{2}$.

This static game has the following (pure-strategy) Nash-equilibria:

- If $\beta < \frac{1}{2}$: Both shippers choosing truck is a unique Nash-equilibrium. In this case, the equilibrium is efficient as the total cost of truck transport adds up to $2\beta C$ which is less than C for $\beta < \frac{1}{2}$.
- If $\frac{1}{2} < \beta < 1$: The game is a 'stag hunt' game with multiple (two) equilibria being both shippers choosing truck and both shippers choosing ship. In this case, only the equilibrium involving ship is efficient as $2\beta C > C$ as $\beta > \frac{1}{2}$.
- If $\beta > 1$: Both shippers choosing ship is a unique Nash-equilibrium. In this case, the equilibrium is efficient as the total cost of truck transport adds up to $2\beta C$ which exceeds C for $\beta > \frac{1}{2}$.

The game above could be contrasted with the game in Hervik & Haugen (2004). That game also predicts a 'stag hunt' game for certain parameter values. However, the model in Hervik & Haugen (2004) also allows for the possibility of a 'prisoners dilemma' kind of game as well as a 'battle of the sexes' kind of game. This is due to the assumption that congestion is significantly affected by the mode choices made by the two shippers. This modified game is in effect a pure coordination game with complete information. In the next section we analyse this coordination game in case of incomplete information.

A mode-choice game with private information

Recall that in Hervik & Haugen (2004), shippers are assumed to be identical in terms of payoffs and furthermore, they have complete information. Although various shippers may happen to be identical in terms of payoffs, it is a rather restrictive assumption that they necessarily are identical. Furthermore, it may seem restrictive to assume that shippers have complete information regarding each other's payoffs. Although a shipper is expected to know its own generalized freight costs, it is not obvious that the shipper has perfect insight into the generalized costs of other shippers. Thus, it seems reasonable to allow shippers to be heterogeneous and have *private (or hidden) information* regarding their own payoffs in the game. We retain the assumption that the transport cost by using truck is not affected by the two shipper's choice of transport cost.

In order to allow for private information regarding each players transport cost, we modify the model in the previous section as follows: If shipper i ($i = 1,2$) chose truck, his cost is $\beta_i \alpha C$ where $\alpha > 0$ and $0 \leq \beta_i \leq 1$ so that $0 \leq \beta_i \alpha C \leq \alpha C$. The payoff matrix is illustrated below:

| | | | |
|-----------|-------|-------------------|-------|
| | | Shipper 2 | |
| | | Truck | Ship |
| Shipper 1 | Truck | $\beta_2\alpha C$ | C |
| | Ship | $\beta_2\alpha C$ | $C/2$ |

Figure 5.3: Payoff matrix

Before analyzing this game, we note that the total transport cost is $(\beta_1 + \beta_2)\alpha C$ if they both choose truck, $(1 + \alpha\beta_i)C$ if one shipper choose ship while the other shipper chooses truck and finally C if they both choose ship. As $0 \leq \beta_i \leq 1$ it follows that $(1 + \alpha\beta_i)C \geq (\beta_1 + \beta_2)\alpha C$. Thus, it is not efficient that the two shippers choose different modes of transport. Concerning the efficiency of truck only versus ship only, truck only is efficient if $(\beta_1 + \beta_2)\alpha C < C$ or $\alpha(\beta_1 + \beta_2) < 1$; ship only is efficient if $\alpha(\beta_1 + \beta_2) > 1$.

Now consider shipper i . Suppose that the probability that shipper $-i$ (where $-i$ denotes the other shipper) choose ship is q . In that case, the expected cost of choosing ship himself is:

$$EC_s = qC/2 + (1 - q)C = C - qC/2 = (1 - q/2)C \tag{1}$$

whereas it is:

$$EC_t = \beta_i\alpha C \tag{2}$$

if he choose truck himself. A risk neutral shipper will choose ship if and only if:

$$EC_s \leq EC_t$$

$$\Leftrightarrow q \geq 2(1 - \beta_i\alpha) \tag{3}$$

Note that the larger the β_i , the smaller the probability q . This is intuitive: The larger the β_i is, the less attractive it is for the shipper to choose truck.

An equilibrium will be of the threshold type, that is: If $\beta_i \leq \beta^*$ the shipper will choose truck, otherwise (if $\beta_i \geq \beta^*$) he will choose ship. In that case:

$$prob(\text{shipper } i \text{ choose truck}) = \beta^*$$

so that the probability that he will choose ship is:

$$q = 1 - \beta^* \tag{4}$$

By making use of (4), the critical β (such that (3) is satisfied with equality) becomes:

$$1 - \beta^* = 2(1 - \beta^*\alpha)$$

$$\Leftrightarrow \beta^* = \frac{1}{2\alpha - 1} \tag{5}$$

As β is a probability, it must be the case that $0 \leq \beta^* \leq 1$ so that a necessary condition for such an equilibrium to exist is that $\alpha \geq 1$. Notice that the larger α , the smaller the probability β^* . The figure below illustrates the determination of β .

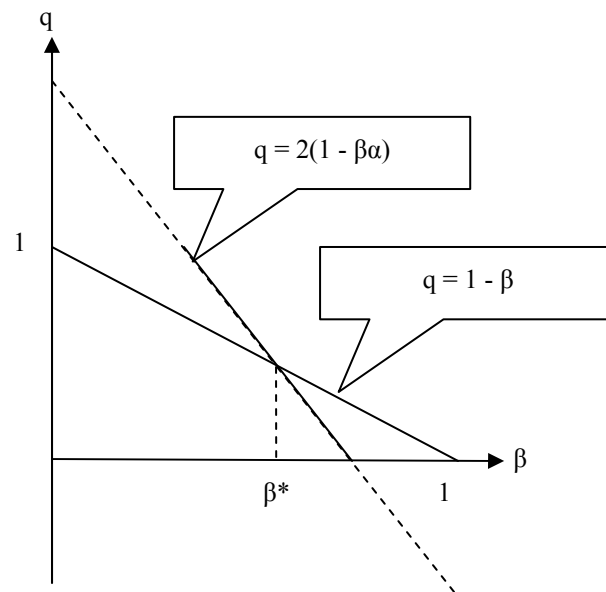


Figure 5.4: Determination of β^*

The figure below illustrates possible combinations of β 's and the corresponding equilibria for $\alpha = 3/2$ which implies $\beta^* = 1/2$.

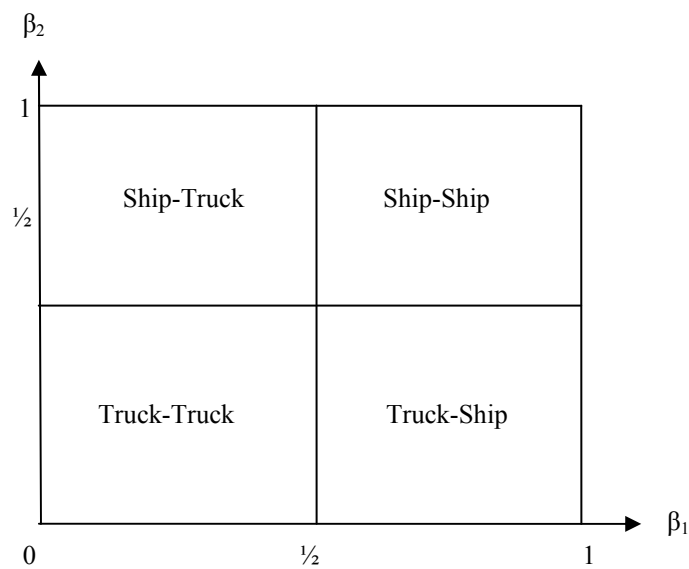


Figure 5.5: Possible equilibria for $\alpha = 3/2$

Notice that in the original model of Hervik & Haugen (2004) shippers are homogeneous with respect to costs whereas in this model we allow shippers to be heterogeneous with respect to costs as β_1 may deviate from β_2 . If both shippers were homogeneous (and this was common knowledge in the game), then there would be no private information: Each shipper could simply deduct from his own value of β the corresponding value of the other shipper's β .

Notice also that there exist equilibria in which the two shippers choose different modes of transport. This is not the case in the coordination game with no private information. In the Hervik & Haugen (2004) model such equilibria can only exist if congestion is significantly affected by the two shippers choice of mode. In our model such equilibria may exist because shippers are unsure about the mode choice of the other shipper. Thus, ship may be ex ante optimal but may not turn out to be ex post optimal once the choice of the other shipper is revealed. Thus, private information may give rise to a coordination failure.

In this model, only 'corner-solutions' are efficient: Either both shippers should use truck or both shippers should use ship; this is due to the economies of scale in ship and no congestion in trucking. As already noted, it is efficient that both use truck if and only if:

$$(\beta_1 + \beta_2)\alpha C \leq C$$

$$\Leftrightarrow \beta_1 + \beta_2 \leq \frac{1}{\alpha}$$

In the figure below, the grey triangle enveloped by the downward-sloping line and the vertical and horizontal axis shows all combinations of β 's in which truck is the efficient mode of transport (for $\alpha = 3/2$); for all combinations of β 's outside this triangle the efficient solution is for both shippers to choose ship.

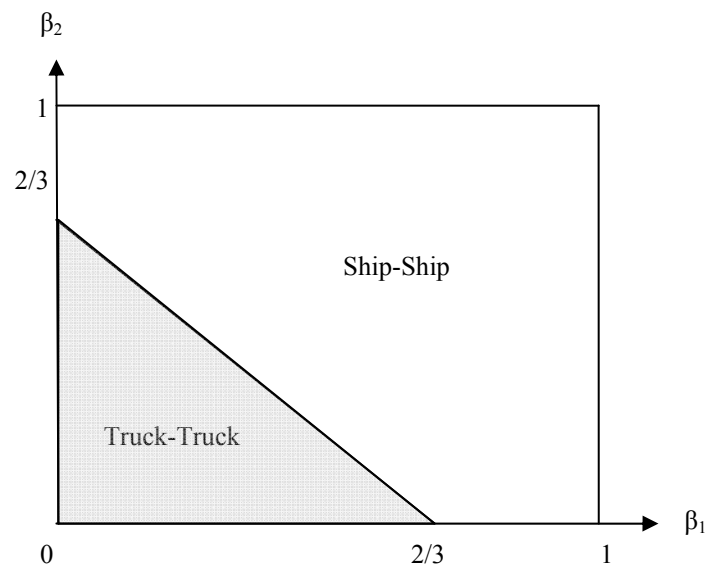


Figure 5.6: Efficient transport modes for $\alpha = 3/2$

The figure below combines the two previous figures. As can be seen from the figure, there is a possibility that one of the shippers will still opt for ship (as illustrated by the parameter values in the black triangles) even though it is efficient for both to choose truck. This is the case if one of the shippers has a rather large value of β (in excess of $\frac{1}{2}$ but below $\frac{2}{3}$) whereas the other has a rather low value of β . The light grey triangle illustrates the case in which both shippers opt for truck whereas they should have chosen ship, whereas the medium grey rectangles (except for the black triangles) illustrates the case in which only one of the shippers choose ship whereas they both should have chosen ship. The white areas illustrate values of β 's which leads to efficient equilibria – the truncated white triangle illustrates combinations of β 's in which truck is the optimal mode whereas the white rectangle illustrates combinations of β 's in which ship is the single optimal mode.

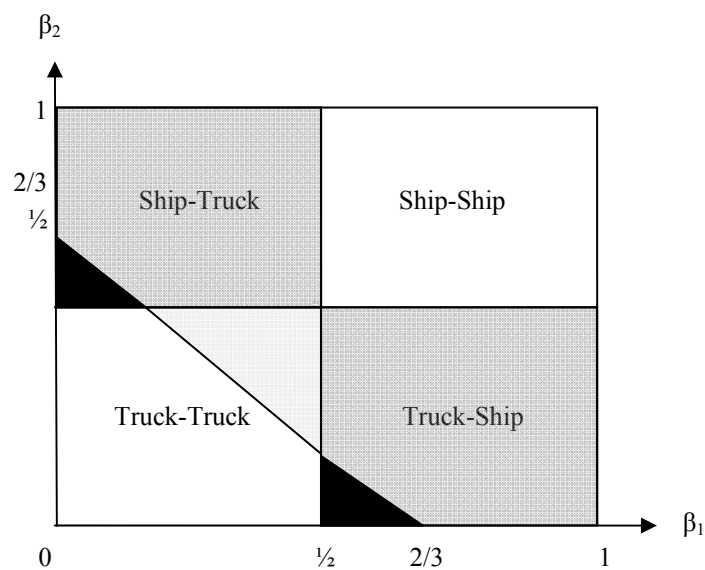


Figure 5.7: Efficiency for $\alpha = 3/2$

As is evident from the above, the model predicts efficient equilibria in the following cases:

1. $\beta_1, \beta_2 \leq \frac{1}{2}$ and $\beta_1 + \beta_2 \leq \frac{2}{3} \rightarrow$ Efficient Truck-only equilibrium
2. $\beta_1, \beta_2 \geq \frac{1}{2} \rightarrow$ Efficient ship-only equilibrium

A mode-choice game with private information: Less extreme economies of scale

In the model above, economies of scale in shipping are extreme as there are fixed costs only and zero marginal costs. A less extreme case can be modeled by assuming that the cost of shipping a single carrier's cargo is still C , but by shipping both shippers cargo the cost increases to $(1 + \delta)C$ where $0 \leq \delta \leq 1$; if $\delta = 0$ then we have the basic model with extreme economies of scale whereas if $\delta = 1$ there are constant returns to scale; we do not consider $\delta > 1$ which would imply congestion. A larger value of the parameter delta (δ) means less economies of scale.

We retain the assumption that if both shippers choose ship, they will split the cost evenly amongst them. Thus:

$$EC_s = q(1 + \delta)C/2 + (1 - q)C = (1 - (1 - \delta)q/2)C \quad (6)$$

A risk neutral shipper will choose ship if and only if:

$$\begin{aligned} EC_s &\leq EC_t \\ \Leftrightarrow (1 - (1 - \delta)q/2)C &\leq \beta_i \alpha C \\ \Leftrightarrow q &\geq \frac{2}{1 - \delta}(1 - \beta_i \alpha) \end{aligned} \quad (7)$$

By comparing (7) with the previous (5) of the basic model, we notice that the probability that the other shipper choose ship as well must be larger if a shipper is to choose ship. The reason is obvious: With extreme economies of scale (fixed costs only) a shippers transport cost falls from C to $C/2$ if the other shipper joins him in using ship. With less extreme economies of scale a shippers transport cost falls from C to $(1 + \delta)C/2$ which exceeds $C/2$.

By making use of the fact that the probability that the other shipper will choose ship as well is $1 - \beta$ according to (4), the threshold value of β must satisfy:

$$\begin{aligned} 1 - \beta^* &= \frac{2}{1 - \delta}(1 - \beta^* \alpha) \\ \Leftrightarrow \beta^* &= \frac{1 + \delta}{2\alpha - 1 + \delta} \end{aligned} \quad (8)$$

which is to be compared to (5) in the basic model:

$$\beta^* = \frac{1}{2\alpha - 1} \quad (5)$$

As expected, β^* is larger in the case of less extreme economies of scale. As in the basic model: As β is a probability, it must be the case that $0 \leq \beta^* \leq 1$ so that a necessary condition for such an equilibrium to exist (with less than extreme economies of scale) is that $\alpha \geq 1$ (as in the basic model).

The figure below illustrates possible equilibria for $\alpha = 3/2$ and $\delta = 1/2$ which implies $\beta^* = 3/5$ ($> 1/2 = \beta^*$ in the basic model for $\alpha = 3/2$). Notice that it is less likely that there is an equilibrium involving ship in this case than in the case of extreme economies of scale (as in the benchmark model).

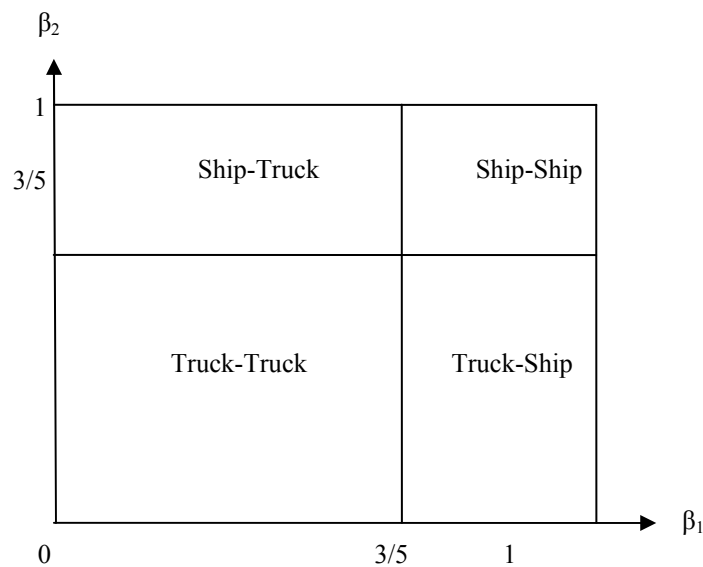


Figure 5.8: Possible equilibria for $\alpha = 3/2$ and $\delta = 1/2$

In the basic model we concluded that there exist only two possible types of efficient equilibria, namely truck-only and ship-only. In this case with less than extreme economies of scale, equilibria involving both modes of transport may be efficient. Mixed modes are efficient as compared to ship-only if:

$$\beta_i \alpha C + C < (1 + \delta)C$$

$$\Leftrightarrow \beta_i < \frac{\delta}{\alpha}$$

whereas mixed modes are efficient as compared to truck-only if:

$$\beta_i \alpha C + C < (\beta_i + \beta_{-i}) \alpha C$$

$$\Leftrightarrow \beta_{-i} > \frac{1}{\alpha}$$

so that mixed modes of transport are efficient if one of the shippers has a β less than δ/α and the other has a β in excess of $1/\alpha$. (For $\alpha = 3/2$ and $\delta = 1/2$, this implies that one of the shippers must have a β less than $\delta/\alpha = 1/3$ and the other in excess of $1/\alpha = 2/3$). Finally, it is efficient that both use truck rather than both use ship if:

$$(\beta_1 + \beta_2) \alpha C \leq (1 + \delta)C$$

$$\Leftrightarrow \beta_1 + \beta_2 \leq \frac{1 + \delta}{\alpha}$$

(For $\alpha = 3/2$ and $\delta = 1/2$, this implies that $\beta_1 + \beta_2$ must be less than $(1 + \delta)/\alpha = (1 + 1/2)/3/2 = 1$). The figure below shows the efficient mode-combinations for the various possible combinations of β 's.

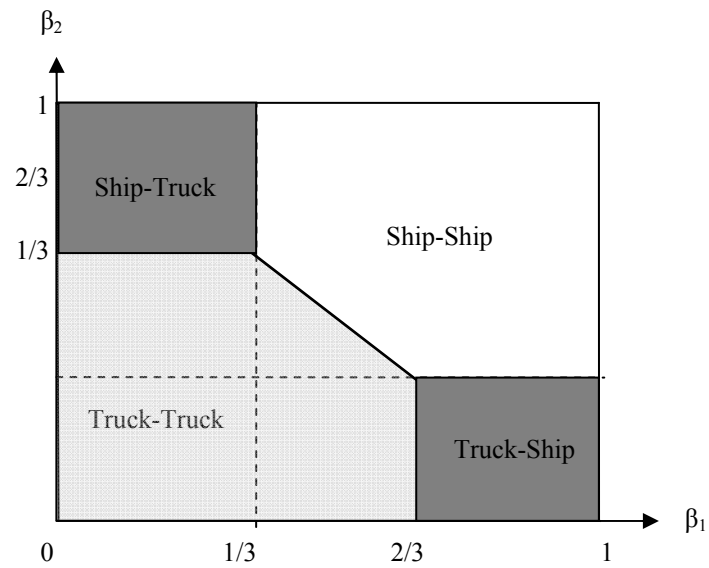


Figure 5.9: Efficient modes of transport for $\alpha = 3/2$ and $\delta = 1/2$

Notice that as compared to the basic model (in which there are extreme economies of scale) less extreme economies of scale makes it more probable that truck is efficient – either that both shippers use truck (light grey area) or that at one of them use truck (dark grey rectangles).

The figure below combines the two previous figures. The dark grey areas illustrate combinations of β 's involving truck-only equilibrium whereas it is efficient with mixed modes of transport. The light grey triangle and the medium grey rectangles illustrate combinations of β 's involving truck-only or truck-and-ship equilibria whereas it is efficient with ship-only equilibrium.

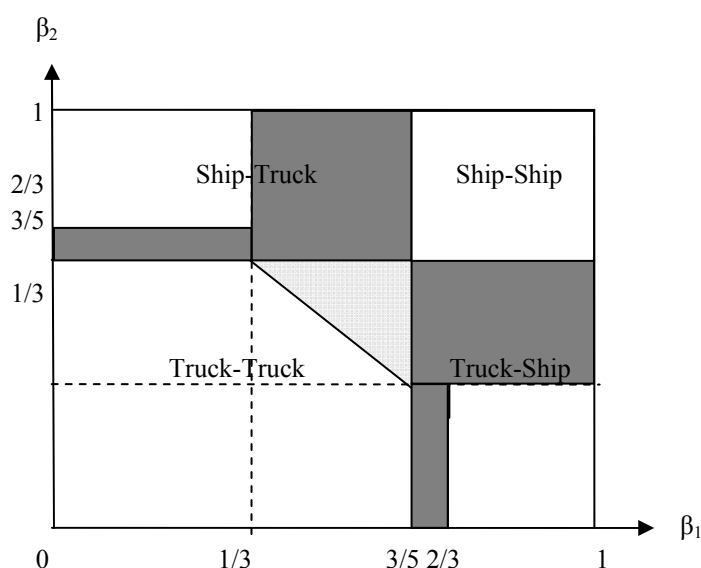


Figure 5.10: Efficiency for $\alpha = 3/2$ and $\delta = 1/2$

We have argued that the level of congestion is not to be expected to be significantly affected by the choice of mode made by the two shippers, and that the game then becomes a pure coordination game. If so, there is no conflict of interest between the shippers. As a consequence, direct communication (or 'cheap talk'; ie. Farrell & Rabin, 1996) could solve the coordination problem and the players could realize a pareto-optimal equilibrium. That is, if the total cost of shipping the cargo by truck exceeds that of shipping the cargo by ship, the two shippers could simply agree to ship their cargo by ship.¹ But this hinges on the assumption that each shipper's share of the fixed cost is exogenous as if not, there is a conflict of interest between the shippers regarding how to divide the fixed cost. As this assumption is far from innocent, we now turn to a game in which the shippers may bargain on how to divide the fixed cost.

A mode-choice game with endogenous cost sharing

In Haugen & Hervik (2004) and the model above it is assumed that if both shippers choose ship, they will split the cost evenly amongst them (both pay $C/2$ or $(1+\delta)C/2$). While this may seem to be a reasonable assumption if the shippers are identical (as assumed in Haugen & Hervik, 2004), it is far from an innocuous assumption. This is especially true if shippers may be heterogeneous in the sense that the cost associated with alternative modes of transport (such as truck) may differ. As a consequence, it seems natural to allow the shippers to bargain on how the costs are to be shared amongst them.

Consider first the case where shippers are identical and have perfect information as in the basic Hervik & Haugen (2004) model. The shippers incur a transport cost βC each in case of

¹ If congestion is significantly affected by the mode choices made by the two shippers as in Hervik & Haugen (2004) however, a shipper may try to persuade the other shipper to choose ship in order to choose truck himself, benefiting of the less congested roads. Thus, direct communication is no longer to be trusted as there is a conflict of interest.

truck and a fixed cost C in case of ship. Assuming that $\beta > \frac{1}{2}$, if both shippers choose truck the total cost by using truck exceeds that of using ship; $2\beta C > C$. In the figure below, it is assumed that $\frac{1}{2} < \beta < 1$.

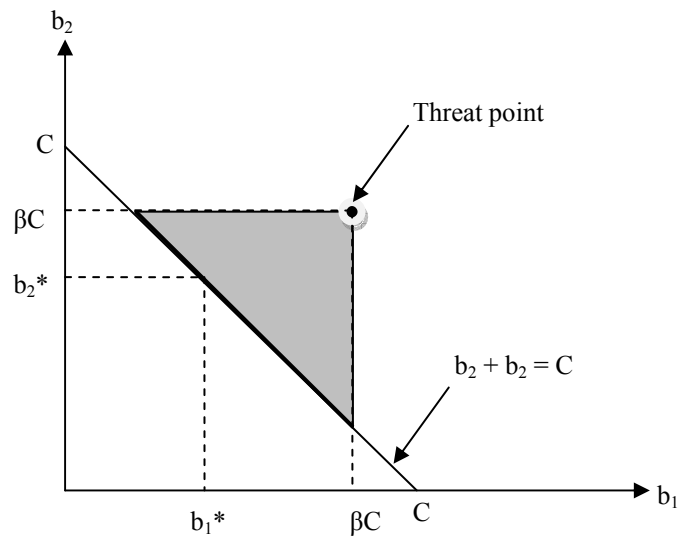


Figure 5.11: Threat point

Suppose shipper i contribute (offer to pay) b_i in order to cover the fixed cost C . Total contributions must cover the fixed cost C , that is: $b_1 + b_2 \geq C$. In terms of the figure above, this corresponds to all combinations of contributions northeast of the line $b_1 + b_2 = C$ which we may call the budget line. Furthermore, each shipper's maximal willingness to contribute is βC . In terms of the figure above, this corresponds to all combinations of contributions southwest of what is called the threat point which corresponds to the case where both shippers choose truck. In that case, the two shippers may bargain on combinations of contributions located in the grey area. Every combination of contributions in the grey area Pareto-dominates the case where both shippers choose truck. Only the combinations of contributions on the budget line ($b_1 + b_2 = C$) are Pareto-optimal though.

Let us consider the following simple bargaining procedure: Both shippers announce their contributions simultaneously and non-cooperatively. If the sum of contributions covers the fixed cost they agree to make use of ship, each paying his or hers proposed contribution. If not, they will both make use of truck. Let's consider the optimal contribution from shipper i facing a shipper that is proposing to contribute b_{-i} : If shipper i is to make sure that he will reach an agreement with the other shipper, then he or she must make a contribution that is at least as large as $C - b_{-i}$, that is; $b_i \geq C - b_{-i}$. As making contributions is costly to the shipper, he will minimize his contributions, in which case $b_i = C - b_{-i}$. If contributing $C - b_{-i}$ is to be rational however, then his contribution must not exceed the cost of the alternative mode of transport being truck, that is: $b_i \leq \beta C$. We obtain the following best reply for shipper i :

$$b_i^* = \min[C - b_{-i}, \beta C]$$

where it is assumed that $C \geq b_{-i}$. In terms of the figure above, this means that the best reply for shipper 1 coincides with the budget line to the left of βC on the horizontal axis. Likewise, the best reply for shipper 2 coincides with the budget line below βC on the

vertical axis. As a result, for any combination of contributions on the budget line in the grey area (such as b_1^* and b_2^*), the shippers contributions are best responses to each other and thus constitute a Nash equilibrium. As a result, there is an abundance of Nash equilibria in this bargaining game. This is not surprising when we realize that this is in fact a version of the Nash demand game (Nash, 1953).²

There have been two major approaches to modelling bargaining with private (or incomplete) information. One approach is to assume that there is a principal who is able to design and commit to a mechanism which gives the agents (the shippers in our case) an incentive to reveal truthfully their willingness to contribute (or pay). According to the revelation principle (ie. Myerson, 1979) there is nothing to lose and possibly something to gain from providing incentives for the agents (in our case shippers) to reveal their private information. Of course, such a mechanism is not costless, and agents are expected to earn an information rent. Thus, we are in the world of the second best.

Mechanism design supposes that there is a principal that designs a mechanism in such a way that his or hers objective function is maximized subject to a set of constraints. As a consequence, the incentive scheme will depend on the objective function of the principal; whether it is a private firm (in our case this could be a carrier) whose aim is to maximize its expected profits or a benevolent agent (say a public authority) whose aim is to maximize social surplus. First and foremost, agents (shipper in our case) must be provided with incentives to reveal truthfully their private information (willingness to contribute or pay in our case); the corresponding constraints are called *incentive compatibility constraints*. Secondly, each agent must be willing to participate; the corresponding constraints are called *participation constraints*. Thirdly, in the absence of (costless) public funds, the total payments from the agents must be at least as large as the fixed cost; the corresponding constraint is called a *budget constraint*. (If the principal has access to (costless) public funds, the latter constraint may be ignored).

Large fixed costs and low or zero marginal cost means that the freight transport service is a kind of semi-public good; it is a public good in the sense that marginal cost is low or zero and a private good in the sense that it is possible to exclude shippers from making use of the service (if they don't pay). But paying for the fixed cost may be considered to be a *public good*. That is, if one shipper pays for the fixed cost there is no need for contributions from the other shipper. In other words, a shipper may 'free-ride' on the contributions made by the other shipper. If the principal is a benevolent public authority whose aim is to maximize social surplus, it seems natural to consider mechanisms aimed at eliciting the willingness to pay for public goods such as Clark (1971), Groves (1973) and Green & Laffont (1977). There is also a literature assuming that the principal is a private profit-maximizing firm (ie. Cornelli, 1996).

The second approach to analysing bargaining under incomplete information is to assume a specific bargaining procedure. One approach is to assume a single-period bargaining game in which both (or all) make a 'once-and-for-all' offer. The Nash demand game considered earlier is an example, albeit with perfect information. Most bargaining models consider multi-period bargaining games however, typically amongst a single seller and a single

² Other bargaining procedures (such as the alternating offer models by Ståhl (1978) and Rubinstein (1982)) may provide us with a unique equilibrium in the case of complete (no private) information, or one may apply non-cooperative game theory (ie. Nash, 1950). However, it may seem restrictive to assume that the two shippers have complete information or that they cooperate.

buyer.³ One possibility is to assume that there is asymmetric information where for instance the buyer has private information regarding his or her willingness to pay, and where only the seller can make “take-it-or-leave-it” offers to which the buyer can either accept or reject. This means that the informed party (the buyer) has a very limited possibility to ‘signal’ his or her ‘type’ (as the only options are to accept or to refuse); the seller has no need to ‘signal’ his or her ‘type’ as he or she has no private information. A second possibility is to assume that both the buyer and the seller has private information and may alternate in making offers to each other. This means that both parts (the buyer and the seller) may use their offers to ‘signal’ their ‘types’, and this makes such models more demanding to analyse.

We assume that both shippers offer contributions to cover the fixed cost that a carrier incurs. If the sum of contributions exceeds the fixed cost, a carrier is hired in order to supply the transport service on behalf of the shippers. Excess contributions (if any) are kept by the carrier (in terms of profit) and not wasted.⁴ If the sum of contributions does not exceed the fixed cost however, there will be no supply. In that case, contributions are refunded. Thus, we are in effect analysing a multi-stage game with the following structure: In the first stage, the shippers make their contributions. In the second stage, the shippers offers the sum of contributions to a shipper who has to either accept or reject the offer. The carrier’s choice is trivial: If the sum of contributions exceeds his cost of supplying the transport service, he will accept; otherwise he will reject the offer.

Let b_i denote the contribution (or ‘bid’) from shipper i ; $i = 1, 2$. If the sum of contributions exceeds a fixed cost C , a carrier is hired in order to supply the transport service on behalf of the shippers:

$$b_1 + b_2 \geq C$$

Let v_i denote shipper i ’s willingness to pay for a transport service, where the willingness to pay equals the cost of the alternative transport (ie. truck). The willingness to pay is private information, but it is common knowledge that it is uniformly distributed with support $[\underline{v}, \bar{v}]$ where $\bar{v} > \underline{v}$. A shipper that contributes b_i will thus obtain a surplus $v_i - b_i$ provided that $b_1 + b_2 \geq C$, and 0 otherwise. We assume that each shipper is risk neutral, maximizing his or her expected surplus being the product of the surplus and the probability that the sum of contributions exceeds the fixed cost. For shipper 1:

$$ES_1 = (v_1 - b_1) \cdot \text{prob}(b_1 + b_2 \geq C)$$

As is evident from the expected surplus function, a shipper faces a trade-off between the surplus (which decreases with his contribution) and the probability that the sum of contributions exceeds the fixed cost (which increases with his contribution). The first order condition for maximum expected surplus is:

$$\frac{\partial ES_1}{\partial b_1} = -\text{prob}(b_1 + b_2 \geq C) + (v_1 - b_1) \cdot \frac{\partial \text{prob}(b_1 + b_2 \geq C)}{\partial b_1} = 0$$

³ The case with multiple buyers and/or multiple sellers is in effect an auction.

⁴ To assume that the carrier retains any excess contributions is first and foremost a simplifying assumption, but is not unrealistic if the true size of the fixed cost is private information for the carrier.

The probability that the sum of contributions exceeds the fixed cost depends on shipper 2's contribution as well, however. As a result, the solution to the first order condition depends on shipper 2's contribution. Likewise, the solution to the first order condition for the optimization problem for shipper 2 depends on shipper 1's contribution. Thus, the shippers choices of contributions is a game. As the two shippers decide on their contributions simultaneously and as each shippers willingness to pay is private information, this is a simultaneous-move game of incomplete information.

The solution to the first order condition for shipper 1 depends (amongst other things) on his willingness to pay, v_1 . The same goes for shipper 2. As shipper 2's willingness to pay is private information however, the optimal contribution from shipper 1 must be based on shipper 1's *expectations* regarding the contribution from shipper 2. If we let $E(b_2)$ denote the expected contribution from shipper 2, the expected surplus for shipper 1 is:

$$ES_1 = (v_1 - b_1) \cdot \text{prob}(b_1 + E(b_2) \geq C)$$

Let us further assume that the shippers are uncertain regarding the size of the fixed cost.⁵ More specifically, let us assume that the fixed cost is uniformly distributed with a support $[\underline{C}, \overline{C}]$ where $\overline{C} > \underline{C}$. In that case, the expected surplus is:

$$ES_1 = (v_1 - b_1) \cdot \frac{b_1 + E(b_2) - \underline{C}}{\overline{C} - \underline{C}}$$

The first order condition for maximum expected surplus is:⁶

$$\begin{aligned} \frac{\partial ES_1}{\partial b_1} &= -\frac{b_1 + E(b_2) - \underline{C}}{\overline{C} - \underline{C}} + (v_1 - b_1) \cdot \frac{1}{\overline{C} - \underline{C}} = 0 \\ \Leftrightarrow b_1^* &= \frac{1}{2}(v_1 + \underline{C}) - \frac{1}{2}E(b_2) \end{aligned}$$

and correspondingly for shipper 2:

$$b_2^* = \frac{1}{2}(v_2 + \underline{C}) - \frac{1}{2}E(b_1)$$

These are the shippers best reply functions.⁷ As is evident, each shippers optimal contribution is a decreasing function of the other shippers contribution. In other words, the shippers contributions are strategic substitutes. The figure below depicts the best reply function for shipper 1.

⁵ This is actually a simplifying assumption as it avoids multiple (Bayesian) Nash-equilibria: Barbieri & Malueg (2008) has proved that in a game with private contributions to a public good, a deterministic cost or treshold will give rise to multiple (Bayesian) Nash-equilibria, whereas Barbieri & Malueg (2010) has proved that if the cost or treshold is stochastic there is a unique (Bayesian) Nash-equilibrium.

⁶ The second order condition is fulfilled as the expected surplus is strictly concave in b_1 :

$$\frac{\partial^2 ES_1}{\partial b_1^2} = -\frac{2}{\overline{C} - \underline{C}} < 0$$

⁷ Implicitly, we have made the assumption that $b_i^* \geq 0$ which is equivalent to assuming that $v_i \geq E(b_{-i}) - \underline{C}$. As the minimal willingness to pay is \underline{v} , a sufficient condition is: $\underline{v} \geq E(b_{-i}) - \underline{C}$.

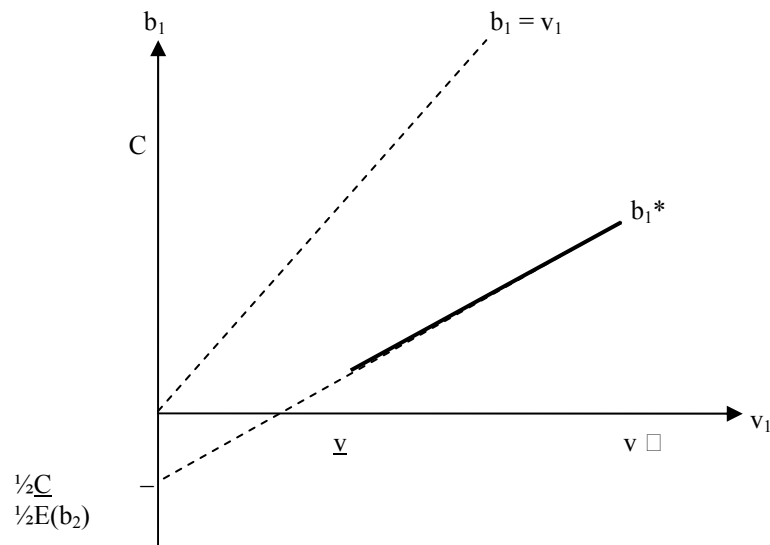


Figure 5.12: Best reply function shipper 1

Taking the expectation of shipper 1's best reply function, we obtain:

$$E(b_1^*) = E\left[\frac{1}{2}(v_1 + \underline{C}) - \frac{1}{2}E(b_2)\right] = \frac{1}{4}(\bar{v} - \underline{v}) + \frac{1}{2}\underline{C} - \frac{1}{2}E(b_2)$$

As shipper 2 is expected to contribute according to his best reply function, $E(b_2) = E(b_2^*)$. If we make the assumption that the two shippers choose identical best reply functions (that is, we assume a symmetric Bayesian Nash-equilibrium), $E(b_2^*) = E(b_1^*) \equiv E(b^*)$ in which case we obtain:

$$E(b^*) = \frac{1}{4}(\bar{v} - \underline{v}) + \frac{1}{2}\underline{C} - \frac{1}{2}E(b^*)$$

$$\Leftrightarrow E(b^*) = \frac{1}{6}(\bar{v} - \underline{v}) + \frac{1}{3}\underline{C}$$

Substituting $E(b_2)$ with $E(b^*)$, the optimal contribution from shipper 1 become:

$$b_1^* = \frac{1}{2}(v_1 + \underline{C}) - \frac{1}{2}\left[\frac{1}{6}(\bar{v} - \underline{v}) + \frac{1}{3}\underline{C}\right]$$

$$\Leftrightarrow b_1^* = \frac{1}{2}v_1 - \frac{\bar{v} - \underline{v} - 2\underline{C}}{12}$$

and correspondingly for shipper 2:

$$b_2^* = \frac{1}{2}v_2 - \frac{\bar{v} - \underline{v} - 2\underline{C}}{12}$$

These are the Bayesian Nash-equilibrium contributions.⁸ As can be seen, each shipper's contribution is increasing in his or her willingness to pay (v_i) which is hardly surprising. Furthermore, a shipper's equilibrium contribution depends negatively on the spread of the (other) shippers willingness to pay ($v - \underline{v}$) and finally, it depends positively on the least possible fixed cost (\underline{C}).

If we subtract the equilibrium contribution from a shippers willingness to pay, we obtain (for shipper 1):

$$v_1 - b_1^* = \frac{1}{2}v_1 + \frac{\bar{v} - \underline{v} - 2\underline{C}}{12}$$

In the jargon of auction theory (ie. Klemperer, 2004), this may be interpreted as shipper 1's 'shading' of his willingness to pay. Provided that $v - \underline{v} \geq 2\underline{C} - 5\underline{v}$ (which is fulfilled by assuming $0 \leq b_i^* \leq v_1$), $v_1 > b_1^*$. That is, a shipper will 'shade' his or her willingness to pay. Furthermore, the 'relative shading':

$$\frac{v_1 - b_1^*}{v_1} = \left[\frac{1}{2} + \frac{\bar{v} - \underline{v} - 2\underline{C}}{12v_1} \right] / v_1 = \frac{1}{2} + \frac{\bar{v} - \underline{v} - 2\underline{C}}{12v_1}$$

is increasing in the willingness to pay.

As a benchmark, we may compare the outcome of this bargaining game (regarding the splitting of the fixed cost in case of extreme economies of scale) with the case in which there are no fixed costs at all (that is; constant returns to scale). We do this by assuming that the cost of supplying a single shipper (that is, the 'marginal' or 'average' cost) is $\frac{1}{2}C$. We consider the following simple game: In the first stage each shipper makes a 'bid' b_i . In the second stage, the carrier decides whether to accept or reject the 'bid' from each shipper (separately). If the carrier accepts a 'bid' from a shipper, the carrier will serve the shipper who is obliged to pay his 'bid'. The outcome of the second stage is trivial: The carrier will accept a 'bid' from a shipper if and only if it exceeds the 'marginal' cost $\frac{1}{2}C$. Thus, a shipper will be served by the carrier if and only if $b_i \geq \frac{1}{2}C$. So we may focus on the first stage in which each shipper maximizes his expected surplus which is (for shipper 1):⁹

$$ES_1 = (v_1 - b_1) \cdot \text{prob}(b_1 \geq 0,5C)$$

We retain the assumption that each shipper does not know the true cost, only that it is uniformly distributed with a support $[\frac{1}{2}\underline{C}, \frac{1}{2}C + \underline{v}]$. In that case, shipper 1's expected surplus is:

$$ES_1 = (v_1 - b_1) \cdot \frac{b_1 - 0,5C}{0,5(C - \underline{C})}$$

⁸ It is assumed that $0 \leq b_i^* \leq v_i$ for $i = 1, 2$. A necessary condition is: $2\underline{C} - 5\underline{v} \leq v - \underline{v} \leq 2\underline{C} + 7\underline{v}$.

⁹ We need not consider shipper 2 in this case as the shippers face identical decision problems and furthermore, there are no interdependencies in case of no economies of scale.

As is evident from ES_1 , a shipper faces a trade-off between the surplus in case of being served by the carrier (which decreases with his 'bid'), and the probability of being served by the carrier (which increases with his 'bid'). The first order condition for maximum expected surplus is:¹⁰

$$\frac{\partial ES_1}{\partial b_1} = -\frac{b_1 - 0,5\underline{C}}{0,5(\bar{C} - \underline{C})} + (v_1 - b_1) \cdot \frac{1}{0,5(\bar{C} - \underline{C})} = 0$$

$$\Leftrightarrow b_1^{**} = \frac{1}{2}v_1 + \frac{1}{4}\underline{C}$$

where b_1^{**} denotes the shipper's optimal 'bid' in case of constant returns to scale. We notice that the optimal 'bid' increases with the willingness to pay (as in the case of extreme economies of scale) and the least possible 'marginal' cost (which is $\frac{1}{2}\underline{C}$ in the case of constant returns to scale). If we subtract the optimal 'bid' from the shippers willingness to pay, we obtain (for shipper 1):

$$v_1 - b_1^{**} = \frac{1}{2}v_1 - \frac{1}{4}\underline{C}$$

Thus, a shipper 'shades' his willingness to pay. In this case, this 'shading' occurs because the shipper may strike a better deal with the carrier by 'bidding' less than his willingness to pay. Of course, this is a gamble as by 'shading' his willingness to pay he will run the risk of not being served despite the fact that his true willingness to pay may exceed the carriers 'marginal' cost ($\frac{1}{2}\underline{C}$). We may compare the 'shading' in this case of constant returns to scale (that is: $v_1 - b_1^{**}$) with the 'shading' in case of extreme economies of scale (that is: $v_1 - b_1^*$). The 'shading' is less in the case of constant returns to scale (no fixed cost) than in the case of extreme economies of scale (fixed costs only) if and only if $b_1^{**} > b_1^*$ or $b_1^{**} - b_1^* > 0$ which we may confirm:

$$b_1^{**} - b_1^* = \frac{1}{2}v_1 + \frac{1}{4}\underline{C} - \left[\frac{1}{2}v_1 + \frac{\bar{v} - v - 2\underline{C}}{12} \right] = \frac{5}{12}\underline{C} + \frac{1}{12}(\bar{v} - v) > 0$$

Thus, shippers are less willing to reveal their willingness to pay for a transport service in case of extreme economies of scale than in case of constant economies of scale. This is due to the fact that in case of extreme economies of scale, the carrier is only concerned with whether or not the sum of contributions exceeds the fixed cost and thus a shipper may get away with a small contribution provided that the other shipper contributes sufficiently. In other words, paying for the service is a 'public good' and each shipper will thus tend to 'free ride' to a certain extent. This is not the case with constant returns to scale as in this case, a carrier will only serve a shipper if he offers to pay at least as much as the 'marginal' or 'average' cost of serving him (which is independent of whether the carrier serves the other shipper or not).

Looking at efficiency, the condition for ex post efficiency in case of extreme economies of scale is that the total willingness to pay is exceeds the fixed cost:

¹⁰ The second order condition is fulfilled as the expected surplus is strictly concave in b_1 :

$$\frac{\partial^2 ES_1}{\partial b_1^2} = -\frac{2}{\bar{C} - \underline{C}} < 0$$

$$v_1 + v_2 \geq C$$

whereas the two shippers will succeed in hiring a carrier if:

$$b_1^* + b_2^* \geq C$$

As shippers are 'shading' their bids, that is $b_i^* < v_i$, it is trivially true that there is a positive probability that there will be ex post inefficiency.¹¹

Conclusions and comments

Hervik & Haugen (2004) analyse a static non-cooperative game in which two shippers are to make a choice between two modes of transport. One mode of transport, assumed to be ship, is characterised by extreme economies of scale as there are only fixed costs. It is assumed that each shipper pays half the fixed cost if they both make use of this mode of transport, whereas a shipper must pay for the entire fixed cost if he is the sole user of this mode of transport. The other mode of transport, assumed to be truck, is characterised by constant returns to scale at the micro level as there are only variable costs. At the macro level however, truck is characterized by possibly 'diseconomies' of scale due to congestion. The shippers (players) have complete information regarding each others payoffs (cost of transport). Hervik & Haugen (2004) demonstrate that there may be multiple Nash-equilibria and possibly inefficiency.

We have modified the mode-choice game in Hervik & Haugen (2004) in various ways. We allow for less extreme economies of scale so that ship may have both variable and fixed costs. We assume that the cost of making use of truck is unaffected by the choices made by the two shippers; in other words, there may be congestion at the macro level, but congestion is not significantly affected by the choices made by the two shippers. Furthermore, we assume that shippers have private information regarding their (generalized freight) cost of making use of truck, the alternative to ship. In other words, there is private information regarding the willingness to pay for ship transport.

Whether or not a shipper chooses ship transport depends on the cost of the alternative mode of transport (truck) and – as the cost is halved if both choose ship - whether the other shipper chooses ship or not. The latter is not known with certainty due to the aforementioned private information. As a result, each shipper must 'gamble' and choose between the cost of truck transport which is known with certainty, and the cost of ship transport which is uncertain (as there is uncertainty regarding whether the other shipper will share the fixed cost or not). Even if shippers are risk neutral, this causes shippers to be cautious to choose ship. As a result, even if joint transport by ship is ex post efficient, shippers may still opt for truck transport. Even worse, a shipper may turn out to be the sole user of ship transport having to pay for the entire fixed cost himself whereas the other

¹¹ In the case of constant returns to scale, there are two independent conditions for efficiency, namely that a shippers willingness to pay should exceed the 'marginal' or 'average' cost of serving him ($\frac{1}{2}C$). Even though the conditions for ex post efficiency are not directly comparable, we notice that there is less 'shading' in the case of constant returns to scale than in the case of extreme economies of scale. Thus, ex post efficiency is more likely in the case of constant returns to scale than in the case of extreme economies of scale.

shipper incurs the cost of shipping his cargo by truck even though the 'marginal' cost of shipping his cargo by ship is very low. Thus, the modified model confirms the results in Hervik & Haugen (2004) that the shippers may choose modes of transport that are inefficient. But this is not a result of conflict of interests amongst the shippers (players) as this is a pure coordination game. Rather, it is due to the lack of (or private) information.

In a pure coordination game with no conflict of interest, it seems natural to assume that players have an incentive to communicate before deciding whether or not to opt for ship transport. Such 'cheap talk' could solve the coordination problem. But if shippers can communicate in advance, it seems natural that they may also use this opportunity to bargain on how the fixed cost is to be shared amongst them. If so, there is a conflict of interest that simple communication cannot solve. We have therefore allowed shippers to bargain on how the fixed cost is to be shared between themselves. More specifically, we assume that each shipper may make contributions simultaneously and non-cooperatively. If the sum of contributions exceeds the fixed cost associated with ship transport, the shippers pay accordingly and are served by a carrier. If not, contributions are refunded and shippers choose the alternative mode of transport (truck). It turns out that the shippers true willingness to pay for a ship transport service exceeds their equilibrium contributions. In the jargon of auction theory, they 'shade' their true willingness to pay. The reason is simply that paying for the fixed cost is a kind of 'public good' and as a result, each shipper has an incentive to 'free ride' on the contributions made by the other shipper. As a result of this 'shading', ship transport may not be provided due to insufficient contributions even though the total willingness to pay exceeds the fixed cost. Thus, inefficiency may prevail despite the fact that shippers may communicate. In this model the only cause of inefficiency is a complete lack of ship transport; the case in which a shipper is the sole user of ship transport by misfortune (as in the pure coordination game) is ruled out by allowing for communication before each shipper have to make his choice of mode of transport.

Could an outside agent (ie. a public authority) improve on efficiency? If the splitting of the fixed cost amongst the shippers is not an issue, there is no conflict of interest amongst the shippers. In such a pure coordination game of incomplete information, what is needed is simply communication. An outside or external agent may initiate such communication. Each shipper would have an incentive to reveal truthfully their willingness to pay to such an agent, provided that there are no conflicting interests between the shippers and the agent (which is not obvious if the agent happens to be a profit-maximizing carrier). However, it is not obvious why there is need for such a mediator in the first place as shippers could communicate directly with each other when there is no conflict of interest.

If the splitting of the fixed cost amongst the shippers is an issue however, our analysis has revealed that shippers will not have the proper incentives to reveal truthfully their willingness to pay for ship transport. In such a bargaining game of incomplete information in which there is a conflict of interest, simple communication amongst the shippers will not solve the problem. In this case however, an outside or external agent may improve on efficiency by providing the shippers with the incentives to reveal truthfully their willingness to pay provided that such an agent can commit himself. For instance, such an agent could implement mechanisms along the lines in Clark (1971), Groves(1973) and Green & Laffont (1977). In these mechanisms, truth-telling is a dominant strategy in order to reveal the willingness to pay for a public good (which in our case is the fixed cost associated with ship transport). However, it is well known that implementing such mechanisms will raise revenue that falls short of the cost. Thus, there is need for public funds in order to balance

the budget. As public funds has a shadow price however, this implies that there is a trade-off between efficiency and (the cost of) public funds and in general, an optimal mechanism will to a certain extent sacrifice efficiency in order to save public funds. In a dynamic setting the saving of public funds could even be detrimental to a mechanism: Suppose that the contract based on the mechanism has a limited duration. Once the contract terminates, the agent could simply propose a new contract in which each shipper is asked to make a contribution slightly less than his previously stated willingness to pay. Each shipper will accept such a contract. As a result, the agent may save (and even raise) public funds and at the same time implement ship as an efficient mode of transport. Presumably the shippers will anticipate this and as a result, may be reluctant to reveal truthfully their willingness to pay in the first place. This is known as the 'ratchet effect' with the theory of regulation (Laffont & Tirole, 1988).

Even though these models provide us with valuable insight, there is still scope for further research. For instance, both the coordination model and the bargaining model could be extended to multi-period models. Preliminary findings from a two-period coordination model seem to indicate that choices in early rounds can tend to reinforce themselves over time (cause 'path dependence'): If the two shippers do both choose ship in the first period, they have both revealed that they have rather high costs associated with using the alternative mode of transport (truck). As a result, they will both choose ship in the second period as well. Likewise, if the two shippers do both choose truck in the first period, they have both revealed that they have rather low costs associated with using the alternative mode of transport (truck). As a result, they will both choose truck in the second period as well.

Also the bargaining game could be made dynamic. It must be admitted though that dynamic models of incomplete information tend to be immensely difficult to analyse and tend to be burdened by a large number of (perfect Bayesian) Nash-equilibria. This is especially true if those who participate (the shippers in our case) have the opportunity to use the contributions in earlier rounds to either reveal or conceal their 'types' (through 'signalling' and 'signal jamming' respectively) in order to obtain a more favourable bargain in later rounds. If shippers are faced with simple 'take-it-or-leave-it' prices (or freight rate) however, their opportunities to manipulate information in this way are severely restricted. An example of such a simple but dynamic bargaining game is to assume that one of the shippers has chosen ship and makes 'take-it-or-leave-it' to the other shipper in order to share the fixed costs. Preliminary findings from such a model tend to show a decreasing sequence of equilibrium prices or offers along the lines of Coase (1972). Allowing the shippers to enter short term contracts only has the opposite effect: By accepting an offer, the shipper will reveal that his willingness to pay exceeds the offer. This revelation of information is exploited when the contract is to be renegotiated, and the shipper will face a higher price. Anticipating this, a shipper will be reluctant to accept anything but very low offers initially.

We have maintained the assumption of only two carriers as this simplifies the games. Adding more shippers could provide valuable insight into how the outcome may depend on the number of shippers. For instance, in the bargaining game we have detected that shippers will tend to 'shade' their willingness to pay for ship transport as paying for the fixed cost associated with this mode of transport is a kind of 'public good'. Increasing the number of shippers reduces the probability that a specific shipper is pivotal concerning whether or not the sum of contributions exceeds the fixed cost. If so, each shipper can be

predicted to reduce his contribution. In other words, the tendency to 'free ride' on the contributions made by fellow shippers will increase as the number of shippers increase.

Finally, we have focused on the shipper's willingness to choose or pay for ship transport with significant economies of scale. Carriers have only played a passive role. More specifically, if there is demand or sufficient contributions to cover the fixed costs, a ship service will be provided by a carrier. Adding carriers to the game could provide valuable insight into the market process and efficiency.

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5.2 Paper 2: Cooperation among freight forwarders: mode choice and intermodal freight transport

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Abstract

The objective of this paper is to compare vertical and horizontal cooperation among freight forwarders. The paper analyses three freight forwarders ('players') with two different means of transportation. The first two players are truck-operating freight forwarders, one large and one small. The third player is a freight forwarder with its own ship. For the purposes of analysis, the paper applied a two-stage game. In the first stage, the three players must decide whether to act alone or to enter into a coalition with another player. Presumably, the decision at this stage would be based on the predicted outcome for the second stage, which is modelled here as a Bertrand game with one outside competitor and the coalition. The results revealed that the best form of cooperation is the one in which the large truck-operating company would establish a coalition with the ship-operating company; that is, vertical cooperation. This cooperation would generate better payoffs in the form of profit, not only to the members of this coalition, but also to the outsider player (the smaller truck-operating company). However, user surplus is negative in all coalitions, which shows that the establishment of these kind of cooperation is not beneficial for the users of these service providers.

Key words: Freight forwarders, Intermodal-transport, Game theory, Bertrand model, Coalition

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Introduction

Freight forwarders have long played an important role in commerce and the international carriage of goods. Traditionally, the freight forwarder was the link between the owner of the goods and the carrier, and provided forwarding or clearing services. The forwarder acted as the agent for the owner of the cargo or the carrier.

Researchers have failed to agree on a definition of the international freight forwarders sector. Most definitions imply that freight forwarders play the role of the intermediary in international transport. According to Bob Torrance (Bell, 2000):

'Freight forwarders are companies that offer all services related to transport to anyone that places an order, everywhere in the world, whenever that is requested, using whatever means of transport, aiming at making profit'

However, freight forwarders have recently assumed a new role, not only helping the parties get the goods transported, but also 'undertaking' to have the goods transported by their own means of transport (truck/train/ship) or making arrangements with other transport providers. In this role, the freight forwarder acts as a principal rather than an agent and is known by many names, such as a NVOCC (non-vessel-owning common carrier); an MTO (multi-modal transport operator) including vessel-operating multimodal transport operators (VO-MTOs) and non-vessel-operating multimodal transport operators (NVO-MTOs); a logistics service provider, etc.¹²

Today, freight forwarders' activities include the following functions:

- Acting on the customers' behalf to procure the most suitable mode/combination of transport modes, be it road, rail, sea or air. However, road, sea and air transport is most commonly used, while very few freight forwarding companies deal with railway transport, even casually (Kokkinis *et al.* 2006).
- Undertaking the arrangement of the routing and choice of mode for the customer, together with any ancillary service such as customs clearance or packing. This level of involvement introduces a higher level of expertise, which the shipper may not always be able to provide.
- Offering stand-alone ancillary services, such as warehousing, customs clearance, packing and port agency.

Many enterprises outsource transportation tasks by entrusting independent freight forwarding companies with their transportation activities. The forwarding company is allowed to choose the mode of fulfilment; that is, it can use its own vehicles to execute the corresponding entrusted tasks (self-fulfilment), or an external freight carrier (subcontractor) receives a fee for the request fulfilment (subcontracting). The

¹² See <http://www.unescap.org/ttdw/CapBuild/Module%20-%20The%20Evolving%20Role%20of%20the%20Freight%20Forwarder.pdf> and http://www.unescap.org/ttdw/Publications/TIS_pubs/pub_2032/tamc-chap4.pdf, accessed 3 June 2010.

subcontractor receives independent shipment contracts of different types and specifications for completion. According to (Chu, 2005) there are two incentives for involving a subcontractor. Firstly, when the total demand is greater than the overall capacity of owned trucks, logistics managers may consider using outside carriers. Secondly, integrating the choice of fulfilment mode into transportation planning may bring significant cost savings to the company because better solutions can be generated in an extended decision space. This extended problem is known as integrated operational freight carrier planning.

A freight forwarding company's profit is the difference between the price that the customer is obliged to pay for the request execution and the costs of request fulfilment. These costs result either from fulfilment by the company's own transportation capacity or from the external processing of orders as a consequence of involving a subcontractor (Krajewska and Kopfer, 2006).

As globalisation proceeds, large international freight forwarding companies have a competitive advantage over small companies due to their wider portfolio of disposable resources and market power position. This leaves medium- and small-sized carrier businesses with the option of establishing coalitions in order to extend their resource portfolios and reinforce their market positions (Krajewska and Kopfer, 2006). Moreover, the structure of large freight forwarding companies often assumes autonomously operating subsidiaries that should cooperate in order to maximise business' overall profit.

The purpose of having freight forwarders cooperate is to find equilibrium between the demanded and the available transport resources within several carrier entities by interchanging customer requests (Kopfer and Pankratz, 1999).

Players

In this paper following three players are defined:

A freight forwarder with its own means of land transport (a truck). This is assumed to be a large truck-operating company.

The second player is a small truck-operating company that also works as a freight forwarder.

The third player is a freight forwarder with its ship. This type of player is known in the literature as a vessel-operating multimodal transport operator (VO-MTO). VO-MTOs are ship owners that have extended their services beyond carrying the cargo from port to port to include carriage over land and even by air. They may or may not own the other means of transport, in which case they arrange for these types of transport by subcontracting with such carriers.¹³

¹³ See http://www.unescap.org/ttdw/Publications/TIS_pubs/pub_2032/tarnc-chap4.pdf, accessed 3 June 2010.

Route: From Oslo to Rotterdam

By sea: For example, the Unifeeder service line offers a container feeder service from Oslo to Rotterdam, two times in a week.¹⁴ The capacity of feeder vessels is between 700 and 750 TEUs.

By road: A road vehicle maintaining an average speed of 40mph (64 km/h) would take approximately 19.35 hours to travel from Oslo to Rotterdam for an estimated driving distance of 774 miles.¹⁵

Different combinations of coalitions

Various combinations of coalitions are possible in this situation, like coalition between players 1 and 3 or between players 2 and 3. For instance, if player 1 or player 2 cooperated with player 3, this would result in an *intermodal freight transportation* situation. Similarly, players 1 and 2 could cooperate with each other.

Expected incentives to form coalitions

The following are some of the expected benefits from the formation of coalitions:

Potentially higher profit due to improved service quality: After collaboration, freight forwarders will gain a competitive advantage that will increase the profit margin. Even if prices increase, customers may appreciate the corresponding increase in service quality. Many researchers have found that customers selecting freight forwarders place greater emphasis on factors other than price, such as travel duration, reliability, and quality of transportation (Bardi, 1973; McGinnis, 1979; Lambert *et al.* 1993; Bell, 2000; Gibson *et al.* 2002). After collaboration, players will be able to improve the service quality in terms of travel duration, reliability, etc.

Economies of Scale: Freight forwarders that form a coalition will have large volumes of cargos to transfer and will therefore be able to negotiate better agreements with the carriers, load their means of transport to capacity, and decrease costs. In so doing, they will achieve economies of scale by transferring large quantities per cargo.

Moreover, one of the disadvantages of sea transport (second player) compared to road transport (first player) is low frequency. In order to offer a satisfactory level of frequency and flexibility in service, sea transport needs a certain volume of cargo 'critical mass'. The formation of a coalition will help the sea transport to achieve this critical mass.

Other disadvantages of sea transport (second player) are slow speed and low flexibility. However, there may be room to improve these drawbacks by combined transport solutions, using faster modes of transport on part of the journey. This is illustrated by an example of a differentiated set of transport alternatives between Kobe, Japan and Amsterdam. A customer could choose pure sea transport, which would take 28 days but at a very low cost. A faster alternative would be the 'landbridge' solution of transporting the cargo by train over the USA. An even faster alternative would be a combined air-sea alternative, or an air-only transport alternative.

¹⁴ See

<http://www.unifeeder.com/C125702600609F2D/0/DD65A320D08D0680C125708300548F1C?opendocument>

¹⁵ See <http://www.distance-calculator.co.uk/distance-from-oslo-to-rotterdam.htm>

Formation of coalition/coalitions, especially involving player 3, will help to reduce the congestion in roads because cargo will be shifted from road to sea.

The objective of this paper is to compare vertical and horizontal cooperation among freight forwarders. A two-stage game is applied for the purpose of analysis. In the first stage, the three players have to decide on whether to act singleton or to enter into a coalition with any other player. The decision at this stage should presumably be based on the predicted outcome for the second stage. The second stage is here modelled as a Bertrand game with one outside competitor and the coalition. Since the first stage decision (when players have to decide whether to join the coalition or not) depends on the predicted outcome for the second stage, the problem will be studied by backward induction. Furthermore, the stability of these suggested coalitions will be checked with the help of concepts of "coalitional rationality" of the cooperative game.

The rest of the paper is organised as follows: In Section 2, presents a number of research works related to the application of cooperative game theory to the freight forwarders' sector, and the difference between this research and previous research. In Section 3, a model for a Bertrand game for the second stage and its parameters are presented. Section 4 constitutes a numerical analysis and is followed by a conclusion and policy implications in Section 5.

Literature review

Krajewska and Kopfer (2006) presented a model for collaboration among independent freight forwarding entities. They argued that, in today's highly competitive transportation branch, freight forwarders reduce their fulfilment costs by exploiting different execution modes (self-fulfilment and subcontracting). The freight forwarders use their own vehicles to execute self-fulfilment requests and forward subcontracting orders to external freight carriers. Competitiveness can be further enhanced if the freight forwarders cooperate in the form of coalitions in order to balance their request portfolios. Participation in such a coalition provides additional profit for the entire coalition and for each participant, which reinforces the market position of the partners. Their paper introduces the integrated operational transport problem, as well as existing collaboration approaches.

Moreover, the model proposed by Krajewska and Kopfer (2006) is based on the combinatorial auction theory, as well as on the operations research game theory. The model's main strength is that each participant generates no losses as a consequence of the collaboration and has a realistic chance of increasing its profit by participating in the coalition. The collaboration-advantage indexes have been chosen in such a way that enables all participating coalition members to expect positive payoff vectors. Therefore, each partner has strong incentives to join and to maintain the coalition to which they belong.

Ting (2009) described the logistics service (even freight forwarders with no independent means of transport) as a type of oligopoly market because a small number of logistics service providers (LSPs) always compete to win a shipping contract. They are interdependent in the sense that the profit that each provider earns also depends on the others' actions. LSPs use a game theoretic approach including the Cournot, Collusion and Stackelberg models to study the cooperative and competitive behaviour among the oligopolistic competitors.

Cantos-Sanchez et al. (2010) developed a theoretical model for freight transport that is characterised by competition between means of transport (the road and maritime sectors), where modes are perceived as differentiated products. Competitive behaviour is assumed in the road freight sector, and there are constant returns to scale. In contrast, the freight maritime sector is characterised by oligopolistic behaviour, whereby shipping lines enjoy economies of scale. The market equilibrium in which the shipping lines behave as profit maximisers provides a first approximation to the determinants of market shares, profits and user welfare.

Moreover, the results show that maritime freight increases after the merger, in cases where the merger entails further economies of scale. When prices for maritime services increase, which occurs when the merger only has a strategic effect, road freight transport also increases. Furthermore, horizontal integration has been found to be beneficial in private and social terms under certain conditions. In empirical applications, Cantos-Sanchez et al. (2010) employed data for two freight routes between the hinterland of Valencia and the hinterlands of Genoa and Antwerp. Their results show that, in all of the examined cases, the shipping lines have strong incentives to merge. Additionally, a merger (horizontal integration) between two shipping lines in which economies of scale are exploited further generally leads to an increase in social welfare. In most cases, the merger produces a significant increase in road traffic that is greater than the reduction in traffic transported by the shipping lines, which leads to an increase in user surplus. Their study has found that the social gains depend mainly on the characteristics of the market. Then, the social gains obtained with the merger are higher in those markets where the road and shipping services are less differentiated. If the services are clearly differentiated, then the social gains are significantly lower.

Krajewska et al. (2007) analysed the profit margins that resulted from horizontal cooperation among freight carriers. The work presented in their paper combines features of routing and scheduling problems and of cooperative game theory. The authors assumed that the structure of customer requests corresponds to that of a pick-up and delivery problem with time windows for each freight carrier. The paper then discusses the possibility of sharing these profit margins fairly among the partners. The paper also presents numerical results for real-life and artificial instances. The paper shows that collaboration can yield a considerable cost decrease and that efficient profit allocation is possible using cooperative game theory.

Theys et al. (2008) illustrated the potential of cooperative game theory as a methodological tool with which to analyse intermodal networks. More specifically, they have used the many solution concepts proposed in the game-theoretic literature to evaluate whether cooperation in an intermodal project is *feasible* and *efficient*, as well as what would be a *fair* cost division among the participants.

According to Theys et al. (2008), an important assumption that is often made in applications of cooperative game theory is the subadditivity of the characteristic function, which implies that no player is worse off as a result of cooperating and that the grand coalition is the most efficient cooperation structure. This assumption of subadditivity will hold for most economic applications. However, as Theys et al. (2008) illustrated, this is not necessarily the case for more realistic intermodal cooperation projects. Hence, they concludes that, for real-life applications in intermodal transportation, one must rely on far

more advanced game-theoretic solution concepts, which results in a significant increase in computational complexity. Hence, practical limitations to the computations in intermodal cost-allocation games seem to exist and should be explored further.

This research is different from the previously mentioned research done in the same field in the following aspects. First, in none of the research is the multinomial logit model used to analyse the game outcome by solving a numerical example with the help of data. Second, to our knowledge, no one has analysed the possibilities of coalitions between freight forwarders (vertical and horizontal cooperation) as presented in this paper. Third, in this paper the Bertrand game in terms of prices is solved but we also analyse the outcome from the perspective of users' benefits when coalitions are formed.

Model

The demand for freight forwarders

The present model treats the competition between freight forwarders as a Bertrand game and also uses the outcome of Bertrand games to investigate the payoff (profit) to different coalitions. The Bertrand game is a natural choice in this setting. We are dealing with a service industry in which competitors offer services that, from the perspective of individual customers, are similar but not quite homogeneous. In order to detail the structure of the Bertrand game, the demand function faced by each service provider must be made explicit.

Schedule delay

Another important concept, introduced by Small (1982), is the schedule delay costs for trips. Consumers (users) who want to undertake certain activities during a day will schedule them according to their preferences, taking into consideration external constraints. Deviating from these scheduling preferences will result in disutility; that is, schedule delay costs. Schedule delay costs focus on alleviating congested transport networks because they indicate the costs that travellers attribute to changing their travel behaviour (Bakens et al. 2010).

Schedule delays become much more important for users' decisions when any mode of transportation has low frequencies and timetable information is used to select that mode of transportation. If a mode of transportation has high frequencies, it is believed that users do not use timetable information *ex ante*. In other words, it takes users some effort to consult timetables, and this effort is negligible when there is little to gain by it. Therefore, for those modes of transportation that have high-frequency services, users will tend to choose the preferred departure time from the origin and accept the uncertainty in terms of waiting time and total travel time. In our case, trucks have a high frequency and low waiting time compared to ships. The model considers this feature by assigning positive values of alternative specific constants in the utility functions of players 1 and 2.

In our numerical implementation of the Bertrand model, the market share of each freight forwarder is determined by an aggregate multinomial logit model,¹⁶ and the demand for all freight forwarders combined is a function of the logsum from the logit model.

The use of a logit model presupposes that a 'utility function' can be assigned to each freight forwarder. The utility functions in an aggregate logit model can be interpreted as a measure of the attractiveness of a freight forwarder as perceived by the 'average' user.

The utility functions of freight forwarders are given as follows:

$$U_i = a_i + b(p_i) \quad (1)$$

Where U_i is the 'utility' of freight forwarder i

P_i is price charged per unit by freight forwarder i

b is the co-efficient of price charged by freight forwarders and;

a_i is the alternative specific constant for freight forwarder i ;

$a_1, a_2 > a_3$ due to low waiting time and high frequency of trucks;

The market share of freight forwarder ' i ' is given by the logit expression:

$$Q_i = \frac{e^{U_i}}{\sum_j e^{U_j}} \quad i = \text{freight forwarders} \quad (2)$$

The logsum is defined by:

$$LS = \ln\left(\sum_j e^{U_j}\right) \quad (3)$$

Thus, the total aggregate demand (in TEUs) for all the players is given by:

$$X = Ae^{\theta LS} \quad (4)$$

where A and θ are constants and $0 < \theta < 1$,

Individual demand for player ' i ' is given by the equation:

$$X_i = X \cdot Q_i \quad i = \text{freight forwarder} \quad (5)$$

Therefore, the demand faced by a freight forwarder i will depend on handling prices and schedule delay (which is reflected in alternative specific constant) for all players. Individual demand is elastic because changes in the price and other attributes of one freight forwarder will shift the cargo between that freight forwarder and other freight forwarders. There will also be a slight effect on the total demand via the logsum.

¹⁶ For detail about the logit model, see Ben-Akiva and Lerman (1985) and Train (2003). Choice models have also been used in Port and shipping, such as Tiwari et al. (2003), Nir et al. (2003), Malchow and Kanafani (2004) and Magala (2004).

Revenue/profit for freight forwarders

The operating surplus of the freight forwarder 'i' is:

$$\Pi_i = (p_i - c_i) \cdot X_i \quad (6)$$

Where p_i is the price per cargo unit paid by the users, c_i is the marginal cost per cargo unit.

In a competitive situation with few players and a non-homogeneous product, the outcome in terms of market shares and prices can often be treated as the result of a game in which each player maximises its profit but with due consideration of the expected reaction of its competitors. When a competitor's actions are confined to setting the prices of its own product (service), the outcome can be modelled as the Bertrand equilibrium (Pindyck and Rubinfeld, 2001).

Whatever the price that other freight forwarders are charging, the freight forwarder 'i's profit is maximised when the incremental profit from a very small increase in its own price is only zero. Thus, in order to find the best reply for player i, its profit function is differentiated with respect to p_i and the derivative is set equal to zero. Thus, the Bertrand Nash equilibrium is characterised by the first-order conditions:

$$\frac{\partial \Pi_i}{\partial p_i} = 0, \quad i = \text{freight forwarders} \quad (7)$$

The profit function, say for freight forwarder 1, is given by:

$$\Pi_1 = (p_1 - c_1) \cdot X_1 \quad (8)$$

$$\text{Since } X_1 = Ae^{\theta LS} Q_1 \quad (9)$$

By substituting the value of X_1 in equation (8):

$$\Pi_1 = (p_1 - c_1) \cdot Ae^{\theta LS} Q_1 \quad (10)$$

$$\Pi_1 = p_1 \cdot Ae^{\theta LS} Q_1 - c_1 \cdot Ae^{\theta LS} Q_1 \quad (11)$$

By taking the derivative of equation (11) and setting it equal to zero:

$$\frac{\partial \Pi_1}{\partial p_1} = Ae^{\theta LS} Q_1 + p_1 \frac{\partial (Ae^{\theta LS} Q_1)}{\partial p_1} - c_1 \frac{\partial (Ae^{\theta LS} Q_1)}{\partial p_1} = 0 \quad (12)$$

$$\frac{\partial \Pi_1}{\partial p_1} = Ae^{\theta LS} Q_1 + (p_1 - c_1) \frac{\partial (Ae^{\theta LS} Q_1)}{\partial p_1} = 0 \quad (13)$$

$$\text{Since } X_1 = Ae^{\theta LS} Q_1$$

Taking the log of the above equation results in:

$$\ln(X_1) = \ln(A) + \theta LS + U_1 - LS \quad (14)$$

$$\frac{\partial \ln(X_1)}{\partial p_1} = \frac{\partial X_1}{\partial p_1} \times \frac{1}{X_1} \quad (15)$$

OR

$$\frac{\partial X_1}{\partial p_1} = \frac{\partial \ln(X_1)}{\partial p_1} \times X_1 \quad (16)$$

Taking the derivative of equation (14) with respect to P_1 results in:

$$\frac{\partial \ln(X_1)}{\partial p_1} = \frac{\theta}{\sum_j e^{U_j}} \times \frac{\partial (\sum_j e^{U_j})}{\partial p_1} + \frac{\partial U_1}{\partial p_1} - \frac{1}{\sum_j e^{U_j}} \frac{\partial (\sum_j e^{U_j})}{\partial p_1} \quad (17)$$

$$= \frac{\theta}{\sum_j e^{U_j}} \times e^{U_1} (b) + b - \frac{1}{\sum_j e^{U_j}} \times e^{U_1} (b) \quad (18)$$

$$= \theta b \frac{e^{U_1}}{\sum_j e^{U_j}} + b - \frac{e^{U_1}}{\sum_j e^{U_j}} \times b \quad (19)$$

$$\text{Since } Q_1 = \frac{e^{U_1}}{\sum_j e^{U_j}}$$

Substituting the value of Q_1 in the above equation results in:

$$\frac{\partial \ln(X_1)}{\partial p_1} = \theta b Q_1 + b - b Q_1 \quad (20)$$

$$= b(\theta Q_1 + 1 - Q_1) \quad (21)$$

Substituting equations (9) and (21) in equation (16) results in:

$$\frac{\partial X_1}{\partial p_1} = A e^{\theta LS} Q_1 [b(\theta Q_1 + 1 - Q_1)] \quad (22)$$

Substituting equation (22) into equation (13) results in:

$$\frac{\partial \Pi_1}{\partial p_1} = A e^{\theta LS} Q_1 + (p_1 - c_1) [b(\theta Q_1 + 1 - Q_1)] A e^{\theta LS} Q_1 = 0 \quad (23)$$

$$A e^{\theta LS} Q_1 + (p_1 - c_1) [b(\theta Q_1 + 1 - Q_1)] A e^{\theta LS} Q_1 = 0 \quad (24)$$

$$Ae^{\theta LS} Q_1 \{1 + (p_1 - c_1)[b(\theta Q_1 + 1 - Q_1)]\} = 0 \quad (25)$$

Solving the above equation for p_1 results in:

$$p_1 = c_1 - \frac{1}{b(\theta Q_1 + 1 - Q_1)} \quad (26)$$

This is the implicit reaction curve (pricing rule) for player 1. The reaction function cannot be given on a closed form in this model. The prices of the other players enter via Q_i , see (1) and (2). Similarly, the reaction curves for the other two players can be derived. Solving these reaction functions yields the Nash equilibrium in prices.

Cooperative game with external competitors

As suggested above, the three freight forwarders can establish different combinations of coalitions. In this situation, the profit function for each player will be different from equation (6). For instance, if all the freight forwarders decided to work under one decision unit, then the profit function of the coalition (player 1, for example) would be as follows:

$$\Pi_1 = [X_1(p_1 - c_1) + X_2(p_2 - c_2) + X_3(p_3 - c_3)] \quad (27)$$

This will give three conditions, one for each price. Again, the Bertrand Nash equilibrium is characterised by the first-order conditions. Therefore, by taking the derivative of equation (27) and setting it equal to zero, we get the condition:

$$\begin{aligned} \frac{\partial \Pi_1}{\partial p_1} = & \frac{\partial(Ae^{\theta LS} Q_1)}{\partial p_1} (p_1 - c_1) + Ae^{\theta LS} Q_1 + \frac{\partial(Ae^{\theta LS} Q_2)}{\partial p_1} (p_2 - c_2) \\ & + \frac{\partial(Ae^{\theta LS} Q_3)}{\partial p_1} (p_3 - c_3) = 0 \end{aligned} \quad (28)$$

From equation (22) we have:

$$\frac{\partial(Ae^{\theta LS} Q_1)}{\partial p_1} = Ae^{\theta LS} Q_1 [b(\theta Q_1 + 1 - Q_1)]$$

The third (and fourth) terms in equation (28) are the cross-derivatives.

$$\frac{\partial(Ae^{\theta LS} Q_2)}{\partial p_1} (p_2 - c_2) = Ae^{\theta LS} Q_2 [b(\theta Q_1 - Q_1)] (p_2 - c_2) \quad (29)$$

Similarly,

$$\frac{\partial(Ae^{\theta LS} Q_3)}{\partial p_1} (p_3 - c_3) = Ae^{\theta LS} Q_3 [b(\theta Q_1 - Q_1)] (p_3 - c_3) \quad (30)$$

Substituting equations (22), (29) and (30) in equation (28) results in:

$$\frac{\partial \Pi_1}{\partial p_1} = Ae^{\theta LS} Q_1 [b(\theta Q_1 + 1 - Q_1)](p_1 - c_1) + Ae^{\theta LS} Q_1 + Ae^{\theta LS} Q_2 [b(\theta Q_1 - Q_1)](p_2 - c_2) + Ae^{\theta LS} Q_3 [b(\theta Q_1 - Q_1)](p_3 - c_3) = 0 \quad (31)$$

Now:

$$Ae^{\theta LS} Q_1 \text{ cancels out, leaving} \\ [b(\theta Q_1 + 1 - Q_1)](p_1 - c_1) + 1 + Q_2 [b(\theta - 1)](p_2 - c_2) + Q_3 [b(\theta - 1)](p_3 - c_3) = 0 \quad (32)$$

This is the reaction curve for player 1 when all three players have formed a coalition. Similarly, reaction curves for other two players can be derived.

Numerical analysis

A model consisting of equations 1, 2, 6, 26, 32 (for each player) and 4 is solved using an equation solver. In other words, solving the equilibrium of the Bertrand game provides the pricing rule set by the players, which will yield the Nash equilibrium. However, before this we need to make certain assumptions about the values for parameters a, b, marginal costs and capacity of freight forwarders.

Assumptions about the parameters of the model

Due to the unavailability of data, a brief literature review is conducted that is similar in many ways to the current case, in order to establish a base for the assumption about parameters.

Assumed value for b

b is the co-efficient of price or cost for customers. In other words, this is the coefficient of price of the choices faced by decision makers. Polydoropoulou and Litinas (2007) developed models including a multinomial logit model with dependent variable the choice among different types of shipping lines and airlines. Their result shows that the parameter of travel cost of ships is negative and significant. An increase of 1 Euro in shipping costs will result in a utility reduction of 0.0516.

In research conducted by Cantillo et al. (2006), this value is around -0.070 as a coefficient of cost, as an attribute for three choices: taxi, bus and metro. The estimated values for mainline deviation costs (based on deviation from main navigation course for trans-shipment port) and feeder costs (costs of feeder transport stack-to-stack between feeder region and trans-shipment port), are -0.077 and -0.030, respectively, by Veldman and Rachman (2008).

Based on these values, the value for the price parameter in our model is assumed to be -0.050.

Assumed value for a

In general terms, equation (2) can be written by dividing utility into two additive parts. For instance, for two alternatives (A and B), the utilities can be written as follows:

$$U_{An} = V_{An} + \varepsilon_{An} \quad \text{and} \quad U_{Bn} = V_{Bn} + \varepsilon_{Bn} \quad \text{where } n=1, \dots, N. \quad (2a)$$

where N is the number of decision makers (or users), V_{An} and V_{Bn} are the systematic (or representative) components of the utility of A and B, and ε_{An} & ε_{Bn} are the random parts and are called the disturbance (or random components). a is the alternative-specific constant and reflects the mean of $\varepsilon_{Bn} - \varepsilon_{An}$; that is, the difference between the utilities of alternatives A and B when 'all other things are equal'. The values of the alternative-specific constant for players 1 and 2 are chosen arbitrarily. The positive values for player 1 and 2 are set due to the low waiting time and high frequency of trucks.

Assumed value for costs

Commercial trucking firms have costs that depend upon a number of factors, including the types of commodities hauled, the length of hauls, the types of equipment used, the proportion of truckload (TL) or less-than-truckload (LTL) traffic, and the regions they serve (McMullen, 1987). In addition, policies that restrict the routes and weights of commercial vehicle traffic can have an impact on a firm's operating costs (Levinson *et al.* 2004).

Using data collected from a survey of truck operators Levinson *et al.* (2004) calculated the average and marginal truck operating cost in the state of Minnesota. They found that if output is total truckloads, then the marginal cost per truckload is \$6.51. However, by assuming total kilometres to be the output of each firm (truck), then the marginal cost per kilometre is \$0.65. In the present case, we have selected the marginal cost per truckload. As one truck can carry a load equal to two containers, the marginal cost is set at \$13.

According to the results of a 2011 study conducted by Finnish technology company Eniram, the average fuel consumption for a vessel with a speed at sea of between 17 and 23 knots and with 5500 TEUs capacity is between 0.18 and 0.23 tons per nautical mile.¹⁷ In our case:

Vessel's speed = 16.5 knots (for a vessel with capacity 700 TEUs).¹⁸

(1 knot = 1 nautical mile per hour, = 1.85 km/h = 1.15 miles per hour).¹⁹

Distance from Rotterdam to Oslo = 552 nautical miles.²⁰

Fuel (bunker) price = \$300 per tonne.²¹

¹⁷ See <https://www.eniram.fi/files/eniram/News/DShipApr11.pdf>.

¹⁸ See

[http://www.unifeeder.com/C125702600609F2D/\(AllDocsByDocId\)/65757ADF757C6769C12570260069D7B6?Opendocument&imo=9134139&sorttype=Size](http://www.unifeeder.com/C125702600609F2D/(AllDocsByDocId)/65757ADF757C6769C12570260069D7B6?Opendocument&imo=9134139&sorttype=Size).

¹⁹ See <http://www.danaos.com/glossary.php>.

²⁰ See <http://www.cruiseportrotterdam.com/>.

²¹ See Drewry (2009).

According to the Eniram study, fuel consumption also depends on the number of TEUs loaded in a vessel. Therefore, if we assume that the average fuel consumption for a feeder vessel is 0.02 tons per nautical mile,

The total fuel consumption for a round trip = $0.02 * 552 * 2 = 22$ tons.

Fuel price = \$300.

Total fuel cost = $22 * 300 = \$6600$.

Fuel cost per TEUs = $6600/700 = \$9.4$.

Assumed value for θ

A change in the price and other attributes of one player will shift the traffic from the other players to that player. It will not affect the total demand to a great degree but it will affect the market share of all players. That is why the value for θ is quite low.

Capacity

Turnaround time of a vessel in days TTV = 7 days.

(For example, the Unifeeder vessel departs Oslo on Thursday and reaches Rotterdam on Monday. It departs Rotterdam on Friday and reaches Oslo on Monday.²²)

Frequency of scheduled vessel calls per week $f_v = 2$.

Capacity of vessel = X^* (in TEUs) = 700 TEUs.

Annual capacity (one way) = $2 * 52 * 700 = 72,800$ TEUs.

Table 5.1: General parameters of demand

| Level of Demand (A) | Logsum parameter (ϑ) | Price parameter (λ) |
|-------------------------|----------------------------------|-------------------------------|
| 200,000 | 0.010 | -0.050 |

Table 5.2: Freight forwarders' specific parameters

| | Player 1 (Big truck-operating company) | Player 2 (Small truck- operating company) | Player 3 (Ship operator) |
|-----------------------------------|--|---|-----------------------------|
| Alt.spec. constant (α_i) | 0.5 | 0.1 | 0 |
| Marginal cost in \$ (c_i) | \$13 | \$13 | \$9 |
| Capacity (CAP_i) | 3000 TEU | 1000 TEU | 73000 TEU |

²² See

<http://www.unifeeder.com/C125702600609F2D/0/DD65A320D08D0680C125708300548F1C?openDocument>.

Bertrand solutions

In the first case, when all players are working independently, Nash equilibrium prices are higher for players 1 and 2 than for player 3. These are reasonable results because player 3 (the ship) is a cheap means of transportation. However, despite the high price, player 1 captures the largest market share. This reflects users' preference to trucks over ship to carry their cargo, even though ships are cheaper. This could be due to the fact that trucks offer a flexible service with low waiting time.

Table 5.3: Case A: Bertrand equilibrium (when all players are independent)

| | <i>Player 1</i> | <i>Player 2</i> | <i>Player 3</i> |
|-----------------------------------|-----------------|-----------------|-----------------|
| Equilibrium Price US\$/TEU | 45 | 42 | 38 |
| Market share% | 37 | 31 | 31 |
| Profit (in millions of US\$) | 2.3 | 1.8 | 1.8 |
| <i>Total demand in 1000s TEUs</i> | 198.5 | | |
| <i>Logsum</i> | 0.74 | | |

Table 5.4: Case B: Bertrand equilibrium (when players 1 & 3 are cooperating)

| | <i>Player 1</i> | <i>Player 2</i> | <i>Player 3</i> |
|--------------------------------------|-----------------|-----------------|-----------------|
| Equilibrium Price US\$/TEU | 60 | 47 | 56 |
| Market share | 29 | 42 | 29 |
| Profit (in millions of US\$) | 2.7 | 2.8 | 2.7 |
| <i>Total demand in 1000s of TEUs</i> | 197.5 | | |
| <i>Logsum</i> | 1.28 | | |

In case B, players 1 and 3 established a coalition that resulted in a duopoly situation. As expected, the Nash equilibrium prices of all players are higher than in case A. As a result of these higher prices, the market shares of players 1 and 3 have declined. However, player 2, which is an outsider in this situation, is able to capture a higher market share due to the comparatively low price offered by this player. Similarly, in cases C and D, the Nash equilibrium prices of all players are high compared to a situation in which all players are working independently.

Table 5.5: Case C: Bertrand equilibrium (when players 1 & 2 are cooperating)

| | <i>Player 1</i> | <i>Player 2</i> | <i>Player 3</i> |
|--------------------------------------|-----------------|-----------------|-----------------|
| Equilibrium Price US\$/TEU | 59 | 59 | 44 |
| Market share | 33 | 24 | 43 |
| Profit (in millions of US\$) | 2.9 | 2.2 | 2.9 |
| <i>Total demand in 1000s of TEUs</i> | 197.3 | | |
| <i>Logsum</i> | 1.34 | | |

Table 5.6: Case D: Bertrand equilibrium (when players 2 & 3 are cooperating)

| | <i>Player 1</i> | <i>Player 2</i> | <i>Player 3</i> |
|--------------------------------------|-----------------|-----------------|-----------------|
| Equilibrium Price US\$/TEU | 49 | 56 | 52 |
| Market share | 46 | 25 | 28 |
| Profit (in millions of US\$) | 3.3 | 2.1 | 2.3 |
| <i>Total demand in 1000s of TEUs</i> | 197.5 | | |
| <i>Logsum</i> | 1.22 | | |

Analysis of the stability of the coalitions

If all players in a game decide to work together, this raises the question of how to divide the total profit. The literature has discussed several different answers to this question (see Peleg, 2003; Friedman, 1977; Suijs, 2000; Curiel, 1997; Straffin, 1993), the most prominent of which are 'core' and 'Shapley value'. The present paper uses the concept of core to analyse the situation. Core, proposed by Gillies (1953), is a generalisation of Edgworth's 'contract curve' and consists of those payoff vectors that are, in a specific sense, acceptable to all players (Friedmann, 1977).

The core rests upon the idea of an 'imputation'. An imputation satisfies both 'individual rationality' and 'collective rationality' (Shubik, 1968). The formal definitions of these terms, as given by Song and Panayides (2002), are as follows:

Let U be an n -person game in characteristic function form with players $P = (p_1, p_2, \dots, p_n)$. An n -tuple (x_1, x_2, \dots, x_n) of real numbers is said to be an imputation if both of the following conditions hold:

Individual rationality:

$$x_i \geq U(p_i) \quad i = 1, 2, \dots, n \quad (33)$$

The above equation indicates that each agent is only willing to participate in the coalition if it pays him at least as much as he can obtain on his own.

Collective rationality:

$$\sum_{i=1}^n x_i = U(P) \quad (34)$$

Equation (34) states that the sum of payoffs of a group of n -players is equal to the value that is guaranteed by the characteristic function.

Any payoff vector that satisfies equations (33) and (34) is deemed to be an imputation. The imputation can be thought of as a possible social arrangement that satisfies minimal conditions of rationality. Presumably, any ultimate arrangement will be drawn from the set of imputations. However, one drawback of sets of imputations could itself be quite large. Therefore, 'coalition rationality' can be argued to be a natural extension of the conditions of individual and collective rationality. Coalition rationality requires that the security level of every coalition defined by characteristic function be satisfied, formally:

$$\sum_{p_i \in C} x_i \geq U(C) \quad \text{for all } C \text{ in } P \quad (35)$$

where C denotes all possible coalitions formed by a sub-set of the n players. For example, C may stand for the coalition (p_1, p_2) , or (p_1, p_2, p_3) .

The core is made up of the set of imputations that satisfies the conditions of the coalition rationality. The rationale behind condition (35) is as follows. Suppose that a coalition, C , forms and attempts to divide the value assigned to C by the characteristic function. Further, suppose that a sub-group of C , say C_1 , is offered a payoff less than what C_1 is worth according to the characteristic function. In this case, C_1 would not accept the offer, since it can do better without the remaining members of C . Thus, in order for C_1 to remain in the coalition it should receive at least as much as $U(C_1)$. If this argument is extended to all possible conditions, then the condition of coalition rationality is required (Song and Panayides, 2002).

In order to analyse the stability of the coalitions, Tables 7 and 8 show both the individual profit and the joint profit of all three players in all cases. The results show that the individual and joint profits of all players are high in each coalition. This satisfies the condition of coalition rationality; that is, equation 35.

It is more profitable for player 1 to establish a coalition with player 2 than with player 3 because the individual profit is higher. However, the joint profit (5.4) of establishing a coalition with player 3 is higher than doing so with player 2. Therefore, player 1 can negotiate with player 3 to give it at least 2.9 (the same profit it can gain by cooperating with player 2) instead of 2.7. Such a situation would also be beneficial for player 3 because it would receive 2.5 as individual profit. If player 3 established a coalition with player 2, it would receive an individual profit of 2.3.

However, it is better for player 2 (a small truck-operating company) to establish a coalition with player 1 (a large truck-operating company) than with player 3 (a ship-operating company). This is because both the individual and joint profits of establishing a coalition with player 1 are higher than a situation in which player 2 forms a coalition with player 3. The interesting point is that player 2 receives the highest profit (2.8) when players 1 and 3 establish a coalition. Therefore, the formation of a coalition between players 1 and 3 is not only beneficial for these players, but also generates higher profit for an outsider that is not a part of this cooperation (player 2).

Table 5.7: Profit of players for different combinations of coalitions (in millions of US\$)

| <i>Profit (in millions of US\$)</i> | Player 1 | Player 2 | Player 3 | Combined profit of all players |
|---|----------|----------|----------|--------------------------------|
| Case A: All players are independent | 2.3 | 1.8 | 1.8 | 5.9 |
| Case B: (1+3) and Player 2 is independent | 2.7 | 2.8 | 2.7 | 8.2 |
| Case C: (1+2) and Player 3 is independent | 2.9 | 2.2 | 2.9 | 8 |
| Case D: (2+3) and Player 1 is independent | 3.3 | 2.1 | 2.3 | 7.7 |

Table 5.8: Joint profits of players that have formed a coalition (in millions of US\$)

| | <i>Joint profit after coalition</i> | <i>Joint profit before coalition</i> |
|---------------|-------------------------------------|--------------------------------------|
| Players 1 & 3 | 5.4 | 4.1 |
| Players 1 & 2 | 5.1 | 4.1 |
| Players 2 & 3 | 4.4 | 3.6 |

Users' surplus

In addition to profit, which is the payoff for freight forwarders, the situation can be analysed from the users' perspective. The 'rule of the half' is used to estimate the users' benefits. In this method, a change in users' surplus is estimated as being changes in the generalised costs multiplied by the average demand before and after the formation of a coalition, as shown in Equation (36):

$$US = \frac{1}{2}(GC_i - GC_0).(X_i + X_0) \quad (36)$$

where US = users' surplus; GC_0 = generalised costs before coalition i . $i = B, C, D, E.$
 GC_i = generalised costs after formation of a coalition i . $i = B, C, D, E.$
 X_0 = demand before formation of a coalition i . $i = B, C, D, E.$
 X_i = demand after formation of a coalition i . $i = B, C, D, E.$

However, this analysis contains changes in the generalised costs, both for truck and ship users. Accordingly, an alternative method of estimating the user's surplus has been applied, based on the well known property of the logit model. As noted by de la Barra (1989), amongst others, changes in the logsum of the logit model are conceptually equivalent to the traditional user's surplus indicator shown in (36). Therefore, (36) can be written as follows in equation (37):

$$US = \frac{1}{2}(X_i + X_0) \cdot \frac{1}{b}(LS_i - LS_0) \quad (37)$$

where LS_0 = logsum of the logit model before formation of a coalition i . $i = B, C, D, E.$
 LS_1 = logsum after formation of a coalition i . $i = B, C, D, E.$
 b = the model parameter for user's cost.

Table 9 presents the calculated users' surplus in all three coalitions. In all coalitions, the users' surplus is negative. Therefore, the formation of any kind of coalition among freight forwarders is not beneficial for users.

Table 5.9: Users' surplus for all the coalitions (in thousands of US\$)

| <i>Coalitions</i> | <i>Users' surplus</i> |
|---|-----------------------|
| Case B: (1+3) and Player 2 is independent | - 2138 |
| Case C: (1+2) and Player 3 is independent | - 2374 |
| Case D: (2+3) and Player 1 is independent | -1900 |

Conclusion and policy implications

This paper has analysed four cases for three freight forwarders with two different means of transportation. In the first case, all players work independently and the numerical analysis obtained by solving the Bertrand model reveals that the Nash equilibrium prices are higher for players 1 and 2 –freight forwarders with their own trucks. However, despite the high price, player 1 captures the largest market share. This reflects users' preference to trucks over ship to carry their cargo, even though ships are cheaper. This could be due to the fact that trucks offer a flexible service with low waiting time. However, the frequency of ships is lower and waiting time is high. Moreover, although player 2 is also a freight forwarding company with its own truck, it is a small company that simply cannot offer services with the same high frequency as a large truck-operating company.

The next three cases discussed different combination of coalitions among these players. A two-stage game was applied for the purpose of analysis. In the first stage, the three players had to decide whether to act alone or to enter into a coalition with another player. The decision at this stage should presumably be based on the predicted outcome for the second stage. Here, the second stage is modelled as a Bertrand game, with one outside competitor and the coalition. The numerical results reveal that all three kinds of coalitions generate higher profits for the members of the coalitions, as well as for outsiders in each case. The reason for the high profit is the high Nash equilibrium prices that players are able to charge from their users due to the creation of a duopoly after the establishment of a coalition among any two players.

Although all combination of coalitions result in higher profit for the players involved. However, the combined profit of the members of coalition, as well as outsiders, is highest in a situation when players 1 and 3 cooperate and offer intermodal services to their users. Due to market power and improved quality of service, these players are able to charge higher prices. Therefore, according to these findings, it is more beneficial to establish a vertical cooperation between a large truck operator and a ship operator to offer intermodal services than to establish a horizontal cooperation between two players. Moreover, establishing vertical cooperation among a small trucking company and a ship operator is also not as beneficial as the previously mentioned vertical cooperation.

However, calculations of users' surplus show that these kinds of coalitions are not beneficial for users because they generate a negative payoff for them, which reflects the high prices they will have to pay to the service providers.

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6. Empirical Research Methodology

The research will use case studies as the main method. The cases will consist of observed customer and agent initiated intermodal transport chain initiatives in the first place, but also potential chains with good conditions for development will be studied.

The research method that will be used in eliciting how the Norwegian case firms adapt to intermodal transportation will be done by means of case study research. The main issue here will be to consider any obstacles that will hinder the use of intermodal transportation, or the structures and mechanisms that may determine the use of specific transport modes. The focus here will be on the relationships between various characteristics of the firms in question, the characteristics of various transport modes at hand and how transportation needs can be met and obstacles avoided. In the following, a methodology that can be used for approaching these issues is presented.

The 'realist approach' seeks to analyse how and why a phenomenon takes place, by means of the underlying structures and mechanisms that can establish a contingent relation between events (coordinating efforts, changes in the transport systems) and causes (e.g. changes in the use of the transport modes). The causal link between events and causes can be explained by a set of underlying structures and mechanisms. A structure can be defined as the composition of the object to be studied. For simplicity, the object can be termed X (see Fig. 2). In this case, X represents the existing transport system. The structure of the system can be described by the characteristics of the different transport system designs that are relevant for understanding how a change in X may affect local industry's use of the modes. Such characteristics are connected to e.g. departure frequencies for the existing transport services, fuel costs, travel times et cetera. The mechanisms describe how a change in X can determine the causal powers and liabilities that is relevant to the analysis. A causal power may in this sense be interpreted as one factor that can enhance the propensity for firms in the area to increase the use of intermodal transportation, and in turn increase the service quality of the transport system. A liability may e.g. be increased competition from road transport because of the possible threat from the new intermodal system. A change in the infrastructure, vessel types or rolling stock will mechanically change the transport costs directly. This change, expressed by the value of travel time change and the changes in payable transport costs, lead time variance etc, represents causal powers that may trigger off development of intermodal transportation beyond a "critical mass" point, as seen in Figure 1.

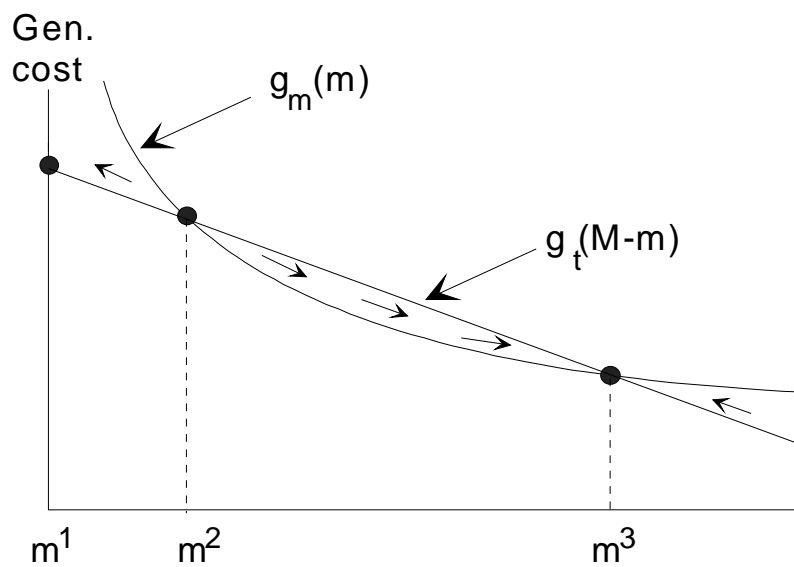


Figure 6.1: Simplified picture of the choice between road transport and intermodal transport (Sunde 2002)

- Straight line: Road transport (RT) costs, x-axis for RT volume running from right to left, costs increasing because of congestion
- Curved line: Intermodal transport (IT) costs, x-axis for MT volume running from left to right, decreasing costs because of scale effects
- m^1 : Road transport only
- m^2 : 'Critical mass' point, minimum use of multi-modal transport
- m^3 : Stable mix of road transport and multi-modal transport

Here, any increase in the use of intermodal transportation (IT) beyond m^2 would increase the IT because of cost advantages. Some of the challenges of getting to m^2 and beyond (i.e. to the right in Figure 1, m^2+) are discussed below. The obstacles which may hinder m^2+ is the main target for this case study.

Figure 6.2 shows schematically the links between objects, causal powers and liabilities, conditions and events.

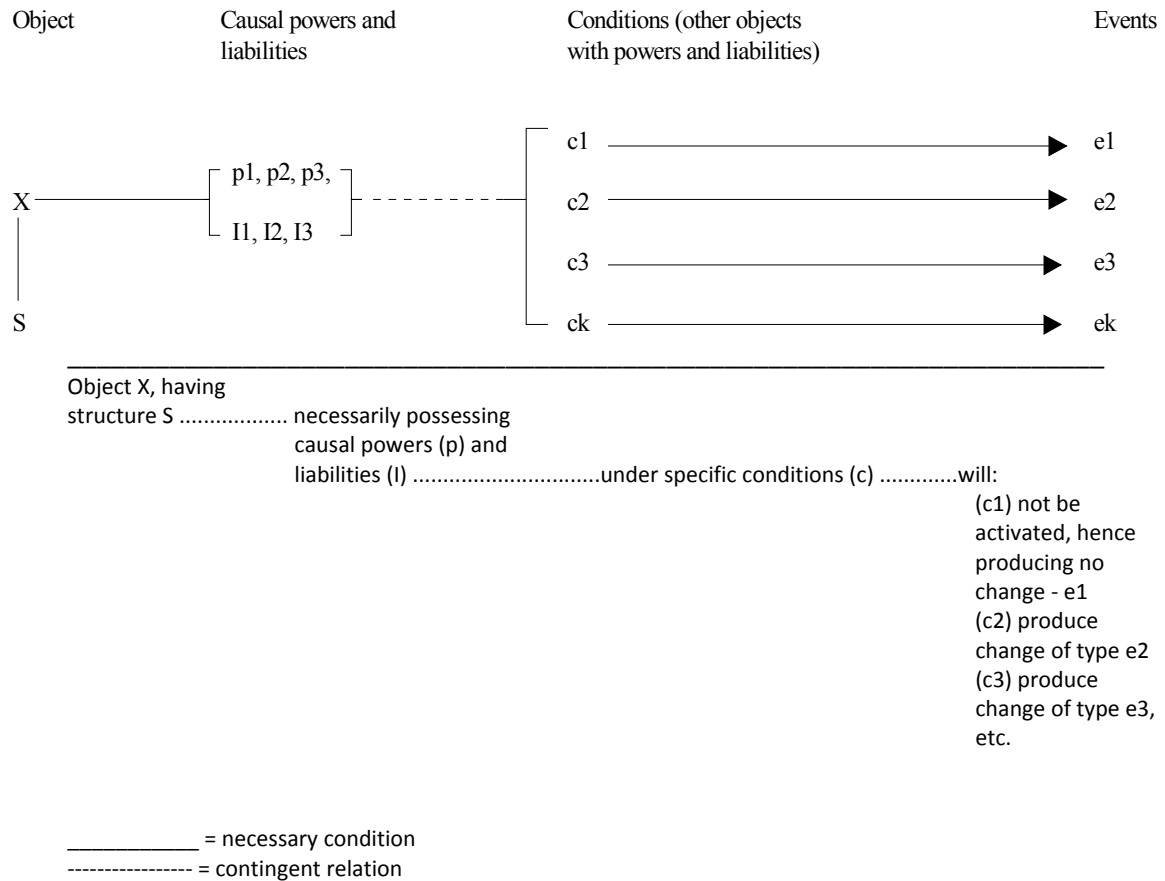


Figure 6.2 The structures of causal explanation. (Source: Sayer 1992)

Changes in X can be considered as changes in transport infrastructure with matching causal powers and liabilities, for instance reduced transport time, increased competition from road transport etc. which may or may not trigger off events (for instance increase or decrease in the use of intermodal transport). These events depend on to what extent conditions like for instance possibilities for coordinating cargo flows to get beyond m2 in Figure 1 are present. Hence, depending on conditions, the operation of the same mechanism (like a frequent sea or rail service) can produce quite different results, or alternatively, different mechanisms may produce the same result.

Structures and mechanisms as underlying conditions are perceived as necessary for the phenomenon to take place. But they may not be sufficient i.e. the same structures and mechanisms may or may not lead to the actual events. This means that certain conditions have to be fulfilled. When studying the relationship between intermodal transport improvements and coordinating efforts, there are reasons to expect that certain characteristics of the local industrial milieu constitute important prerequisites for growth in the use of intermodal transport

In the realist approach, an observable phenomenon is considered as a result of a combination of underlying structures and mechanisms and what can be termed contextual specific matters. To ask for the cause of something is to ask ‘what makes it happen’, what ‘produces’, ‘generates’, ‘creates’ or ‘determines’ it or, more weakly, what ‘enables’ or ‘leads to’ it (Sayer 1992). In this context, the concern is to identify the conditions that may

trigger off a growth in the use of intermodal transport beyond m2 (Figure 1). An important consideration here will be to design the study in accordance with the theoretical models that will be developed as briefly described in section 4.2 below.

The theoretical models may provide a theoretical framework for an empirical survey-type of study amongst agents in the freight transport market. Such a study has previously been carried out by Hervik and Rekdal (2001). A survey-type of study may confirm or reject some of the propositions put forward in the theoretical literature, but it may also reveal issues that are not considered in the (more or less stylized) theoretical models. Thus, a survey-type of study may provide a valuable test of the (propositions put forward in the) theoretical models, but also give impetus to the development of new theories and models. As such, a survey-type of study is complementary to the theoretical models. The tool for doing the empirical research part on Norwegian firms to gain a thorough understanding of the structures and mechanisms that would affect the use of intermodal transportation will be case study research method applied from Yin (2003). Because of the complexity in the nature of the research problem, the survey data collection has been carried out by means of in-depth personal interviews.

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7. Findings from the case study

Introduction

The main aim with the case study interviews is to research whether it is possible to identify information asymmetries that can hamper the development of intermodal transport solutions, in the sense that even if sufficient cargo volumes are present, the involved parties do not signal sufficient willingness to pay to set up or develop a customer- or agent initiated intermodal transport solutions.

We have done in-depth interviews with 6 stakeholders that either have implemented an intermodal solution, or that are in the process of setting up one. Two of the stakeholders have also been involved in attempts earlier to set up intermodal solutions, attempts that did fail at the time. Since there are business models and company information involved, the transcripts in Appendix 1 are kept anonymous. For obvious reasons, we have therefore also chosen not to reveal detailed publicly available information about the respondents. They can shortly be described like this:

- A consolidator which uses intermodal transport on a general basis.
- An intermodal transport company
- A consolidator and 3 PL company
- A durable consumer goods manufacturer
- A public sector moderator
- A bulk product manufacturer

The case study interviews have been done in light of the research questions for this part of the project, listed in Chapter 3. The main theoretical basis is non-cooperative game theory, as described in Chapter 5.1. The case study aims at identifying whether there are traces of information asymmetry that can influence customer- and agent-initiated transport chains. The approach is as described in Chapter 6; to see if the object (intermodal transport) has an inherent structure (freight volumes, structure of transport companies and consolidators, mindsets) that, depending on the conditions (like actions taken by agents, customers and moderators) can be able to establish and develop such intermodal solutions, or not.

The non-cooperative game theory approach is also relevant for this discussion, with its focus on the inherent structure of the transport industry itself. As is well known from the literature, market concentration can in itself entail a cost increase which may influence the choice of transport solutions. There may also be issues on the infrastructure provision side (market power, charging of the use of infrastructure, location of ports and terminals) that may have an effect on mode choice. Albeit important, the Norwegian part of the study does not thoroughly address the structure of the freight transport industry and how this may impact intermodal transport systems.

Propositions

The following three simple propositions give the directions for presenting the findings:

P1: The customers (cargo owners) play the most important role in deciding upon whether intermodal transport should be used. A moderator is a necessary but not a decisive factor.

P2: Transport costs are the main issue when selecting intermodal instead of uni-modal transport.

P3: Information about cargo volumes and transport needs (capacity, frequency) between customers is important when setting up customer-initiated transport chains.

Findings

Customer initiated intermodal transport chains

The first case is a public sector moderator that works as a facilitator for a customer initiated transport chain. There are customer initiated intermodal transport chains currently under establishment in Mid Norway, with this public sector moderator involved in one of the projects. A limited number of cargo owners with highly complementary products are the main stakeholders.

In essence, today in this case the outbound transport (which is less compatible with the nature of inbound transports) is made by trucks on a more or less daily basis. The lead time of the new service is claimed to be shorter to main markets than by truck, but the plan is one weekly departure. Even with a slightly longer lead time, this may not cause problems because the perishable products need a certain amount of time for fermenting. Flexibility may still be an issue. However, the idea is that it is going to be a complement to road transport, in the area of at least 30 to 40 %. There has been made efforts from the Moderator to coordinate with an European port also for return cargo. There is a need for a significant initial investment in port facilities.

The most interesting point is perhaps the change of mindset that appears to have taken place as a result of the efforts from the public sector moderator. There are a smaller number of cargo owners that cooperate for the intermodal transport solution, and the breakthrough has been claimed to be the increased willingness to share information about what volumes that will be available for an intermodal solution. Another interesting point is that the cargo owners are less willing to commit themselves by means of binding contracts. They claim that they still want to have the possibility to adapt to the most efficient logistics solution that is available. So it is still a bit unclear what this can entail in terms of making the necessary commitments. On the other hand, it is claimed that existing vessels can be used for the short sea part of the service. This means that the initial investments connected to tailor-made vessels are modest.

There was an earlier attempt to start a customer initiated Ro-Pax connection from this region, carrying both passengers and goods. It was supposed to be only once a week at the outset with possible increase in frequency. There are many reasons why it failed, one claimed reason being that there was too strong attention towards public and EU funding, and less to the market factors, including needs for commitment and cooperation.

Another case in this study of customer initiated transport chain is of the more conventional type, with large bulk volumes to foreign markets, and where the economies of scale in sea transport is the dominant factor. There is a long-term contract with the shipowner to ensure that there is sufficient capacity.

An earlier attempt to coordinate an intermodal solution with other large customers with special emphasis on return freight was launched some time ago. The bulk manufacturer participated in the development of the project until it was commercially mature, when a shipping line took over. They did not continue with it as planned, mainly because it was very challenging to combine industry goods with other goods. These goods need to have fixed delivery schedules, while industry goods are often exposed to production delays, resulting in a conflict of interest. This makes the other goods shippers seek other more reliable solutions that do not cause delays.

In the end the shipping line settled for a weekly schedule and in addition to bulk goods the terminal handles goods for a number of different freight owners. Some of these freight owners were also part of the initial project. However, because it took too long from project initiation to establishing the weekly schedule, much of the original synergy were lost, which means that the service has become more like an ordinary shipping line and not a dedicated customer-initiated solution.

A third case is represented by a manufacturer of durable consumer goods. They use a consolidator to ship finished goods to consolidation points for overseas export. This service is an example of where a shipping line calls at the company's own facilities. The nearby small-sized (in international terms) container port is too expensive to use for them, also in terms of the costs of road feeder services. They do not cooperate with their competing manufacturing companies in the area. One reason may be that this demands too much supply chain alignments in terms of production plans and compatible markets. This case cannot be characterized as a customer-initiated transport chain.

When it comes to customer-initiated solutions, all 3 propositions are supported. A public sector moderator seems to have played a crucial role in the first case, in terms of (a) getting information about volumes, (b) setting up communication with foreign ports also with the purpose of getting suitable return cargo. We can perhaps draw a tentative conclusion that the moderator has had a necessary but not sufficient role in making this intermodal solution available. In the second case, momentum was lost when the consortium of customers handed the responsibility over to the shipping line. It has not been possible to elicit whether this transfer were premature in the sense that binding commitment was not in place. However the common denominator behind an intermodal success boils down to competitive total logistics costs, including departure frequency and flexibility. Lack of factors like market size and available infrastructure can hardly be compensated.

Agent initiated intermodal transport chains

One of the cases represented a large operator with consolidation from terminals with connections to all transport modes. In relation to the theoretical framework, we are not able to identify anything but continuous efforts to exploit economies of scale and scope of intermodal transport services and to offer these services to their customers. They are e.g. using combinations of load carrier units to exploit these effects. The consolidator is an extensive user of rail freight services, and the scarcity of available slots for rail transport at

the main terminal at Alnabru are claimed as one main obstacle for increased use of intermodal transport. An issue connected to lead time risk and flexibility is connected to the lack of facilities for shifting the load between carriers if something happens along the railway. Another rather well-known issue is connected to railway capacity and the perceived lack of flexibility, due to e.g. lack of double tracks or points for train passing. There are not many efforts made to develop common systems or equipment to reduce development costs. In some cases, one obstacle is the anti-trust legislation.

The second respondent from the agents (an intermodal transport company) claimed that there are two groups that should be involved to increase the use of intermodal transport: 1) the freight forwarders and 2) the freight owners as customers of the forwarders. Both these are large enough in total and with a cargo volume large enough to justify their own and specific intermodal solutions directly from intermodal companies, and the smaller players will have to use the forwarder in any case. The second "agent" respondent claimed that there is a need to work with both these stakeholders, because if the freight owner accepts an intermodal solution and makes this known to the forwarder, the forwarder in turn may become more interested in seeking and offering such solutions. The respondent was also concerned with the fact that it should be a potential for better planning of procurement and coordination of transport flows, which could facilitate intermodal transport.

We were not able to trace any significant information asymmetries in these two cases. They seem to be well aware of the cost structure of various modes, and also of their customer's preferences. The lack of supply chain alignments was claimed to be a hindrance for intermodal transportation. The first respondent focused on this issue along the transportation chain, whereas the second respondent also focused on the need for alignment in their customers' supply chains, like coordination of purchasing and also to take the geographical location of their suppliers into consideration, to build volumes.

The third respondent from the agents appears as a bit different. It acts as a consolidator who is co-located with a medium-sized port. Their competitive advantage lies in the ability to coordinate sea-, rail- and road transport directly, being physically located at a small-scale intermodal node. In addition, they are able to provide various kinds of third party logistics services (3 PL), like warehousing and container storage. They are working with linkages to short sea shipping lines. One of their businesses is to tailor intermodal transport to the needs of their larger customers, with which they worked extensively. This tailoring appeared to include also 3 PL services other than directly transport-related issues. It can well be that this is a higher degree of customization than the other consolidators and intermodal transport companies are currently offering. It may also be that a larger product variety in transport and logistics services can make it easier to reap their customers' willingness to pay for these kinds of services and at the same time exploit their own scale and scope effects in their production (by e.g. converting inactive port areas to 3 PL facilities).

To summarize, proposition 1 appears to be partly supported in cases of agent initiated transport chains. The customers (cargo owners) appears to have a less important role in deciding upon whether intermodal transport should be used in typical cases where agents are used by many smaller customers. The agent is the main decision maker, and acts as the focal firm in the intermodal supply chain. Proposition 2 is supported. As a point of departure transport costs are the main issue when selecting intermodal instead of uni-modal transport for this segment as well. However 3 PL services can extend product variety

in the intermodal transport chain and hence create a kind of “strategic distance” towards more standardized intermodal solutions. Hence, one could anticipate that a bit more expensive intermodal transport chains could be competitive after all, if 3 PL services that suit the customer’s supply chains are included.

8. Appendix 1: Case study interviews

All interviews were done by Svein Bråthen, Jan Husdal and Edith Sorkina

Case 1: Large Consolidator

Respondent: You are always marked by the world you have lived and worked in. I have worked with transportation since I started working. I am very concerned with traffic operations and logistics. XX and Linjegods began using intermodal transport just before the new millennium, but this has seen a significant development in recent years. Today, more or less ALL transportation in XX is intermodal. Other shippers that also do intermodal are B and Bring.

We are serving the business market exclusively; orders from private persons are not accepted (too much paperwork, possible issues with collecting payment, too many low-value shipments etc.). Our customers are mainly wholesalers and manufacturers, and we feel as responsible as if we were a direct part of their supply chain, and it has become very challenging to meet their demands as to delivery quality and delivery price. Price: Since Norway is a high-cost country, price is very import. Quality: We always work on a next-day delivery basis, i.e. if we collect/receive goods on day 0, we promise to deliver it on day 1. Consequently, many of our customers have relinquished their warehouses and rely on us in on-time delivery. Many people are perhaps unaware of this and don't realize how challenging logistics is in Norway.

Businesses are much more dependent on transportation and logistics than many politicians (and decision-makers) who are promoting intermodal (green) transportation are aware of. Intermodal transport does not change the customers' demands as to price and quality (reliability). That is why I earlier this year said that we would stop using the railway between Oslo and Bergen because it was too unreliable. All goods is on the same one train, having a next-day delivery promise, regardless of whether it is toilet paper or medicines, and if there is a problem with the railway, while there is a system in place to take care of the stranded passengers, there is no such system for goods. The goods is simply taken back to the point of origin and the shippers must sort the issue out themselves, making it very hard to fulfil the next-day delivery. The biggest problem is that there are no places to transfer goods from rail back to road between Oslo and Bergen or Oslo and Trondheim in case of a railway disruption. We simply have to wait until the wagons are taken back to where they were sent from and it is only then that we can start finding other ways to bring the goods to its destination.

During one month (earlier this year) we had two major disruptions and over a year we have had four or five incidents, leading to a significant increase in costs, which is why XX must consider its transportation options and in hindsight, considering the costs of disruptions, using unimodal transport (road) may come down as the cheapest and most reliable option overall. The reason: large volumes are split into smaller units, each having many options for getting from A to B. Interestingly, during the last closure of the railway from Oslo to Bergen we managed to deliver our shipments on time and according to schedule, using road transport. Perhaps it would be an idea to use road transport for rush deliveries (that cannot tolerate delays), while rail can be used for all remaining shipments, which are not as urgent. This is perhaps how intermodal transport should be used. While there are seven freight trains per day between Oslo and Bergen there are only three passenger trains (*Note: four passenger trains if you count in an overnight train*). None theless, passenger disruptions are given priority over freight disruptions.

Interviewer: What are your contracts with the railway operator?

Respondent: "Force majeure", in other words, it's our problem, not theirs'.

Interviewer: So even if the cause can be related to lack of maintenance, it is "force majeure"?

Respondent: Well, yes. I mean, why does a wagon derail? We had a case some two years ago where the soil under the railway tracks gave in, resulting in a derailment of a wagon and our shipment with YY products. While we have a contract with X and have settled our issues, there is still an ongoing

case between CargoNet as the operator and Jernbaneverket (JBV) as the railway owner as to what was the cause of the derailment. Situations like this are an obstacle for intermodal transport.

(... about rail). It is difficult to work with JBV. Norwegian shippers in general, have been very keen on developing intermodal solutions, but JBV hasn't followed suit. (...more on rail). If it were not for our confidence in our abilities or if we did not have Z's support and equipment we would not have been able to apply for the tender.

Interviewer: So Z's equipment can be used in Norway?

Respondent: Yes, if it is approved for use in Norway. Although it may be approved within Europe, this does not mean that it is approved for use in Norway. Vice versa, Norwegian equipment is normally approved in the rest of Europe, but not the other way round.

In 1996 the old Norwegian State Railways (NSB) were split into the new operating company NSB, the infrastructure company JBV (Norwegian National Rail Administration) and the supervising authority JBT (Norwegian Railway Inspectorate). The freight division of NSB became known as CargoNet. While CargoNet by definition is a competitor to XX in the freight market, they also operate and even own the Alnabru cargo terminal. In fact, they own 27 of the 30 tracks available, thus only allowing competition to take place on the three "free" tracks that every other operator has to compete for. So when JBV is allotting our slots, it is based on those three tracks.

Interviewer: So there is a historical reason why CargoNet owns 27 tracks? And this is not an easy matter to solve (in order to open up for more competition), is it?

Respondent: No, and it is a particular challenge and hindrance in developing more intermodal solutions.

Interviewer: What about the development plans for Alnabru? How far are they from being completed?

Respondent: After three years of planning, the process is currently on hold, with no solution in sight. This is a dramatic setback for the development of intermodal solutions, because the terminals are the key. The terminals are more than just a terminal, they are cargo hubs and they include repair and maintenance shops, possibilities for cross-docking and re-shuffling of trains. A cargo terminal is much more than an in-out train station.

Interviewer: How about Bergen and Trondheim?

Respondent: Bergen serves the same function as Oslo, but on a smaller scale. There is an ongoing discussion about where a new terminal should be built, and laying a new track and building it near the airport would be the best solution. However, because this is too expensive, current plans call for an expansion in the city centre, where there is very little space to do this. That too is an issue that we have to consider when planning to increase intermodal services. The space we were offered was much smaller than we need, meaning that we would need two terminals to effectively serve both rail/road and sea/road, which would increase our costs more than necessary.

Interviewer: Co-location of transport modes is the key to intermodal transport?

Respondent: Yes, definitely. In Stavanger, the cargo terminal was moved to Ganddal and we followed. Similarly, if the rail cargo terminal in Bergen is moved to either Flesland or Arna we will move, too, because we have to be where the rail cargo terminal is, but we also expect that the terminal is arranged in such a way (with enough space) that we can use it effectively. While the terminal operator does the best he can, very little thought is given to future expansion and capacity increases, mainly due to lack of funds.

Interviewer: So Oslo is a major bottleneck?

Respondent: Yes, Oslo is indeed the key to creating effective services. Mind you, XX also operates internationally. There are about YYY trucks carrying both mixed cargo and wholesale cargo and operated by XX arriving in Norway and Oslo every week, not all of which pass through the terminal, but many.

In Norway, rail transport is cheap compared to Europe, and cheaper than road transport. In Europe it is the other way round, road is more expensive than rail. That is why there is little goods to and from Europe by rail.

Interviewer: So rail is a major transport mode?

Respondent: yes. 60-70% of all goods that leaves Alnabru does so by rail.

Interviewer: Now, let's assume that prices change (perhaps due to government incentives/regulations) and road transport becomes much more expensive in Norway, would you have enough flexibility to increase rail transport?

Respondent: Yes, we would have no problems, provided that there is enough rail transport capacity. In order to keep up with next-day delivery we need to have capacity in late afternoon and in the evening. That capacity depends on the number of trains that can be sent in either direction, which in turn depends on the number (and length) of crossing points along the track. (more on rail capacity)

Respondent: Well, it should not be a capacity problem. There is enough track space, but maybe not when we need it. Ideally we need a double track railway line (which we don't have), so the big issue are the crossing points, which determine when trains can meet at what length. Keeping the time schedule is thus imperative. If one leaves Alnabru, say, only 5 minutes late, it is practically impossible to catch up again, and one may have to wait for an hour or more at the next possible crossing point. Building more or extending of the existing crossing points could solve some of these issues. Many crossing points are designed for passenger trains mainly and are too short for freight trains. For instance between Oslo and Stavanger there are hardly any crossing points between Kristiansand and Stavanger (235km). The track incline is another issue: For example, while one can carry 1000 tons to Stavanger, going back one can only carry 800tons, because of a 3k long steep incline, meaning that the train will have 200t of empty wagons. One could use a second locomotive for extra pulling power, but that would be very costly.

Interviewer: Would it be possible to run shorter and more frequent trains?

Respondent: No, not really. CargoNet say that they have capacity, but not in the afternoon, which is when we need it.

This has perhaps been a very general perspective, but it goes to show all that affects the intermodal transportation, which we are a keen supporter of, and which we strive to implement as best we can.

Interviewer: For us it is important to understand bottlenecks and hindrances. Have you in recent time undertaken a project where you have worked with particular customers in order to implement a specifically designed solution or are most solutions covered by what you offer otherwise?

Respondent: We always try to transport as much as possible by rail, because that is what makes us competitive. Earlier this year we signed on a large customer, XXX. We deliver all their goods from their suppliers to their N distribution centers in Norway. Most of this is done by rail, in addition to semi-trailers and containers. Many of our large customers state explicitly that they want to use rail for environmental reasons. That said, when push comes to shove, what matters most is price and quality, and in some case road wins over rail. B, one of our other customers, buys most of their fruit and vegetables in Spain, most of which arrives in Norway by road, like it or not, mainly because perishables need to be delivered as soon as possible and cannot wait for consolidation with other goods. Price and quality is what matters.

Most of Northern Norway is distributed via Z, with delivery distances of up to 4-500kms. Here, the most common return freight is fish or other agricultural products. An ideal case would be a 25,25 LHV (semi-trailer and container) leaving A for B today carrying mixed goods. After B the empty containers are shipped to C, where we load paper destined for D. In many cases we will use a thermo container or a thermo semi-trailer and a regular container. Loading a thermo container with paper may seem strange, but this way we can use that semi-trailer for carrying perishable goods from D to E. The semi is sent by rail to D, where a truck takes it to F for delivery in the morning, continues on to G, loads fish for return to, say, Paris, and needs to make it back to D in time for the train departure at 1am. From Oslo the fish container then goes by road to Paris, because the European train system is too unreliable. From Paris the thermo semi may then go to the Netherlands, taking fruit or vegetables back to Oslo, coming full circle. Usually this plays well, but it doesn't take many delays en route before the schedule is impossible to keep. Having said that, I believe that many European shippers are impressed with this system of tight schedules and combined use of different load carriers.

Interviewer: What happens if the truck does not make it in time for the train in D? Do you drive all the way to Oslo?

Respondent: Yes. That is the only alternative. However, in order to keep the schedule, this requires three drivers, which can be costly, but as I said, it is the only option today.

Interviewer: I can see that there is a lot of combined loads and load carriers here.

Respondent: Yes, this is for flexibility, as we can never really know what the next order brings. That is why we prefer 25,25 trucks, although not everyone in Norway approves of this. I say that it is an established system that fits very well with intermodality, because we use a semi that can be used in both rail and road and we use a container that can be used in both rail and road transport. By using this to the full we can explore many new opportunities. That is why most if not all transport by XX is now based on this principle and we now have some XXX of these so-called P400 semi-trailers that can be transported by rail.

Interviewer: How do you calculate the prices? Is there a fixed price list or is it based on a case-by-case negotiation with the customer?

Respondent: All prices are based on negotiations with the customer. Some are based per weight unit (tons or kilograms), or per volume unit (m³), some are based per pallet. It is then our responsibility to fill the truck/container with as many pallets or as many tons as possible in order to utilize the capacity to the full, and if necessary, we will consolidate loads. That is how we are able to offer competitive prices.

Interviewer: So even if you have to consolidate loads, you still stick to the next-day delivery promise?

Respondent: Yes. In accordance with our delivery guidelines, 9X% of our mixed cargo is supposed to be delivered the next day. However, there are variants of "next day", because some customers demand delivery before 12 or before 10 etc., and in our negotiations we may then have to adjust (increase) our prices because we cannot use a full truckload if the delivery has to be at or before a certain time. The agreed delivery time is the key here. We are very aware of that the customer (company) has based its production or sales on our delivery reliability, and we try to meet the customer's requirements as best we can. After all, you as the consumer expect your local grocer to have what you are looking for, and will likely not return to a store if you are met by empty shelves because the goods didn't arrive on time. When I was working with A we were responsible for delivering the major newspapers (...) in the entire C county. The newspapers were transferred electronically from the desk in Oslo to the printer in X, where we picked them up for delivery at 4am. This may seem like an easy task, but it was perhaps the most challenging we were doing at that time. If you expect to buy your newspaper when you have lunch, and it isn't there, then you complain to the newsvendor, who complains to the delivery truck, who in turn complains to the pick-up truck. Every link in the chain is important. A lost newspaper sale may seem insignificant, but if you add many enough it becomes significant. In the end it is our reputation as a reliable transportation company that is at stake.

Interviewer: How has your business changed during the last 10 years?

Respondent: There is now a stronger focus on Just-in-time than before. There is also a strong focus on price and being number one matters; there are no prizes for being second best. This means that we must seek every measure for maximizing the utilization of our equipment; we don't make money by wasting space in container. Intermodal transport helps. Another development has been IT, in particular trace and track, where the customer can see where his shipment is at any time. For instance, we track all our thermo containers and thermo semitrailers, and I can check their whereabouts any time on the Internet.

Interviewer: Will that also assist in dealing with, say, late deliveries? At least the customer knows where his shipment is, even if it may be delayed?

Respondent: Yes. That is something we think about. Many customers say that "if we had known you were one or two hours late we could have planned accordingly". So being proactive when it comes to notifying customers of delays is important. We are notified if a train is late, and we can then check whether there are important or urgent shipments on that train and let the customer know. More often than not, however, the customer experiences a delay before we are able to give a notice, but we are trying to improve our customer service here. It is our job to call the customer, not vice versa. This is very important when dealing with large customers. By being proactive we can let the customer know of any problems and together we can try to work out a solution. Perhaps the goods can wait or perhaps the customer has trucks that can assist us? If we can work out solutions like that, that is where we want to be. Customer relations management is very important in intermodal transportation solutions.

One example of how important track and trace are is insulin. Insulin needs to be transported above zero temperature or it will turn into poison and if we can keep track of the temperature in the container we can halt distribution if necessary. If nobody checks and insulin is transported at below zero at some point in the chain, a subsequent accident investigation may find that we are to blame, and we do not want to risk that. Our thermo containers are equipped with a sensor that alerts our office if the temperature deviates more than 4 degrees from what it is set to be at. In fact, we have actually stopped trains because of such alarms. Of course, this is much easier with a truck that can be stopped almost anywhere en route, a train. Not only do you need stopping points, you also need to have certified personnel on call if we need to do repairs on refrigerated rail containers while parked under live wires. We may also need equipment for unloading the container from rail to road, which isn't always easy.

A container may cost as much as 500000 a piece (and you need two per truck), while a semi trailer cost 700000, and is thus a cheaper and more versatile solution. Semi trailers have become the standard solution these days.

Interviewer: In the car industry it is common for different manufacturers to share development costs. Do you work together with your competitors in developing IT support systems?

Respondent: Yes, we have done this to some degree, although we need to be careful not to violate the rules set by the Norwegian Competition Authority (Konkurransetilsynet). Something we have done is to work with competing suppliers in the electric consumer goods market, where we have developed a common solution serving both, instead of having two different solutions for each customer. This where road transport is more flexible than rail transport, especially in Southern Norway There is a company in Oslo that has developed specialized solutions for the distribution of automotive parts, with larger trucks serving some major axes, and smaller distribution trucks serving each customer.

Interviewer: What about more general infrastructure and equipment?

Respondent: We do have distributors who are serving both us and Tollpost, our competitor, so "our" distributors may have contracts with others as well, which is fine with us.

Another matter are delivery ramps, which can turn into major bottlenecks. In Oslo it is only Oslo City (mall) that has one central delivery point from which all goods is distributed. Many delivery ramps are practically inaccessible for larger trucks, thus making efficient deliveries impossible. It is often not possible to deliver straight from the truck to the recipient's door. Loading ramps are often neglected when buildings are planned.

Interviewer: Would better loading ramps affect the overall delivery efficiency?

Respondent: Yes, it would have a huge effect on our deliveries. Sometimes we have to distribute our load onto smaller vehicles in order to reach some of the ramps, and if we could have accessed it with a larger truck, it would not only save time, it would also affect intermodality, if we can come straight from rail to road to delivery without intermediate unloading and reloading onto smaller trucks. We try to standardize our equipment and processes as much as possible, but we can only do so much if the delivery ramps are the way they are.

Another interesting matter is that downtown Oslo is closed to large vehicles after 11am, but stores do not open before 10am, which means that not only we but everybody else too has about one hour where all deliveries have to be made. We would have liked to come early, but there is no one there to receive us. In fact, we probably use twice the equipment we actually need when it comes to serving downtown Oslo, because we have to squeeze everything into this one hour time slot, in addition to inadequate delivery ramps. In the end this also makes intermodal transport more expensive because the end destination is not prepared for an efficient transportation solution. I find it quite astonishing that this has not yet been picked up by the building code, which has a lot of other minimum requirements when it comes to buildings. In my experience, the delivery ramps or delivery area has to make do with whatever area that is left after the building is erected, and more often than not this is much less than would normally be sufficient.

Interviewer: I can see the problem. Essentially then, it is the customer who has to pay for these inefficient solutions, and this is probably an area where the authorities and lawmakers can play a role in making intermodal solutions more efficient. You have mentioned delivery ramp requirements and building codes, you have mentioned railway infrastructure and freight operations, you have

mentioned equipment standards such as 25,25...are there any other areas where the government can do their part in improving intermodal transport. You have mentioned the lack of capacity of the cargo terminal earlier.

Respondent: Yes, having enough space for operating a terminal is a key issue, and it is an issue where the planning authorities can make things better for us. Unfortunately they don't seem to understand our needs. For example, one of the access road to our terminal here at Alnabru is subject to being closed, which will make our internal transport operations much more difficult.

We as shippers and transport operators are struggling to tell the public and especially the authorities how demanding and challenging freight operations really are. They are much more advanced and intricate than most people may think of. It is much more than simply driving a car from A to B.

Interviewer: Going back a bit, what if one of the electrical consumer goods wholesalers would ask you to set up an intermodal transportation solution for their specific needs, how long would it take you, say from the request is made until you have a solution set up?

Respondent: It depends, and it is very difficult to answer on a general level. Answering a request usually takes a month and setting up the solution normally takes 3.4 months. That said, we have allotted slots on all trains running to (...) etc., and it is our job to make sure these slots are filled at any time, or bear the cost if not.

Interviewer: Do you happen to be unable to fill these slots?

Respondent: Yes, it does happen. In our agreement with CargoNet we will have to pay for these slots in part or full depending on how close to departure we make a cancellation.

Interviewer: on the other hand, what if there is excess capacity with other operators that are unable to fill their slots with CargoNet?

Respondent: If that operator notifies CargoNet of this, then CargoNet will make it available to others. However, this will usually be offered at a price 30% higher than the regular price.

Interviewer: This makes this almost as expensive as road transport, doesn't it?

Respondent: Yes, that is true. Considering our slots, we have some slots on all trains throughout the day, but most slots at night, and we work hard to fill these slots. Perhaps CargoNet should work the opposite way, and try to fill their early slots at lower prices, thus giving us an incentive to send goods when there is an opportunity while at the same time ensuring that there is enough spare capacity at night when most of the goods we ship arrive at our terminal. There is also very little (no) dynamic pricing on CargoNet's end.

Interviewer: Are you aware of how CargoNet's capacity fluctuates?

Respondent: No, not in any detail. In general, night departures are fully booked, while earlier departures have excess capacity. I am not sure that a dynamic pricing model will work, because our customers rely on price and quality, i.e. on-time delivery at a set price, let alone on-time pick up for shipping. Even if CargoNet has available space at earlier trains, and we can change our behaviour accordingly, we may be unable to change our customer to do the same. In addition, this may wreak havoc on the overall track and trace systems we operate if customer shipments are split into several sub-shipments to take advantage of dynamic departures.

Interviewer: Is there anything that could be done to make shipments ready earlier in the day? Or is it just easier to ship all at once rather than splitting it?

Respondent: Obviously, it is easier to ship everything at once. Nonetheless, we as a shipper should still focus on having shipments ready as early as possible and be able to send shipments in several loads (trains). D is able to handle a full train at once, in Bergen this is not possible; here they need to have goods arriving at intervals in order to keep production at an even level. Narvik operates at night mostly and has practically no activity during the day, because it is the hub for goods to and from Tromsø and beyond.

The winner in the shipping business is the company that has the most efficient operations, and in Norway the most efficient operations solution is intermodal transport, but unfortunately, the necessary legal and regulatory framework is not in place yet.

Case2: Intermodal transport company/shipping line**Content:**

Respondent: We are both a ship owner operating ships and a carrier operating trucks, semi trailers and containers, and we operate in the full load market mainly. This also applies to intermodal transports.

Our focus in recent years has been to promote how we can move more goods from road transport to sea transport, since sea transport is what we do as a ship owner. Rail transport has similar drivers towards intermodality that sea transport has, eg. more environmentally friendly. What I have championed is the number and structure of ports as a main driver in establishing intermodal transport. There are many ports today, and every port wants to offer all facilities and services to the shipping community, even if they are only a stone's throw away from each other. Firstly, I consider this a waste of money, and secondly, it does not help in increasing sea transport. In my opinion, the ports must cooperate more if they want to achieve more sea transport. While I will advocate to reduce the number of ports as such, but we need to limit short sea ports, if we want to increase sea transport volumes, because if all ships need to call at all ports this will take a very long time, which will negatively impact the frequency and frequency is important for operating good intermodal solutions. The same goes for rail transport. The frequency need to be at a certain level for customers to consider using the services. That is why it is much better for us to have fewer ports of call.

I am very excited about what is happening in Østfold right now, because it seems that the ports here are trying to cooperate rather than compete with each other. While they all have the same services, there is a movement towards diversification, where each port tries to develop particular functions in agreement with the other, and basically dividing the workload from a strategic perspective. I believe many other ports should look to Østfold and what is going on there. It may be too early to draw a final conclusion, but it seems to be a promising start.

Interviewer: It would appear that they have taken a leading role among the ports along the Oslo Fjord, and it may not be equally easy to find similar cooperation on the Western side of the fjord?

Respondent: I think it should be done. That said, Østfold is easier, since it is one county and the municipalities alone that have to work together. On the Western side of the Oslo Fjord you also have several counties that need to be dealt with. Obviously, this will be more challenging, but I think it is necessary, if you consider the benefits: businesses will have better services, because fewer ports of call means more frequent calls. I know most of the port authorities along the Oslo Fjord, and not all of them are likely to agree with me, but I think that this is a goal we should pursue. It may take time, but I hope that this is the direction we are headed.

Interviewer: One of the barriers has perhaps been that each port hasn't invested enough in their own infrastructure and handling equipment to be able to offer a one-port-of-call solution?

Respondent: That is true, but there is also the issue of every port wanting to have similar equipment that the other port has, for competition reasons, and if they all have the same equipment, but none of them is big enough to handle large volumes, they all loose. Cooperation is the key.

Interviewer: Isn't there anyone that can take control and say, well "here", this is where we want the (major) port to be?

Interviewer: No there isn't, and that is what has plagued the sea transport sector for decades. Ports are a municipal responsibility, and they have always fought against each other, wanting to be the best.

Respondent: That's why I enjoy seeing that some ports (like in Østfold) are trying to do the opposite, cooperate rather than compete, and I do hope that they succeed.

Interviewer: So will Larvik or Grenland be the main port for the Western side of the Oslo Fjord?

Respondent: Well, there is actually a third alternative, right at the border between Telemark and Vestfold counties, where the port would be able to serve both counties, although at present there are no concrete plans for it, it has only been suggested as a possibility.

Interviewer: Have you undertaken any specific projects in intermodal transport related to certain customers or types of cargo?

Respondent: That is exactly what we do all the time. All our transportation is based on intermodality. Otherwise we wouldn't be able to be in the business we are in.

Interviewer: Who takes the initiative towards intermodal transport, you or the customer?

Respondent: We do, because we are selling intermodal transport as a product and offer it to the market. In the Oslo Fjord region we have done this for a long time already, and we have now set our eyes on Western Norway as a new potential market. The Western coast has so far been a lost opportunity, but we hope that it is not lost forever, and we are working on that. So far, there has been no real alternative to using semi trailers in Western Norway. There are many container ships, but they are either overseas or carry 20" or 40" containers, if I see it in black or white. In reality, it is a bit more nuanced, but mainly this is true; the ships that pass along the coast have their own market niche and do not compete with road transport. We do now with our Bergen – Trondheim/Skogn route, where we use 45" containers. The challenge we are facing here is to convince the freight forwarders that this is a smart thing to do. Interestingly, the freight forwarders are not easy to convince. You would think that freight forwarders are very cost-minded and if things are cheaper but have the same result, they would go for the cheapest solution, but it's not that simple. One issue that freight forwarders are very hesitant to change from one carrier to another, especially if this is not supported or promoted by the management. A freight forwarder may choose to stay with one carrier for historical reasons because it has always worked well, so why switch? Now, changing carrier is difficult, imagine how difficult it is to change transportation mode as well: Instead of driving a truck we will now use a ship. That is the challenge we are facing here.

We have two groups we need to reach to make this work: 1) the freight forwarders and 2) the freight owners or customers of the forwarder. Both these are large enough and with a cargo volume big enough to justify their own and specific intermodal solutions directly from us, and the smaller players will have to use the forwarder in any case. We need to work with both, because if the freight owner accepts an intermodal solution and makes this known to the forwarder, the forwarder in turn may become more interested in seeking and offering such solutions. One example that comes to mind, say, is if a company in Norway imports goods from their supplier in France, they demand a 36 hour delivery time maximum, otherwise they will not use this supplier. However, if they then switch to a supplier in China, suddenly they can make do with a lead time of three weeks. Why? Because they are too lazy to plan in the first case. In the latter they have to, so they do plan. Why is that? This is where educational institutions can make a difference, if they stop proclaiming Just-in-Time and zero storage as the mantra of manufacturing and logistics. Perhaps not all industries can work this way, because production cost must be balanced against storage costs, and in some cases the overall cost may be higher with JIT than without JIT.

Interviewer: Well, we do that. We tell our students that this must be calculated for every case. And yes, this is particular the case if there is a disruption in a tight supply chain. That issue is overlooked in much of the literature.

Are there customers that have a freight volume large enough to have their own sea route, and where you establish a route outside your regular routes?

Respondent: Typically, a Norwegian company may have, say, 10 suppliers in other countries, half of which are in destinations that could be linked by sea transport, the rest will have to go by rail or road. Some companies may have suppliers located in places where no sea transport can be made, so it may not be possible to use an intermodal solution for all the freight volume of a customer. How this plays out does not depend on customer size per size, but on how the company procures its supplies. That said, if a company has some goods that can be transported by sea, it may be possible to adapt more of its goods flows towards sea transport. That is why the freight owners need to be part of this together with the freight forwarders, because the forwarder will start to work on intermodal solutions if the customer requests it. In order to promote more intermodal transport, it is probably more effective to target freight owners than to target the freight forwarders.

What is often overlooked is that the different modes of transport affect the balance of incoming and outgoing flows in different ways, and this is where intermodal transport has its strength: in achieving a better balance. If the distance isn't too far, it is cheaper to position empty containers than empty trailers. For example, if a freight forwarder has, say, 10 loads coming to Norway, well, he should distribute this onto 5 trucks by road and 5 containers by sea. This way you can use the very flexible trailer for exporting goods in return, and you can easily position incoming containers. This is where I see that intermodal transport has many opportunities, by fully exploiting the

different modes of transport, especially if you remember that both semi-trailers and containers can also be shipped by rail.

Interviewer: What happens when you suggest a intermodal solution to customer? If this customer is using road transport today, at a given price and service level, so in order for the customer to make the switch, is price what it comes down to?

Respondent: Essentially yes. Price is what matters. In addition to service level, regularity and reliability, but price is what will matter most.

Interviewer: How do you decide the price? If you are negotiating with several freight owners in order to fully load an intermodal solution, you may not know how many that will sign up, and the more who use it, the lower the unit cost, so how is the price set? Do you offer an assumed price and an assumed service level based on how many you expect that will join or do you negotiate in several steps, depending on how many customers that join?

Respondent: Calculating the price for intermodal solutions is not more difficult than for unimodal solutions. However, what matters most perhaps is how much cheaper must intermodal be to make it more attractive, and that is highly debated, but many will say that intermodal needs to be 10-20% cheaper than road transport for freight forwarders and owners to make the switch. Others have said that as long as there is no difference it's ok, because that will ensure a balanced competition.

Interviewer: You have mentioned some of the barriers that need to be overcome to make the switch from unimodal to intermodal. Are there more hindrances?

Respondent: Mindset. We often think of sea transport as difficult, because there are more modes involved. Door-to-door road transport is just a phone call away, but essentially, sea transport is too. We are interested in attracting more forwarders to our services, but we realize that in order to reach out to the forwarders we must attract their customers first. Another matter is that transport operators and freight forwarders make up the majority of attendees at many logistics and transport conferences, while there are very few freight owners; 80% are operators, 20% are freight owners...how can this be changed. My suggestion for the upcoming Oslofjordkonferansen would be to limit the number of operators to 20%, which would make it a smaller conference, but perhaps a better conference when it comes to highlighting intermodal solutions. Having transport operators talking to each other is not going to make more freight owners chose intermodal transport; we really need to have the freight owners on board to make this work. That is why we need to seek out the meeting places where we can talk to the freight owners. While we will continue to work with the operators, unless we can convince their customers not much is going to change.

Interviewer: In our research we have spent some thoughts on why there isn't more use of intermodal transport on the freight owner's side. Each of them want the cheapest solution, they all know that intermodal transport exists, they probably also know that this is cheaper than road transport, and yet, they still don't make the switch. Could it be that they are afraid of choosing a solution that is not going to be used by enough other companies to be viable in the long run? Obviously, switching transport modes will incur costs, cost they will not incur if they stay with their current solution, i.e. road transport. Is that a reason?

Respondent: As I see it, freight owners do not think too much about how their transport demand is solved in practice. To the freight owner, the issue may be to send 33 pallets of goods from Belgium to Norway within a certain time and cost limit. How this is done is essentially not important to the freight owner. Intermodal transport may take more time, but the time it takes for one load to reach its destination is not so important, what matters more is frequency, which takes me back to the issue of having fewer ports. Fewer ports equals higher calling frequency equals more goods can be shipped at more times.

I have been invited to speak at the Transport og Logistikk conference in Oslo this year, and I will use that opportunity to raise this issue there, as I have done at other conferences. I believe that the switch from road to sea has to happen now, or it will never happen. There is a lot of focus on sea transport now. Sea transport has received a lot of conference attention Both last year and this year, and a lot of groundwork has been laid in the SITMA report that was presented last year. The challenge that remains is how to go forward from here. I think there need s to be a better streamlining of efforts to promote intermodal transport; it should not be mixed in with all other transportation issues at various conferences. Intermodal transport needs its own meeting arena. In

my opinion, the different issues need different arenas, i.e. a technical forum for technical questions, a regulatory forum for regulatory questions and a political forum for political issues, etc. One major obstacle is that sea transport is handled by one Ministry, while rail and road transport is regulated by a different Ministry. If all were subjected to one Ministry it would be much easier to achieve better coordination, let alone prioritization of the funding of transport modes, and thus, also of intermodal transport.

Interviewer: That is an issue yes. Actually, there are four Ministries involved, Trade and Industry, Fisheries and Coastal Affairs, Local Government and Regional Development, and Transport and Communications.

Respondent: Correct. Nonetheless, the issue is that sea and transport and road/rail transport are governed by different political agencies. I think that is wrong, because this way the political decision makers don't have to make a choice as to which mode they want to promote or prioritize.

Well, political change aside, what is needed is an arena where the customer side can meet and discuss issues, and where we as a supplier of intermodal transport can promote our services and create interest and enthusiasm, which in turn will make the forwarders see this, too. One major fear that the freight owners may have is that sea transport is too complicated. It's not. In fact there is more sea transport than most people are aware of. Many of the ferries from Denmark or Germany to Norway carry a lot of semi-trailers; that is sea transport. The better question is perhaps to ask how long should the sea leg be compared to the road leg? The customers may have to rethink their production processes and plan a day or two more ahead than with road transport only, but in return they will receive a much more flexible and a much more reliable service. Why? Because there isn't the same focus on delivering as fast as possible as there may be with door-to-door road transport, where goods has to be loaded and unloaded whenever the truck arrives, whereas we may be more flexible in terms of delivery times, because the goods, once unloaded from the ship, may be left in intermediate storage for a day or two if necessary... if the customer plan accordingly. In this perspective, sea transport has greater flexibility than road transport or rail transport. In general, sea transport is also considered more environmentally friendly than road transport.

Interviewer: That is right, although it depends on whether the ship is fully loaded and/or cruising at full speed.

Respondent: Yes. The top 3 knots are very expensive, both in terms of fuel and in terms of environmental impact, so cruising at less than full speed is better, because it also adds some slack that can be used in case of a delay.

Interviewer: You mentioned that you were going to speak at conference, and naturally you will use this as an opportunity for a sales pitch to promote intermodal transport, and you have mentioned flexibility as one of the reasons why intermodal transport should be used. The road transport operators say the exact same thing, namely that road transport is flexible and easy to adapt to load volumes and frequency of demand. So are there other reasons you can think of that are selling arguments for intermodal transport vis-a-vis the freight owners and freight forwarders?

Respondent: The freight owner will probably only look at the price offered by the forwarder. The freight forwarder, as already mentioned, can achieve a better balance incoming and outgoing load units, something that a good freight forwarder should care about, if he cares about his costs. This in turn will enable the forwarder to offer lower prices, which is what the selling point is for the freight owner, who agrees to accept a longer lead time but an overall cheaper solution. Because time matters, the difference in lead must not be too long, or intermodal transport will not win, regardless of how cheap it may be. So essentially, price and time is what it comes down to, everything else is the same: the customer makes a call to the forwarder to order his transport needs, and the forwarder calls us (or the road transport operator), and we do the rest. It's not more complicated than that, but some still think it is.

Interviewer: So basically, as you said, it comes down to price and level of service, i.e. quality, frequency reliability and price. One issue that we haven't talked about yet is the stronger need for coordination and flow of information in an intermodal solution than in a unimodal solution.

Respondent. That is true. We do track our load units all the way, so we know where it is. But for sure, that is an area that can be developed further, and that is probably the area within the transportation sector that has seen the biggest development in recent times. In intermodal transport, if I look at all processes, starting with when the pick-up is made and until a load is

delivered, I don't see any reason why intermodal should be a "worse" or more difficult mode of transportation than road transport when it comes to exchanging information. It depends more on the operator than the mode, I think. Some companies like UPS and DHL have extreme systems for trace and track, while others may have less sophisticated systems. Of course we can always improve what we do when it comes to exchanging information with our customers and business partners.

Interviewer: What about terminal operations, such as loading and unloading, do you see particular issues there that affect intermodal transport, e.g. breakage?

Respondent: That terminal loading and unloading is a reason for breakage is a myth. I mean, we lift entire containers to and from a ship, a train or a truck, not pieces of goods, so I don't see breakage as a major issue that shippers should be worried about in intermodal transport. Obviously, there is some lag when you have to unload several hundred containers from a ship, but that's the way it is. Our biggest challenge is getting the facts out about intermodal transport and debunking the myths about it. This is where I think educational institutions like you can play a role in educating your students. Whatever I say about intermodal is likely to be seen as a sales pitch, but what you say – and where you omit some of my selling points – is more likely to be seen as truthful information about intermodal. To me, making sure that intermodal is viewed correctly is very important, because your students today may be our customers tomorrow, or they may be working as freight forwarders or freight owners, and they should thus be made aware of what intermodal really is.

Interviewer: That is our challenge, and that is why meetings like this are very interesting in debunking some of the myths that pervade modern textbooks, e.g. the myth of much breakage at terminals.

Respondent: Well, a terminal is many things. For example, if A or B or C or any other forwarder were to use our service for goods from the UK, then this would first arrive at our terminal in X or Y where we unload a container and load it onto a truck that takes it to XXX terminal in Oslo. That is the terminal handling done in intermodal transport. What happens after that is another matter, and unrelated to intermodal transport, because XXX terminal handles all modes, so any breakage there will be a common issue. That's why we don't see breakage as an issue in intermodal transport.

There is also the issue of full load versus partial load. The latter will have to pass through a terminal, while the former may not, and this may also depend on the type of cargo. There are many other challenges related to terminals, but it shouldn't be a major factor in deciding whether to go intermodal or not.

Interviewer: How do you solve capacity issues, e.g. collecting how many truckloads to fill a certain ship?

Respondent: That is often done at assembly or collection points spread across the entire system. And it is at those points that the freight forwarder must make a decision to send how much by road, rail or sea. For instance, XXX may have a certain volume of goods at an assembly point in Paris that has been collected from all over France and that has to be transported to Norway. Then a decision must be made how to send this from XXX terminal in Paris to XXX terminal in Oslo. Now, there could be many customers involved here, with different types of goods with different priorities. Some of this may be less important and can go by sea, some of this is urgent and needs to be transported by road. This is where XXX should work with their customers or the freight owners and work out the best overall solution, even if this means persuading some customers to accept a longer lead time. That is why it is important to address both the freight owner and the freight forwarder.

Interviewer: Yes, I see that the freight owners are the key here, because they determine the lead time that is acceptable, and the forwarder simply works with whatever the customers asks for.

Interviewer: So lead time is what will compel freight owners to make the switch to intermodal transport? If we can make the freight owners accept a longer time, then the case is won, so to speak?

Respondent: Essentially yes. But again we need to separate lead time and frequency of service. For instance, if intermodal takes 12 hours longer than road transport that may be fine with many freight owners, but if there are 48 hours between departures, then the case is lost.

I think that much it comes down to the lack of planning. Perhaps companies should adapt their production planning horizon to fit the lead time of the various transportation alternatives, instead of vice versa, where the operator always has to adapt to the demands of the companies.

Interviewer: So there is a need to change the mindset of the business world, where getting what you need as soon as possible is how most companies think?

Respondent: Yes, I am always surprised by how companies can learn to accept a three-week lead time from Asia, and plan accordingly, but not from Europe. I believe that with better planning lead times could be increased in Europe as well. This would also lower the transportation costs in Europe, if businesses can learn to make do with longer lead times, and thus make intermodal transport more attractive to use. I believe that Western Norway has suffered from this for years, because the mantra has been that road transport is the most viable option. It is not, but nobody has seen sea transport as possible.

Interviewer: Should there have been an option?

Respondent: Yes. We have just started our route here.

Interviewer: Where do you call?

Respondent: We depart from X and call in Bergen and Y and return to D.

Interviewer: Not C?

Respondent: No.

Interviewer: Could you have called at more ports?

Respondent: Yes, if there is a large enough volume of goods, we could. The challenge is convincing the market in Western Norway that intermodal is a good choice. We leave X on a Saturday and arrive in G on Monday; that is faster than you can do by truck.

Interviewer: How do you move the goods from when it arrives at the port?

Respondent: We have a contract with a carrier.

Interviewer: On what terms? A long-term contract or an order-by-order contract?

Respondent: A standard normal agreement, nothing particular. One issue here that hasn't had much attention in the public debate is that intermodal transport actually benefits the Norwegian carriers. Road transport from Europe to Norway is more and more taken over by low cost European carriers, because Norwegian carriers are not competitive enough there, but goods that arrives in Norway by sea is available to them, so the Norwegian carriers should actually welcome intermodal transport as lucrative business opportunity that actually has a future.

Interviewer: Do you have specially fitted transports for certain customers with non-standard goods or does all go by container?

Respondent: Not all goods is packed into containers. Our ships have side ports, with containers on deck and non-container goods under deck. It's all standard industry products. It should be remembered that we do large volumes. You may have heard that XXX has their own train to Narvik that takes 1000tons five times a week. What they do in one week is less than we do on one trip, and we have one weekly trip.

Interviewer: My understanding is that freight forwarders or freight owners are a bit unwilling to use intermodal transport unless they can be sure there is enough volume to make this a viable long-term option, is that so?

Respondent: That is not my understanding. What I see is a resistance to change, not an uncertainty about long-term operations. I mean, we have been around for many years, and will continue to be around, so that should not be an issue. Our challenge is understanding and overcoming the resistance to change that is so ingrained in the business.

Interviewer: How do work with your potential customers to make them interested in intermodal?

Respondent: We just finished a project with Y, who chose our solution for their new frozen storage. In this case we actually moved a large volume of goods from road to sea, with only a small remainder of road transport from the port to their storage facility. That story has a very positive marketing value.

Interviewer: Are your customers setting any requirements as to environmental impact and such?

Respondent: Yes, many customers ask for a footprint calculation, but what matters first is everything else, and environmental issues come last, and are not the main argument. Some large companies put more emphasis on going green, but in general, it is only when road transport and sea transport come out as being equal in terms of overall cost that the environmental argument wins.

Interviewer: Can you tell more about the Y project?

Respondent: I am not that familiar with the project, but Y issued a tender for the transport of frozen goods to their storage facility in D, where we won the tender, and where all incoming goods is shipped by sea to D, and then by truck to the facility. Before much of it, if not most of it, came by truck. Obviously then, intermodal transport works and can be the cheapest overall solution, and I would like to see it getting more attention.

Interviewer: Well, we will try to do so. That is why we often use practitioners as guest lecturers.

Respondent: That is a good idea and balances theory and practice.

Case 3: Consolidator and 3PL operator

Respondent: Much of the goods we deal with comes from Asia and we cooperate with many handling agents. We have customers here, who we have freight forwarding contracts with and they usually tell us that “we are going to by X, Y, and Z from supplier A, B and C, please get in touch with them to get the goods, to load the container and consolidate our shipments and let us know when it arrives in Norway. So we work very close with the supplier side of each customer company and essentially we become part of their supply chain, not just because we provide the logistics, but because we are in close contact with their suppliers and customers. In practice, what we do is to issue routing orders, signed by our customers, which tells the suppliers to be in touch with us and our agents and partners in the Far East. So essentially, we handle the entire transport chain, starting with a contractual agreement with our customers.

Respondent: This also means that we have different roles at different stages in the supply chain. It could be a very small role, or it could be a large role, where some goods pass through here, and some does not, it could be companies operating on a global or it could be smaller client where we handle all needs from our offices here. So the products or services we offer are basically split into overseas transport and short sea transport, with a range of subproducts under these. We handle both full load cargo and mixed cargo, where we have developed our own products that we offer. We realized the advantage of multimodal transport already many years ago, and having freight forwarding, freight distribution and container depot all in one place is a major advantage. This is the case here in D and also at many of our subsidiaries, and it is the reason why we have been able to develop the products that we offer.

Interviewer: Where do you split the oversea loads?

Respondent: Most shipments are split in Norway, depending on where the customer is. In general loads are split as close to the final destination as possible. Oversea shipments are normally split in Rotterdam before they are sent on to Norway. As to overseas goods, we have partnered with XXX Group (a member of the Y Group of companies), which operates hubs in China and Asia where the freight is collected and consolidated before shipping, typically in Hong Kong and Shanghai to mention some of them.

Interviewer: How about the flow of information about shipments? Is everything sent electronically?

Respondent: Everything is done electronically yes, but we ourselves do not have our own a track and trace system. That is because we do not have overseas offices but work through a number of agents, so we have many information flows, but not a system of our own. Not yet, but it is currently under development.

Respondent: Actually we operate several “manual” systems based on the specific needs of our clients. These are systems that are linked to and adapted to the clients’ own systems. It depends on what the client wants, because some of our customers use our facilities for storage, while others have their goods delivered directly at their doorstep.

We have many roles; we are a freight forwarder in general, but we are also a stevedor in the port here. We offer one stop shopping: we have storage, we have cross-docking, we strip and stuff, we do basically every operation you can think of in a supply chain. We have a storage area of XXXXm² and we do many operations beyond simply unloading and reloading containers here at the port. So as far as intermodal is concerned, our focus is on the transport itself and the necessary transport functions related to intermodal.

Interviewer: Do you consider yourself a 3PL?

Respondent: Yes, that is exactly what we do with all our facilities here. We have a number of large customers where we have entered long-term contracts.

Interviewer: What do you do exactly?

Respondent: We have two large customers, X and Y (?), for whom we have all incoming flows and where we have a link to their CRM system and work as a 3PL; we load and unload, we manage warehousing, and we also label the shipments (X only).

Respondent: Labelling can also be done through our partners in China, where the goods is ready-labelled when it leaves China.

Respondent: We also consolidate shipments, because some customers may have shipments arriving from many places, and ensure that they leave here as one package, so to speak. I like to think of us a port-based freight forwarder who offers intermodality as a part of our overall product. We are part forwarder, in close relation with the freight owners, and a stevedor operating in the harbor, unloading/loading ships and/or trains, and we work together with many other logistics operators. While we have many roles and many services, the core business is centered around being a freight forwarder who happens to be located at a port.

Interviewer: So what happens from here on is not your business?

Respondent: Well, we make it happens, since we are organizing the outgoing shipments, but it's not part of our operations. For domestic distribution we have partnered with several operators, we are also handling agent for (a shipping line).

Respondent: What matters to us is that we are in charge of the entire transportation chain, regardless of who operates which part. So if a customer enters a contract with us, and we are using sub-contractors, we are still in charge and responsible for getting the goods to where it is supposed to go.

Interviewer: That must require a lot of coordination? I mean, there is a lot of operations and many actors involved in intermodal transport, you need to exchange information, and there are many things that can go wrong. How do you handle this?

Respondent: Yes, there is a lot that needs to be done to make this work. How well it works will of course depend on the current situation and the overall workload, how many orders that are in progress, and what resources that are available, both in the Far East and here. That also depends on what customers or customer groups that decide to sign up with us, what business they are in and what kind or volume of activities they have and where they do business and then work accordingly. So far this has not been a problem. Obviously there have been some problems from time to time, because we are dependent on the ships being on time and arrive when they are supposed to and transfer their goods to the terminals they are meant to, and yes, delays can happen. While a delay of a week or two may be no cause for concern to the ship owner, to the end customer it can be a severe matter, and if a overseas ship misses a call in Europe, or if the short sea ship is late for pick up, that is when we must decide whether or not to use a truck or use other modes or means of transport to get the goods to D. This is where it is very important to be proactive and let the customer know of any possible delay in the overseas leg and ask the customer whether this matter and what we should do about it. Since we don't have our own track and trace system, we have a manual spreadsheet that we update constantly and that keeps track of all purchase orders and shipments and when they are expected to arrive, and if there is a delay we contact the customer.

Interviewer: This spreadsheet, is that an online version that the customers can log into themselves or is it sent out by you?

Respondent: It's a spreadsheet that we send to each of our customers manually, in lack of our own track and trace system. Interestingly, we often experience that customers say that this is exactly what they need, because they can pass on the information to who needs it without having to do the track and trace themselves. Naturally, this depends on the customer. Existing customer with an established working relation are fine with our solution, while potential new clients will often ask for a track and trace solution, which makes selling our services a bit more difficult, sometimes. So we see that there is a demand for this, which is why we are developing it.

Respondent: Yes, that is something we are working. It should be kept in mind though that we have developed our services, processes and systems step by step over a very long time and in close cooperation with our customers, where we have adapted to the specific customer's needs. Admittedly, a track and trace system would be nice to have and is a selling point, but it also needs to match our customers' needs. Our focus has always been to forge close customer relationships and our handlers at our offices follow our customers very tightly, and so do our agents overseas, and I even dare to say that we have a closer relationship to our customers than many of our competitors have to their customers.

Interviewer: What about your customer size?

Respondent: We have a pretty balanced mix, both large and small customers.

Interviewer: So when a load arrives here it needs to be forwarded, either by rail or road, who chooses which mode to use, you or the customer?

Respondent: We do, depending on destination, urgency and overall cost. For instance, to Trondheim will be by rail from here and then by car locally from there. The same applies to destinations further North, first by rail and then by road. This is where D is unique in Norway, because we have a direct link to the main rail line directly from the harbor without having to pass through another terminal.

Respondent: As I already said, we have everything here, cargo forwarding, container terminal, rail terminal, warehouse and storage depots, we have large areas available where containers or goods can be stored, and there are still large unused areas next to the pier that allow for new opportunities to be developed. There is enough space for future developments – something that Oslo is lacking – and we are also able to operate on a 24/7 basis, if needed, which is another advantage to our competitiveness. Because we are en route to Oslo we can receive goods and deliver it in Oslo earlier than Oslo itself may be able to.

Respondent: (The terminal focuses much on relations with the public). Enabling the public to take a firsthand close look at the port activities underscores the message that this is where we need to be, and creates a greater understanding about our needs with the public in general and our customers in specific. It also creates a close link between us, the port authorities and our customers.

We have a large network of people and companies that we keep in touch with and we are constantly developing new intermodal products, in cooperation with our customers, or in cooperation with existing or new partners and ship owners, e.g. how different overseas transports or container transports can be linked, how to develop the terminal operations or how to improve stevedoring, and we are constantly working on how to attract more freight, by talking to the large freight owners in the region. We see it as our task to develop the port into a hub for the businesses, industries and freight owners here in D, and in return they will hopefully realize that by using the port it will not be a viable port in the future but it is a port that will adapt to their specific needs.

Respondent: It should be noted that international ship owners consider it quite absurd that every little harbor town in Norway wants to have their own cargo terminal; they would prefer to have only one terminal for the Oslofjord region, instead of having to use a feeder ship for many smaller terminals, as they have to do now. That is our challenge, in that we need to convince the freight owners that it is an advantage for them to land their container as close as possible, and not use a truck to pull it from Oslo or wherever. Obviously, the ship owners are competing against each other among the freight owners and it is the freight owner who determines which port he wants to use, so if they start telling the freight forwarders and ship owners that they want their goods delivered in D, the ship owners and forwarders will follow suit. Of course, the overseas ship owners want as few terminals as possible, while we want to deliver as close to the customer as possible, so we need more terminals.

Interviewer: So there is a conflict here?

Respondent: Not really. The important thing is to cooperate in developing optimal solutions that can serve both needs. Streamlining loading and unloading operations and making them more efficient has a benefit to the port and to us, because turnaround time is what matters to the ship owners; after all, a ship is supposed to be at sea, not at port.

Interviewer: Are you benchmarking yourself against other ports?

Respondent: Yes, we record that for each ship and also compare ourselves to other harbors. You may have noticed that we are using a mobile crane while other ports have gantry cranes, so the coordination of onshore and onboard operations is very important in creating a smooth workflow. It is possible to create good and efficient solutions even though we may not have the most sophisticated loading equipment. We even record how long loading it takes for every single container to be loaded onto or from the ship. That also includes planning which containers we need to load where on the ship to make the workflow more efficient

(A shipping line) has a ship that travels from (GB), (NL), (DK), D, (2 other cities), and obviously the ships must be loaded according to where they call, which makes unloading more easy, let alone faster. The ship arrives here Xday night, with a lot of goods that needs to be in Oslo on Yday morning and we always are in close dialogue with (shipping line) in order to know where “our” containers are placed, so that we can be more efficient when the ship arrives. We are currently working on this and

we are getting better. (The shipping line) started operations with a X TEU ship, and the most recent one is (approx 2X) TEU, and it always takes a while to achieve efficiency when changing ships, in addition to keeping an eye on security and HES.

Interviewer: How large ships can you handle here?

Respondent: We can handle ships up to XXXm, although I am not sure about TEU. Naturally, overseas ships will be too large, but we should have no problems in handling a Unifeeder ship.

Respondent: I am sure that we will be able to handle any ship as efficiently as we can, but it may not be as fast as the ship owner would want. Normally we will be able to handle Z containers per hour and while we would like to reach Z+5 or even Z+10 per hour, we have to make do with the equipment we have, and work with that as best we can.

Respondent: We may be lacking in equipment, but we focus on working efficiently and that also includes planning how to unload the ship, by knowing beforehand where each container is on the ship and by planning where to place the loaded and the unloaded containers onshore, and by using the port area efficiently, and making sure there is enough space before the ship arrives, so that we don't waste space or loading operations. We are constantly working on improving our operations, given the limits that our equipment has.

We are also working with CargoNet, who are thinking about starting a train service directly from the port in D to H, bypassing the Alnabru terminal, where we will act as stevedore for loading and unloading the train.

Respondent: It will pass through Alnabru alright, but CargoNet does have capacity problems at their Alnabru terminal, and this service will send a strong signal to their customers that CargoNet sees D as an alternative to Oslo.

Interviewer: Can you load a 600m train here?

Respondent: Yes. (...). Many of the large players are very positive to CargoNet's plan, because many of them are hauling their containers to Oslo today, and here the containers can be loaded or unloaded directly to or from a ship. We also have space for storing containers. CargoNet has said that they would need a load level of 80% before they would establish the train service, and it appears that they are very close to actually starting it on January 1st next year. No decision has been made so far, though. This train will not only service Trondheim, but also X. We are very much in favor of such a service, because we would like to attract as much freight as possible. So that we can develop our products further.

Respondent: The freight volumes that we are able to attract will of course be a driver for D port in making new investments.

Interviewer: Speaking of which, what are the current barriers blocking further development?

Respondent: The most important issue is to bring more ships to D. At the moment D is served by (shipping operator), a short sea operator, and we have worked extensively with them in order to have them accept feeder cargo for another ship owner that we have a cooperation with. If we want to attract more overseas cargo we need a commercial feeder operator, e.g. Y, Z or others, who are serving as a feeder for the major overseas operators. Obviously, (shipping line) could take on this role. Nonetheless, what we need is a commercial player in the feeder market who starts looking at D as a port they want to serve. This would make D a port like Oslo, A or B.

Respondent: Currently, there is enough capacity for this kind of development. Ships aren't exactly lining up outside here, so both the port and we as an operator have enough capacity to take on more ships. As I said, we have always focused on developing our products and intermodal solutions, and together with our agents in (NL) and in the UK we have developed our own mixed cargo product here in Norway. We have offices in A, B and D, and it is product that we think has been a success. From a very small beginning we now have some 8-10 mixed cargo containers per week. We have also started services in Bergen. Much of our success is based on joining forces with good agents in the UK and BENELUX who know the local market and who are able to secure customers. I think we have been quite successful in convincing those customers about our handling, stuffing, storing, forwarding and other abilities, which is part of our mixed cargo product that we continuously seek to develop and improve.

Interviewer: That is a concrete project you have been working on, isn't it?

Respondent: Yes, that is a project that we have initiated and established and contracted to our agents on behalf of (Respondent).

Interviewer: What is the length of the contract?

Respondent: It's a three-year contract, but I must add that the product is under continuous development to make it better. The UK is a very interesting market for us, because there are very few direct links to the UK from Norway today as most links are via Sweden. What we see is that there are a lot of private persons importing goods from the UK, e.g. car parts and accessories, something very few other operators seem to have realized. We have and we have established a system for these kinds of imports and we are now harvesting what we invested in.

Interviewer: What other goods are there?

Respondent: Mostly consumer goods. We have some commercial customers, but an increasing number of private customers. One of the reasons why we entered the private market is that it has a very good profit margin.

Interviewer: How often is this route?

Respondent: Once a week. It arrives here on Xday, and the goods are delivered to the customers on Yday morning. The ship leaves the UK at the Y of the week before, so it's a very competitive product

Respondent: We serve most of the Østlandet region with this product, and we also offer this product at our Z office. It is an intermodal product and we consider it a strategic product for (Respondent) with a lot of potential, where we make contact directly with the end customer and try to develop a direct relationship with the end user of our products.

We are constantly seeking to make ourselves and the port of D more attractive by entering new markets and exploring new opportunities that haven't looked at earlier. That also includes new technical solutions that increase the ability to carry return goods the other way.

Interviewer: When talking about intermodal transport, there is often the issue of balancing the freight flows. Is that a question for you? Especially domestically, perhaps, because the door-to-door service is mostly about imports? How about the other way?

Respondent: It's very difficult to balance the flows. If we ship a container to e.g. Tromsø, it's very hard to find goods we can ship in return, so we need to have a round trip solution. Transporting containers from Oslo to Northern Norway is more expensive than taking to Norway from Shanghai, so it's a very valid question. However, since they need to have the goods up North, we just have to take that into account when we set our prices.

Respondent: To have balance in our traffic is a challenge. It always has been, and that is why we seek to enter new markets that can help us achieve this balance. We have used the last year extensively to find export opportunities.

Respondent: As far as container transportation is concerned, Norway is importing more than exporting. Major exports are granite, paper/waste paper (large volume products), so it's difficult to achieve a balance. We have a lot of 20" containers coming in to D, but not so many going out. We have some exporters in the area, and we are successful in attracting other cargo that normally goes via Oslo, so we try hard to attract more exporters and advertise D as a port for their exports.

Another challenge is that import containers coming from China are not compatible for export to the US or other countries and you cannot use those containers with another line, so balancing containers is a very complex matter.

Interviewer: That is because of the ownership, not the shape of the container?

Respondent: Yes, it's ownership-related.

Respondent: We have also looked at how we can tailor our services towards non-containerized shipments, because not everything can be put into a container. Conversely, we also try to make our customers think more about containerizing their shipments and not bring everything in a semi-trailer, because that is how they are used to thinking.

Together with a partner we are looking at a system that makes container stuffing more easy. It is a system that is very well suited for exports from this area. We think it's important to offer a system that is adapted to the product, and where we can combine pallets and containers. If we don't have the right equipment, we need to find it, and this system puts the goods into the container.

Interviewer: You mentioned that you have some large customers. Are these development projects done together with your customers?

Respondent: This is a new project, but this is done with a partner, but we will involve customers as well. We are currently working on a project with Z products and a project for Y product.

Respondent: The big advantage for us in D is that we have space to develop many solutions. We can invite the customer to bring the cargo to the quayside, resulting in fewer expenses for trucking to and from.

Respondent: Our experience is that customers enjoy talking about transportation in new way, especially if it involves cost savings. We will always succeed if we can do a good job in that respect, and we also have space for cross-docking and short-term warehousing that the customers can make use of as part of an intermodal product.

Interviewer: As I see it, you are not too large and your main customers are quite close to where your operations take place, you can tailor solutions and be flexible, correct? That is interesting, because we always thinking of shipping as a large-scale operation where the major benefit lie in using large units, but introduces other costs to the customer, which you are able to avoid, so there is a good trade-off here.

Respondent: Yes, we are not the largest freight forwarder in the world, but in Norway we are among the larger players, if you consider Scandinavian Shipping as one group, but globally, yes, we are just a small player.

Respondent: One of the benefits that we have, and that goes for all our offices, is that we are close to the harbor, close to the customers and close to the partners operating in the harbor. It is our philosophy to be local player.

Respondent: Customers are important, but having carriers and container operators here is also an advantage, because we handle our competitors' freight, too. We handle their vessel, we deliver their containers, we have depot for their containers, so our strategy is to always be directly involved in the terminal operation because that is very important to us, unlike other freight forwarders, which are usually not involved in terminal operations at all.

Respondent: So we foresee that we in the future may have competitors next to us here that we are doing business with, as stevedores, while at the same time we are competing for customers. I think that having all services gives us a special package that others don't have.

Interviewer: That is an interesting concept, and it is not uncommon in other industries, where business compete on design and solution, but cooperate on standard solutions, like in the automotive industry.

Respondent: We use that idea in a project to attract more feeder operators to D. D port has initialized a networking project, which we are part of.

Respondent: The port of D, together with the local business chamber and X business school have recently started a logistics network, which currently counts more than Y members, and which meets Z times per year, where we discuss current projects, share our experiences, build relations and where we look at specific services and products. I think that is the way to do it, by engaging the customers and freight owners directly, because after all, they are the ones that are shaping the business we are in.

Respondent: When we have a meeting with the feeder operators they are always asking "Where is the cargo? What are the cargo owners saying? You are coming to us as a freight forwarder, asking ask to come with a vessel, but what kind of volumes are there?" So within this network we have established a project with the aim to have a feeder operator come to D, and we have a mandate from the exporters and importers with their volumes to negotiate with the feeder lines. So we are now collecting information from the various members of the network, where they give us a mandate to use their volumes in the discussions with the feeder operator. They (the exporters/importers) are saying that if the feeder line decides to come to D they will use this feeder line instead of Oslo, as long as the terms and conditions are the same as for Oslo. The ocean carriers offering rates to the Oslo region have same the rate to X, Y and Z, and the idea is to have D included in the same rate. The feeder operators are then likely to use D instead of Oslo, and they may lose some cargo (because their Oslo customers may not wish to use D and they may win new customers (because some potential customers may wish to use D rather than Oslo, if they have the choice). How we play this in the negotiations is very important. Obviously, they are not very happy with adding another port in the Oslofjord region, but they are afraid that they may lose volumes if they

do not consider D as an option, because if they do decide to call in D they may actually get some Y TEUs more in and out of this region; those are extra volumes currently not handled by sea transport.

Interviewer: Is that overseas or short sea? Could something similar be done for short sea?

Respondent: That is overseas. For D it is either short sea or road transport, so yes, it could be done for short sea, it is a huge market with huge opportunities and this is question we ask ourselves every day, and we work with the short sea market in the same way as we do with the deep sea market.

Respondent: This is a part of the project, although the main focus is to have a feeder line. We already have short sea today, so the first task is to increase the volumes and to see which customers that would have benefits from looking at an intermodal solution.

Respondent: Some of the feeder carriers have also begun to turn their attention to the short sea market. Y shipping line for instance has their own short sea product and they have an explicit target to grow in that market.

Interviewer: Are they using the same vessel for that?

Respondent: Yes, same vessel and same containers.

Respondent: I think this way of working is very interesting, because you get feedback from the companies in the network, and we also have the knowledge and competence that the business school provides and by linking this together many ideas come up about how and what these customers can do together to develop more sea transport.

Respondent: This feeder project involves our major customers, we're in, of course, and so is another freight forwarder. CargoNet is also part of the project, and so is the port of D, so it is quite a huge group that can hopefully put enough pressure on the feeder lines to make them see that D is a very good solution for taking goods in and out of the Oslofjord region.

Respondent: So the aim of the project is to have a solution ready this year, and hopefully start up with a feeder sometime next year. The simple reason for doing this is that we need to work with the customers and with the port authorities to develop a product, because the large carriers don't come to us by themselves, so we really need to do something to be attractive.

Respondent: So this project is in fact an intermodal project. You link the overseas lines to feeders that come to D, here there is a link to railway or road transport, so we have all three transport modes, and we even link deep sea and short sea.

Respondent: One issue we think is important within this project is the difference in external conditions for competition between road and sea transport. To succeed with intermodal transport, road and sea transport must compete on equal ground. They don't do that today. That is why the conclusions and recommendations in the Sitma-report on "Hvordan styrke sjøtransportens konkurransevne?" are important for developing good intermodal solutions. There is a lot of talk, but very little action. For instance, for a short sea ship calling at one port in Norway, no NOx-fee has to be paid, but if you call at three harbor you have to pay a NOx-fee between harbors. (Description of ports with and without piloting). There many small things like this that distorts competition, and we need to highlight these issues in order to make sea transport more competitive. That is why we will present the report in our network meetings and discuss what to do about it and how we can raise the attention of those in charge of our legal and competitive framework.

Interviewer: It is very interesting to learn how you work with your customers and the freight owners, and how you make them commit to shipping a certain volume, because that is – as you have mentioned – the eternal problem, namely the question: "Where is the cargo?"

Respondent: We think this project is based on fertile ground, because we as a freight forwarder have a common interest with the freight owner, the freight forwarders, the port authorities and that is to increase the goods that is sent via the quay here in D. In order to do this we need to know the volumes, and that implies that the freight owners must commit to using a transport solution that is linked through D. Essentially they commit to saying that "Our freight is shipped via D – not Oslo". With this commitment we are then able to negotiate with the feeder lines, and they listen to us much more carefully than if we were doing this alone. The fact that we are acting on behalf of a larger group is a decisive factor.

Respondent: The fact that we can also offer storage and warehousing is another positive factor for us.

Respondent: We have worked hard to get where we are, and we still have a long way to go to make D a real alternative, but we see that there is an increasing demand for D as a port, and we need to build on this demand and develop it further with the freight owners. While the freight owners' job is to bring the cargo volumes to the table, our job is to ensure that we have the capacity and capability to handle this volume. In cooperation we make can this work, and the more companies that start using D, the more companies will follow.

Respondent: This is independent of cargo volumes or size of the company or whether they have long-term contracts with their selected freight forwarder. Our job is to sell D as an intermodal hub and as *the* local port for local businesses. Being such an integral part of the port infrastructure as we are it is our job to promote the port; if we can attract more business to ourselves, that is an added bonus, but the primary focus is to increase the shipping our more goods via D. We would love businesses to use us as their forwarder, but more important is to have the freight owner tell their forwarders to use D.

Respondent: What we have that Oslo has not is space. In Oslo the containers must leave the port area immediately, there is no space for storing them, that is why storing the containers is very expensive in Oslo. We have more than enough space. For instance, if a freight owner receives too much goods in one shipment, part of this can be stored here, at a much lower rate than in Oslo.

Respondent: We are in fact using this as our competitive advantage in the project, explicitly stating that we have short-term storage space, at a much lower rate than the other ports in this area. This could be for customers with seasonal products, or customers with limited storage facilities, and we even a local customer who switched to using sea transport for the reason of having a storage facility, from where the goods can be called according to demand. We think that this adds even more value to our intermodal solution.

Interviewer: How important are environmental issues in selling your services, for example when you talk about competing with road transport?

Respondent: My impression is that environmental issues are cared about as long as it doesn't cost more. Admittedly, "carbon footprint" is the current buzzword in the transportation business and we need to think about it, but in the end it appears that saving money is better argument for our customers than saving the environment. We have approached one locally-based company Y who we thought would care about the environment as part of their brand identity, and thus would want to land the containers in D, near their facilities, but they still prefer to land them in Oslo, and haul them by truck to D. So while we use the environment as part of our selling arguments, it's usually not the environment factor that wins the case, it's the cost factor. We experience that our customers to take environmental issues into account, but it's not a decisive factor and not the first among many factors. We use it as best we can, because we agree that it is important to land the goods at a port as close to the destination as possible rather than to haul it by truck across the border, involving hundreds of kilometers of road transport.

Interviewer: You mentioned that you have space for storage. Do you own these areas?

Respondent: The port of D owns the area, we only have a long-term lease. We have a current lease for parts of the port area, and we have an option to lease more if needed.

Interviewer: So agreeing on storage space for containers with the customer is a matter between you and the customer, without the port as a third party?

Respondent: Yes, it is part of the contract between us as the stevedore and vessel owner or the customer, and we are free to use the leased port area as we see fit, as long as we stay within HES and other port regulations.

Respondent: We are also barred for using the area for non-port related activities: We cannot use the space for cross-docking road transport, e.g. only trucks going in and out; the goods we handle must arrive or leave via the quay.

Respondent: The development plans for the port has designated some areas as industrial zones or business zones. The idea is to attract businesses to establish their facilities as close to the port as possible, to take full advantage of intermodal transport. There are plans for establishing a new rail terminal at the port, and there is talk about moving some smaller terminals operated by other forwarders to the port.

Respondent: Because there is little activity at the moment and much unused space there is a lot of growth potential for the port of D. I think D and Y would be ideal as cargo hubs for Oslo, because Oslo has a very limited possibility for expansion.

Interviewer: Would it be possible to have a look at your strategy plans and/or business plans?

Respondent: Yes, subject to confidentiality of course. What you will find is that we operate differently from other forwarders, based on our location and involvement in port operations. We are currently expanding our staff to have more sales people so we can capture more of the market, while at the same time keeping in very close touch with our customers.

Interviewer: What is interesting about you is the close integration that you have with the port, and the way to work to increase the cargo volumes, which all say is very difficult, but where you apparently are succeeding, so from an academic point of view it would be interesting to see how this is reflected in your business plans.

Respondent: It should be noted that much of the success is due to the port authorities, who are extremely market-oriented and business-minded, accommodating and customer-oriented and actively take part in developing the harbor together with the port users. I don't think you will find many port authorities with a similar open-minded attitude, and it can be seen not only in their management, but with all their staff.

Respondent: Both the port owner and the board members are very active in seeking business opportunities, and we have worked with many of the senior management for years while they held other positions in the logistics industry. These close relationships and long-term networks have definitely been part of making D port (and us) what it is today.

Interviewer: In this research we are particularly interested in looking at drivers or barriers that hinder intermodal transport, or drivers that promote intermodal transport, and you are perhaps an excellent case of the latter.

Respondent: Yes, I think that we make an interesting case, especially the way we work across businesses, together with the port and the freight owners, and how we connect the players and cooperate on establishing an intermodal solution, so I think can be an example or a model that others can use.

Interviewer: Besides you and the port authorities, what customers should we talk to for learning more?

(Discussion about customers and other stakeholders)

Interviewer: Is there a particular customer that you have worked with and who made the switch?

Respondent: X company. We have an all-inclusive contract on all their logistics needs. The lease storage space from us, we have all goods pick-up from their suppliers, we stuff their containers, we ship them, we handle their inter-Asia logistics and more, so they are a very large customer, and a company which is likely to grow a lot in the future. In their contracts with shipyards all over the world they wish to use D as their hub.

Respondent: The freight owners are the key stakeholders in intermodal transport, much more than the freight forwarders, because they hold the goods and they decide which transport mode to use, and that is why the network is so important in exchanging experiences and highlighting what solutions that are available, what solutions that work, and what solutions that don't work.

Respondent: The network meets at various places and also visits companies, which is an excellent way of showing the different logistics solutions and learning from each other.

Respondent: Most importantly, the meetings are not meant to be a sales pitch for certain freight forwarders presenting their solutions, but for discussion professional and business-related logistics issues and how they were solved. We think this makes the meetings worth participating in, because they are about learning what others have done and make your own decisions, and not being talked into or persuaded into doing what others have done.

We have not spent too much time and efforts on meetings like this with you, but I do realize that we may have something to share that others can learn from, and we are happy to do that.

Speaking about the logistics network, there is even talk of establishing a guest professorship sponsored by the network, in order to spread our practical knowledge to future logistics students, because we see that academia needs more links with the logistics business, and hands-on logistical knowledge about how transportation operates.

Case 4: Public sector moderator

Interviewer: Earlier intermodal sea transport projects have been simplified, but you were at the outset: the idea was to charter a ship and to setup the service, with a separate new vessel

Respondent: The original attempt was to start both a Ro-Ro and Ro-Pax connection, both carrying both passengers and goods. And originally too it was supposed to be only once a week just to kind of start it off, and then they would see what would happen afterwards. And we have like tons of market research and all of those things. At the outset it was the businesses themselves that asked for it, it wasn't kind of us coming to them saying: this is a good idea. So it was kind of on-demand, but I don't think the industry themselves thought they had the capacity to actually start something like that: just one in one. They needed someone to coordinate it. So, that's why we went into the project, at first. That being said, business interest and municipality here have been working on establishing such a route for years and years. So, I think it's a more than ten year project before we came into it. That was like mid-90s- the start of it. And, when we were asked to join, that was before my time. They basically needed someone a bit heavier from public administration side, I think, to establish it as a more solid project. So, that's when we came in.

Interviewer: The first time I heard about was in this INTERREG project, from the Motorways of the Sea

Respondent: And Northern Maritime Corridor is probably what you have heard. Because that ran for two periods for the StratMoS as project, and we were in that part too of it. But it was only when we came into StratMoS, we kind of started narrowing it down and making it understandable, I think, to the region here. But a lot of work was done before we came in. I mean, Moregruppen, the company that was established to work with this, they did a lot of market research; they had connections out with the businesses. So, we kind of came in and started skimming the benefits from it and tried to pull together everything.

Interviewer: Because we note that this Moregruppen was actually part of the project that we are working in now. This project is called CA-Chains, it is a collaboration project between Molde and Gothenburg University. The Moregruppen was not a direct participant of the project, but they gave us a letter of intent that they would be willing to share information and their experiences with this process of creating kind or acting as a coordinator to get the service going. And then Moregruppen has ceased to exist?

Respondent: Well, technically they have, I don't know quite the formalities around. But they are out of StratMoS project as it is now. But they did a lot of work in the first years in StratMoS too together with us, but now for the final part. They don't exist anymore.

Interviewer: So, they idea of this project is try to get a deeper insight into processes, behind into slightly different initiatives. Where a big cargo owner can take an initiative, may be get others involved and set up a service. Like what Norske Skog tried in the nineties, perhaps it is easier to see such initiatives in Sweden than here - because of the size of things. Second group is where an agent like for instance XXX or you as a coordinator here takes an initiative, tries to merge the needs of different customers. So the headline is how can an intermodal solution been brought to the air and be successful. And then it's also important, to learn about initiatives that have failed or transformed into something else. So what is the story about this project and in detail: who were suppliers, anything about contracts, the volumes or the rates etc.

Respondent: Yes, I don't know where you want me to start... Just I take that first, when it comes to the actual figures, you can have them after- I can send them to you. And kind of taking it from the opposite end: what we found out is that we cannot really sit down and put down those figures for the industry ourselves. What our role now is, is to out operators and logistics companies in direct touch with end users- so kind of that's the learning from the end of this project and that's what we are doing now, in Y in particular. Because we see, no matter how many public or private companies are in this and no matter how much we want this to happen, we just need to put the guy who can provide it with the guy who wants it. Get them around the same table. One needs to bring the figures: how much can we get on your ship, the other needs to say that is going to cost you this and

this. Because we tried doing it the other way: just sit with operators and try to kind of fish out of them “ what do you think this is going to cost” and they are like: “well, it could cost this and this... do you have the figures from the fish farmers?” (which is like the main customer in this case). And we are like: “yeah, we have roughly...”. They need to say: “we are going to out this much amount on your ship from day one” and then you can have a price. And I think it’s also easier for them to kind of lower their demands and expectations when they speak to each other. So, that’s the process we are in now up in Y. That being said, we have had meeting with fish farmers: the N major and it has been a (year of break through regarding the information flow). (...) But now apparently something has happened and the thing about maritime transport corridors: like everything is coming to media, it is coming into documents, they are hearing about it and then realizing what costs are coming up on road transport... We don’t have trains in this area, but we do have the sea. So we had a meeting with them on the 1st of Y, I think it was, and the companies’ representatives sat around the same table and they said: “basically we are willing to kind of pool our products to make this happen if you think that this is feasible”. And that was a bit of a breakthrough, we think. And they kept in touch and they are still interested and operators are now starting to kind of log on. We have several operators now that are kind of interested, they are like: “can we put our ship up there and just kind of see what happens”.

Interviewer: Are they some of the existing operators that have experience with this kind of waters...

Respondent: Well, the thing is, even if there are existing operators, this is a different type of transportation: being fresh fish and the way of getting it on the boat too. They need a special ro-ro ramp in the port. And that is one of the main tasks for the coastal port of Hitra: to actually put down the infrastructure and that’s also partly what we are helping them with.

Interviewer: That’s interesting. How do they fund that?

Respondent: This is the Y. They are out now looking for funding and more than that I can’t say. (...) But for our county and our industry- this is very interesting, because when we look at our market research: and look at who can put goods on this ship, the industry on X and Y are key to actually establishing the route, then can look at smaller businesses further down that can actually hook on to it. So that’s the learning in it all, that we just need to get 2 or 3 major ones into it, we need to put them in direct touch with operators and both parties are now interested. And then we can do our work: informing the local businesses and the more international businesses. Here in Z we have the oil and gas industry and they ship a lot of stuff. And it’s all kind of a mental exercise, I think, for a lot of companies: thinking that when we have a car or a truck, we can just fill it and then it goes, whereas boat for the fish farmers: they need to rethink the whole process: like “when do we actually start the process”, how long can they stay waiting – those kind of things. So, it’s like one of them said (and I don’t necessarily have to be quoted on this): (....)

Interviewer: How long is the lead time?

Respondent: It’s shorter than doing it by truck. I have the time schedule for you, so I can send that to you. So, it is shorter and also, and this we don’t know 100 %, we do believe that this is cheaper. But then again it depends on: can they actually coordinate their production, all of those N can they put it on the ship at the same time it leaves. And also: the ship leaves once a week, so if you are not done doing you stuff you are out of the boat. But we never intended this, in the county, to be... like this is going to be it. This is going to be a complementary service - we can’t take off all the trucks from roads anyway. Because there are still trucks going in other direction, there is a tiny bit on airplanes, there are some shipped into the train lines and then taken on rail, so it is a complementary service, but our hope is that it might reach like at least 30 or 40 %, that’s optimistic. But if we could cover that much, then they would still have the option to ship a lot of it by truck.

Interviewer: But the investments have not been made yet?

Respondent: In that one? Oh yes, they started. They have started building the port. They are actually now part of the (...). That’s also what I heard about this: they had been in touch with the bigger port in B and didn’t get any feedback on it. And another port here was very eager to cooperate.

Interviewer: but how about the contracts, if any? I think people can express interest, they can say we have volumes and we have good intentions, and then somebody else takes on all the investments, because they don’t engage in that process... There are some stories about such things:

when it comes to it, it can be difficult to actually make it happen. So, how much and to what extent they have committed themselves to it?

Respondent: They haven't signed any contracts. And I think it is unlikely that they will until they are actually sitting down with the operator. I don't think they will sign any contracts with us or with anyone else, they are going to do a direct, from logistics point of view, which I think is correct. I don't think it is our role. But, that being said, they are investing. I don't know how much I can say about that (...).

Interviewer: Alright, so there are specific investments in the area. They are investing with the main objective to use this service....

Respondent: To use that. So, that is interesting and that is very new, because earlier they were like: "we are on that place and this is on that and we have to pull the trucks to get it down there".

If they were to be located on that place - to build the infrastructure there just to get it on the boat is nothing. And I think that's what they are seeing too.

Interviewer: So that's not a big issue?

Respondent: No, it doesn't seem like a big issue. But they haven't signed anything as I know. But the area is now being regulated as we speak: I think it was in July-August it was supposed to be finished. So it has been regulated. And also we have had meeting with food authority in X and different people to check if they wanted to do that - is there a problem: is there any risk of infections going across having the 2 major operators here. And they were just like: "no, that's something we can work around, that's possible". It's is kind of unique that to...

Interviewer: but the investments that they are making, let's say if this fails, these investments can be used anyway for other purposes, or?

Respondent: well, you mean about the moving? They, in any case, 2 of them have to expand anyway. So they are looking for a new area. They are not moving their farming, they are moving their processing. So, I think they have assessed that, but, I don't know how close they are to actually deciding on this is what they are doing. But, what is good now, is that when we are kind of letting a bit go of this, now that the project is ending in September, Y municipality is taking it on full time, and they have a much closer connection with the industry. They have very high standing... They have basically shown a lot of ability to actually run this project onwards. And, I mean, they are investing a lot of money in that area. They have great belief that this is one of the key aspects of kind of developing their businesses.

And also connected to this, that's kind of a side thing, if you look cross the fjord, you have M municipality and they are planning to re-establish a ferry that goes in-between there

Interviewer: I know, they have been considering that...

Respondent: Yes, the battery ferry. The battery ferry is completely a new unfolding for us: re-establishing the ferry route wasn't that popular with the county when it was put down the last time. And we still have a lot of history with that. We are not re-establishing that because we have a politician saying: "we are not going to do that ferry, there is a tunnel. That is what we are going for." But, bringing the battery into the whole matter, makes it completely a new thing - makes it an environmental project, that's one thing. But the other thing is that: if that can't be used on that particular stretch, it can be used in other places. So they have actually got funding for the pre-project.

It is an interesting project and we as a county are seeing it kind of all in frame. But also I know that X is looking at that – they are kind of posting that as a pre for the port, because they don't have enough people as it is, the industry don't have enough people – they are importing workers from everywhere, they have completely blown out the labour market there- they don't have any more to take. So, it is more than just establishing a ferry route for the county: it is expanding the living and work space.

Interviewer: You mentioned that service from X - with the big players up there, would open up for landings down the coast line to pick up other kinds of cargo... Is it possible to have other kinds of cargo on board?

Respondent: yes, you can combine. We have now even little bulk boats interested in carrying containers up or down because they have free space on deck. But these ro-ro vessels can take other types... it is just a matter of technology. And we have heard that it is possible..

Interviewer: But would that be critical for success?

Respondent: Get more people on board? I think it is possible to run it with those Y larger companies- that one route or one boat per week. But, if we want to do more, then we need to get more on board and I don't think that's impossible. I think that once people see that it starts running..

I don't know if you have talked to consolidator C, because we went to their meeting when they started the route Q, which was quite interesting to us, because we haven't heard anything about it - it was like kept a lid on until they started, which is smart, I think. So we are in discussions with them too, because if we can combine something, like to coordinate the existing routes (they is quite a lot going on ships anyways), or to get new people into it. I mean, just think about the car industry, if they are exporting cars, they could get them up by boat. It doesn't necessarily have to take longer time either. So, I think it is key important to start more routes, but it is not necessarily the key to keep this one running. But then all X companies would have to do that, it is not enough that X-1 of them do it. They really need to pool their sources.

Interviewer: How much it has been an issue that they are the same industry, competitors sitting around the same table?

Respondent: It was a big issue earlier, I think. They didn't necessarily even consider cooperating. But I think also when they realized... we are throwing the environmental aspect at them all the time. But, in the end of the day, costs mean more. That's how it is. But, what we see is that if we can point to: "you know what, this is environmentally friendly that is going to matter to your bottom line, that is going to matter for you financially, because it is going to be more expensive to transport your goods by road come 10-15 years". Also, if you can use LNG ships, which is of course also one of our main things, that's going to make it even better. So, I think when you can show them it is financially more beneficial, they will do it. And then they will do it in spite of their competitors doing it.

Interviewer: You don't need any new vessels here, the vessel are in place?

Respondent: You can use existing vessels, but our hope is... Also, the shipping building industry is not so bad at the moment either, it was pretty bad few years ago when we started looking at this. Prices have dropped there too. I also think that's why reasonably many operators are interested. Because they have ships available that are not running in other areas. And now they want to kind of look into: is this something we can do. So that's interesting.

Interviewer: How much the shipping lines are concerned about sort of balancing the flow, running it empty the other way?

Respondent: Of course they are interested in return cargo, but that is also one of the other projects we are looking into with Chalmers: looking at whether or not we can get fruits and vegetables and all those fresh goods up here on return, which is also possible. And then you would probably sue the same cooling technology that you need for the fresh fish. We have estimated that I guess we have around 10 %, when we start. But then we need to build that up or the operators need to build that up, but then our task would be to help them to get in touch with right people there.

We have very good connections with Zeebrugge, both with the heads of departments there and also quite a few of the businesses down there. And they are very interested, they are looking into whether this is the new way to Norway or actually into mid-Scandinavia kind of, because they are looking at central Sweden too.

Interviewer: But you might think in terms of risk here: if there is a road block that might affect some of your trucks, but not the whole ship-load, right? But if you have something going wrong with this ship, then that would affect serious amounts of cargo, cause serious amounts of damage. How has that been addressed?

Respondent: Well, they have certainly raised the issue. But how often do you see a whole ship go down or...

Interviewer: But even a delay of one day...

Respondent: Well, we have one day, so that's the good thing. Of course they have raised that issue, but what we are saying is that: "look at the risk you face carrying it on trucks and take that out of

this project” - it kind of evens out, because during winter time they have... I don't know how many percentage they actually have to just throw away of that cargo they are bringing down because the trucks are just like spread out, also they get stopped at the boarder: Germany, at the borders everywhere down, they can get stuck down in Oslo – they can't get though, so summing that up, there is still a lot of risk putting it on truck.

Interviewer: Has it been assessed?

Respondent: No, I don't think so, actually I don't think so, we have exact figures on it. That is one of the things that X now is addressing actually: looking at the cargo flows, looking at how much actually gets down there on time and what are the bottlenecks in our area and further down, the whole way. So I think that in the market research they did in the beginning of the project: was more like how much can you put on this and so forth. But not so much on how much are you today risking carrying it on truck. So that is interesting..

Interviewer: Because that has been an issue in other cases...

Respondent: But then we also dropped the speed of the boat. There are quite a lot of changes in it when it comes to fuel prices rising some years back. It was completely out of the question to carry passengers and to use the speed boats and also we have seen some pretty disastrous speed boat projects over the years. So that kind of lowers the risk something going wrong to carrying it on about 20-22 knots, I think...

Interviewer: Is that the speed now?

Respondent: I think that's about the speed, I can check it out. And they are stilling making it down there on time, so... And also I think that even when we carry it down there on the return there has been some questions on whether or not we can go in though **Stavanger** and pick something up and then go up here: which would do something for our return cargo, because then you have the oil and gas industry.

The good thing is, X and Y is in the port here, because coming into Z and taking on goods here – there is no NO_x payments for that, because it is within the same port, which makes it a bit easier. I think the port here has addressed quite a lot of those issues: what are the port fees, how much you need to pay if you are outside of the port district.

Interviewer: How has the choice been made on the port down in Europe?

Respondent: Well, originally we were supposed go in through **Rosyth** and we were supposed to go through further south in England and **Shetland** was one of the ports, but I think that Zeebrugge has kind of introduced themselves: they are very interested in this route and they have been looking into a way to central Norway for quite a while - a new route. And our connection there, he keeps calling and he is on the project, which has made it very easy for us to cooperate with him, but of course, in StatMoS project we have the port of Amsterdam, port of Hamburg, we have all those. The thing about Zeebrugge is that they have available capacity and they are a good way of getting in to central Europe. So, I wouldn't say it is random, it is most definitely a very well thought through partner..

Interviewer: Zeebrugge is in a way a very lean port: it is not too big...

Respondent: It is... And also they put a lot of time and effort into this project, which makes it easier for us, but at the same time they are so big that they are serious...

Interviewer: Yes, they are. And if you talk about shipping cars: I mean Zeebrugge is a good place to be?

Respondent: Yes, very interesting. We have been down there too to look at their storage - we have a lot to learn. What is also interesting about Zeebrugge is that when we had a meeting with the head of the port, he was saying: “you know what, you have done this project for what? About 10 years? It has taken us tens and twenties of years to build this port – don't think that you can't do it- just think that these things take time”. Because as we are talking about companies: questioning “what is the risk?” - everyone does that! Everyone who is not used to using maritime transport does that. You know, it is a change of mind kind of. So that was quite encouraging.

So it is interesting to work with a port that is, but is so down-to-earth that they can still say: “we have been there”.

Interviewer: But have you considered trying, I don't know if that's a good idea at all, but there is a lot of dried cod fish going from Northern Norway, passing Trondheim, on truck to Italy and Southern Europe. There is a quite a lot of money involved in that trade and everything is shipped on truck, to my knowledge at least. And that is a kind of cargo that is not that fragile, when it comes to lead time.

Respondent: But from here it is shipped by boat...

Interviewer: But from up North it is not...

Respondent: there are a quite a few partners in StratMoS project, who are very interested in this route too, because if they can hook on: either if they can hook on though driving up from Z to X and just getting on there or if they can actually put it on the boat and connect and kind of re-stack them-put in on the next boat. I think that's very interesting.

And also actually, but that's a different project now, but if you look at the port in R, that's also part of this...What is interesting about that port is that they have a lot of trade with Sweden and they want to do, kind of on a smaller scale, the same thing with getting cargo into Sweden and out of Sweden.

Interviewer: What sort of cargo?

Respondent: I think it is timber, quite a lot of timber. And they see: it is a little bit funny. Not funny for port of Z. There are smaller ports now looking at these issues and trying to pool their knowledge and know-how and actually establishing little hubs. And also to put a lot of time and effort into this. And they actually have a more of natural or geographical benefit than the port of Z has, because it takes so much more time... We have been talking to operators and they say: "if it is on X - that's fine, if it's in Z - no, we can't do it". It's too long, we can't go in there. They spend too much fuel and time.

Interviewer: Yes, it is a natural facility that sort of makes this possible.

Respondent: It's just an anecdote, but it is interesting to hear how different smaller ports are now thinking...

Interviewer: Yes, but in R in connection with this project..

Respondent: It's not a competition really, because it's completely different goods.

Interviewer: But what about this X and the reason why that project sort of failed... To start with, what is the main reason it didn't work out?

Respondent: [more confidential, funding stranded etc]

Interviewer: So what you do is you do a lot of the initial work, that is one way of covering the fixed costs, because they need to be taken anyway and they are just completely written off. They are not able to recover them anyway... so that's one way, one role. But, the construction of these facilities that needs to be done, are they taken by the local municipality?

Respondent: Well they are taken though the port, because what I mean, they are not part of the port.... So parts of it are taken directly through the port here and then municipality of course is paying the research and the market analysis- all those things. Plus, they are very well connected with the want to establish base there. And what we hear is that we have companies who work with packaging, big ones, we have big transport companies- there are big actors who want to just literally move out there and say: "we want to have our head office there". We also have people in Z, who say that: "you know, rather than sending this on truck or on rail, we just want to drive it to X, put it on the boat"- which is also interesting because it takes them about 2 hours to get out there, may be a little bit more, but apparently it is still interesting for them..

Interviewer: And there are also some discussions on improving the road standard.

Respondent: That's definitely on the County's planning for the next I don't know how many years. We are actually in conversation with them about that now, because there is kind of mid-Norway transport group with the counties and the different municipalities. And that definitely is one of the priorities.

Interviewer: Would it be investments for others, if you are going to have some stops in between? Would it be necessary to make investment like that along the coast line? Do they have the facilities?

Respondent: Well, one of the things that we are trying to say is that we want the hubs, we don't want to go through all the local ports. We want them to, if something is being loaded, they have to come to this place- but for us as a county, we need to think: "ok, how is the infrastructure? Can we create like a dry port, instead of creating like a new port- how can we do that?". Here in Y, they are

building a new port further in here, I don't think it is a massive investment. They have everything in place, that's not an issue at all.

Interviewer: T is also interesting, because they have a lot of relevant industry as well..

Respondent: Yes, all the way down you have very interesting spots, but what we said- we need to start from A to B, then we can start looking at the other options. And also, of course the port and other authorities are working up to the national level to look at the costs. Norway is like the backwards country when it comes to how much you have to pay and also if you are comparing using a boat compared to using trucks- I mean, nobody has to pay for using the roads, where do you see a truck driver from a different country or company, driving through Norway, and he has to pay a fee or something? No, they don't! But you have to pay a fee to actually use the port.

Interviewer: How much of that is central decision on level of the fees and how much is local decision?

Respondent: Well, most of it is central. And it ends up with the port trying the lower their own fees to ensure that new business comes in. So, there is something there and I know that they desperately want to have it in the NTP, so that they can actually... so it's there in writing and they can start leaning on that. The national authority still says that it is a priority to shift cargo, have a mode shift, but they don't necessarily do that much about it.

Interviewer: Perhaps not... but that we know for sure, the interesting question then is why don't they do that?

Respondent: I don't think they see... until we... we are saying that we want to establish this, then we show them exactly how much we are actually taking of the roads, what that in real life means for the congestion down in the Oslo area for the use of the roads. They can spend their money doing other things on the infrastructure instead of fixing the roads at all times, because you won't have that many trucks on them. Because I mean they are prioritizing the rail, they are trying to spend more money there, but I don't think they necessarily see that we are a coastal country- that is out top benefit, that's where we can compete, at least the businesses along the coast line. So I don't quite know why- we probably haven't been good enough on the county side either: we have tried meetings and we are getting switched from one department to the other: going to the transport- "no, you have to go to the environmental, no to the coast, no you have to go to businesses"

Interviewer: There is some path dependency here, because we have the inbound influx of cargo going to Oslo, so it is a question of direction of balance...

Respondent: yes, most of it goes there, but most of the export..

Interviewer: ...goes from here, so to balance the flow is a kind of an incentive, market-driven, to go through Oslo that has been the traditional story, at least. And then it is interesting to hear the story about how you struggle to balance the flows up here by bringing food and stuff in, which is also the idea behind the Norske Skog attempt some years back with COOP and REMA at the time, because that is obviously necessary for a viable service... to be able to balance.

But the ro-pax attempt: one obstacle was the operator, at least in the Marco Polo – how they considered it. It is likely that that was an issue. But you say that now you can operate this on a commercial basis, based on these X big companies, but in the initial case – there was not a possibility there to just do this without any kind of support from Malco Polo or others?

Respondent: Well, I think it was if we had a big enough operator, but I think from the outset, the project was kind of targeted as dependent of external funding.

Interviewer: But could you have set up the service between (...) without this EU funding? Trying to merge the needs and get it going without – would that have been possible?

Respondent: It would have been possible if we had a big operator, but at that time the prices were not the same, the available ships were not the same, the interest was not the same, even the end-user wasn't there...

Interviewer: But did you have big enough players in terms of cargo owners?

Respondent: Here?

Interviewer: Or in the area...

Respondent: Well, combining it with X...

Interviewer: Was that in the project at the time: combining it with X?

Respondent: I think it might have been, but it wasn't that much focused on. So when we started doing our new: we had to entirely remake our analysis on industry (...). And when we saw them, it was like: of course, we need to have a departure up there in connection to the one down here, but I think originally it was business interest and public interest here, they were not thinking about X in that way. They might have been thinking that way: getting their trucks down here, I don't know how that was, but it has become clearer and clearer that we need to have a departure with the boat up there. Also one part of the process was that: they were talking about- one reason why a ferry across would be important – was to carry the cargo and by truck, through that ferry, and through the next one down here onto the boat before they could actually develop something up there. But that was just like an intermediate stage and now when they are actually starting to build that's not necessary.

Interviewer: What about: when would it be finished?

Respondent: The port? Well, it is started, I think they are looking at maybe a year, or year and a half- then they have the infrastructure, but we are also (this might of some internal info), they are building something here now. This is the area that the port is discussing whether or not they should put their ro-ro ramp on. But in our final meeting in X, we were discussing, if this is what they are building now, to make sure that we can actually establish this route as quick as possible, why not we just combine that, why not we go a little bit more out there (there is space, that is not a problem). Plus, this is the area where the fish farmers are interested of. We were thinking- it is easy to be closer to them, but this is not far away.

Interviewer: So conflicts of interest?

Respondent: So I think that is going to ensure that it starts earlier than it actually would be possible if it was built there. So I think that's probably the time scale. I am so afraid to say that, because I know that so many people have been out in the meetings, so many people have been saying "we are starting in a year or 2 years".. I would give it a couple of years, before it is up and running.

Interviewer: Have there been some opponents to this? Who say this is not going to work or we are not interested or any conflicts around this?

Respondent: Well, not from the businesses and the operator side. No. Nobody has said that is just not doable. We have heard it from the port of Trondheim of course, several times and we keep hearing it. But what we are thinking: we know it is possible, we know we have the right people in it now, when it starts it is just going to go without saying- this works.

Interviewer: Is it possible to get access to numbers on investments?

Respondent: On this development? I will check out what you can get, because I am sure you can get quite a lot of it, because of what the port is doing.

Interviewer: with that project and also the market considerations around it – it is very interesting to have access to it.

Respondent: I haven't given all my information to you, I do have the figures from the industry, but it is nothing I can release. It is such a leap of faith that they actually came in. They were actually sitting in the same room and saying: this is how much, these are our numbers. And their opponents were sitting there and doing the same thing. We were just going" oh my god, what is happening". But I mean, you don't have to though that much material to understand how much volume actually..

Interviewer: and you could get quite good statistics by just examining the annual reports

Respondent: Yes of course, what you wouldn't get from this: the split on where they go, what happens along the way, does it shift at some stage. And that's also one of the interesting things X is looking into: how do they actually do this? How much in fact goes on truck, how much goes on truck and then on plane? Where does it shift? Where are the bottlenecks?

Respondent: Because what we are doing now: writing up the final report for the StratMoS and we have like tons of reports, it will also go public when the final report comes out. But what I can do, I can send you the market analysis that I have now and then I will send you information on where to find the final reports and everything.

Interviewer: Another sort of question, because you have been kind of a coordinating party in the development process. Now when they switch from a road-based solution to a more complicated (intermodal) solution there are more stages, more parties to coordinate, more contracts, has any logistics provider evolved into an integrating agent, as they also need distribution in Western Europe etc. Has anybody been interested to take that role as an integrator?

Respondent: Yes, they have. I am not too familiar with the terms of it all, but we have like larger ones, I don't know if bring counts as one of them? But they are very interested and they saying we are already in the area, we are interested in doing this. But there are several others and also international ones and in Zeebrugge, our port contact is saying: they are asking about you: "when can we start distributing from there?". If it ends up getting to the market earlier, of course that also raises the product price. But yes, there have been all sorts of interested parties: both in logistics and operators. But I think at the end of the day I see that our role has been mainly to actually coordinate and it will be. Because I mean, even if we are going of the StratMoS project now, the county still has vested interest in this. So, our transport department and one of the guys taking on my job - we are kind of connecting them into the project, because it would be such a shame if this actually came into place and at the end of the day nobody actually knew that we had anything to do with it. But also for our own sake, we need to keep this knowledge in the county: we need to know what happened when that project started, what was the project, if we are doing this again- how can we make it faster in time...

Respondent: But still we need to think what is now left for this to actually happen and we come down to the same answer: we need to get around the same table: the operators and the food producers, make them find some kind of figures that suit everyone also for return cargo.

Interviewer: So when have you succeeded to get the representatives around the same table and also their customers, have the customers been active participants? Have they been part of this project?

Respondent: Not really, not that much. I don't think they really care as long as the cargo comes through.

Interviewer: They don't normally, unless it affects their logistics systems in some way or another.

Respondent: Yes, that's true, because most of the logistics is outsourced. I am sure it would be interesting for them and I am sure risk analysis would help to ease their mind on it. But as I have understood it from the companies here: that is not an obstacle for them to actually try this route, at the outset at least.

Case 5: Durable consumer goods manufacturer

Respondent: Between X and Y% of our shipments are sent by ship from Y. The last week before the summer holiday we shipped Z containers to (... and ... and...)

Respondent: The feeder boat picks them up ... and takes them to Rotterdam. We have a contract with consolidator C, who is our broker and obviously who has many subcontractors. For us it is important that all containers going to the same destination arrive simultaneously. If there isn't enough space on one ship, we need to ensure there is another ship that can take the rest and still arrive at the same time. That is why we use a broker instead of contracting with the shipping lines directly, which means that the shipment can be distributed to any ship that is available.

Respondent: I think we're too small to ask the shipping lines directly, we simply don't have the volume.

Interviewer: But you could have used a truck to Rotterdam?

Respondent: Yes we could, but that would mean that we would have to use a lot of trucks, and we would need to rent storage space in Rotterdam, and that would be a lot more costly. Another option could be to use the roro-projects that come up every now and then, where someone comes up with the idea of sending huge volumes by ship to Europe, and while the business community is eager to establish the project, it usually falls apart before it can begin because there simply isn't enough cargo to make it worthwhile.

Besides, we have and the feeder ships arrive several times per week, so road transport has never been of much of interest to us. Not all operate in cooperation with C, the ship to the UK is linked to consolidator B, others again are connected with consolidator D, because we don't want to put all our eggs in one basket.

Interviewer: So what other cargo that is on the ship or who else uses it is not your concern?

Respondent: No, not as long as we have load carriers designated for our furniture haulage. We mainly use containers and we only want our furniture to be in that container. That is our main concern and that is why stuffing the container correctly is important.

Respondent: Not all our suppliers are good at stuffing the containers. For wood and plywood we use selected suppliers that pack and protect the material so there is minimal breakage. Not only must the individual materials be packed well, the container they are shipped in must also be stuffed well. We have huge problems with our Y suppliers of Z, where packing and stuffing is not done well and where much appears to be haphazardly thrown together, resulting in too much empty space inside the container. Add to that, they use inferior materials for their crates, which not only creates breakage inside the container during transport, but especially when we try to unload them. So that is an issue we are working very hard on, but which we seem unable to solve. One reason may be that they pay for shipping to the Y border, while we pay for hauling the container to Norway.

Respondent: For instance, we are about to start a new fabric in X around November 1st, where we will ship containers with parts for assembly there, and we have initiated specific optimization projects for looking at how we can utilize all the space in the containers, because this utilization mindset is part of our business culture. The same goes for the semi-trailers we send from here.

Respondent: Last year we sent XXXX trailers to Hamburg, which is our facility for consolidating loads for Central and Southern Europe, and since we pay per trailer or container, we really need to maximize the usage. Unfortunately the Ys don't seem to have the same mindset.

Respondent: Interestingly, we have very little problems with our South-American suppliers of Z, who ship some XX containers per month. Perhaps because they pay for shipping, but nonetheless, they appear to have the same mindset as us, where they seek to fully utilize the available space in a container, and stuff it as full as possible without compromising the quality of the product. Obviously, the more you can stuff into a single container, the more you can sell, and they appear to have realized that.

Respondent: On a side note, we use of Z per day.

Interviewer: How are they Ys getting away with this? After all, you have to bear the costs of their mishandling.

Respondent: Well, some are very accommodating and agree to improve and do so, while others seem to ignore our concerns. Unfortunately we cannot import our entire Z supplies from South America, because we need to guard against potential supply disruptions.

Respondent: Z is our most valuable raw material and we buy Z for XXX million NOK every year.

Respondent: Perhaps it is business culture, but the only option for us is to not use them and not buy from them anymore. There appears to be general business culture in the Y tanner industry that is not interested in listening to what the customer wants, and is primarily focused on saving their own expenses (hence the miserable crates and pallets), and doing things they way they are used to. Unfortunately we don't have many other options for our supplies.

We try to work with all our suppliers to make our needs and demands known, because that makes our production more efficient, if raw materials can be packaged and delivered in a certain way.

Interviewer: Are you cooperating with your competitor B on transport solutions?

Respondent: No, and it has never been up for discussion.

Respondent: We have had other companies asking us whether they can use To unload their goods, but we have declined that, because we need to focus on our own goods.

Interviewer: How do you negotiate the haulage rates?

Respondent: We negotiate the rates for the destinations we serve every three months. They may not change from time to time, but we always renegotiate.

Interviewer: In your impression, does the ship have a good utilization of its capacity?

Respondent: We normally have some 30 containers waiting to be loaded and the ship brings in plenty of empty containers, so as far as I can see, yes.

Interviewer: How was it during the financial crisis in 2008?

Respondent: We were largely unaffected and we didn't have any problems in getting supplies in, quite the opposite, our suppliers were perhaps more attentive to our wishes than before (and after). We did work four-day shifts instead of five-day shifts from December to March and while we produced less, we also did not end up with a large overstock, so basically we managed fine.

Interviewer: How about demand, does it change?

Respondent: Demand is very stable and predictable with little fluctuations. So it's easy to plan and volumes in and out stay the same.

Respondent: If I remember correctly we load YYYm3/day, in addition to another YYY that is internal.

Interviewer: In your quarterly negotiations, are they all about price, or other elements like leads time and stopover time at terminal etc.?

Respondent: It is part of the negotiations, but indirectly. Say, if we ask for a low price, we may end up with a ship that calls at many ports, which adds lead time, maybe too much, and in the next round of negotiations we need to address this issue. Because we are too small to have our own logistics manager, everything is outsourced so to speak, and that is why we have linked up with carriers that are "troubleshooters".

Interviewer: Do you experience disruptions or other incidents with your cargo. Obviously, everything is ready made here and then shipped in a container, so there are no assembly operations or processes en route to the destination?

Respondent: No, once it's in the container it's done. But we do have issues with the empty containers, which may be damaged when they arrive here, holes and such that need to be fixed. There could also be remnants of previous cargo, i.e. dirt, which means the container has to be cleaned first.

Respondent: We used to repair containers on site before, but then we also became responsible for any damages to due incomplete or inadequate repairs, so we now use a third part to do that, or we simply return the containers.

Interviewer: Have there been any major changes in your transportation in recent years?

Respondent: All cargo destined for Central and Southern Europe is now consolidated in XXX. Earlier it was trucked directly to the destination country, now it stops in Hamburg first. Our rates are based on volume, so the more we can ship to one customer in one shipment, the less we pay, and that is

the job of the consolidator. We've had sea transport for many years and other than those changes to road transport there have been little changes.

Interviewer: Would it be possible to ship to Hamburg by sea?

Respondent: We could, but we would lose flexibility and the lead time would be unacceptable. We did have a project with C some time back where we considered sending all our cargo by sea, but it was not viable, especially when it came to flexibility and lead time. If we could have a vessel departing every day, it could be possible, that is the frequency we need for our freight. We send X semi-trailers a day, so if we were to wait a week for a ship to collect the containers, add another week for arriving in Hamburg, add more time for sorting and consolidating and arriving at the destination, that would be an unacceptable level of service to our customers. Speaking of that, the Nordic market, Norway, Finland and Sweden are served directly by truck from here. While possible, I don't think a feeder line would be interested in coming here every day just to pick up a few containers, that would be too expensive for them.

Respondent: We're actually quite lucky to be large enough that we have ships calling at all. If not, they would call at X and haul our containers by truck.

Respondent: X port has approached us many times to have us use them for landing our containers, but that costs us some XXX NOK more per container, which adds up to a fairly large amount given our volume, so that is out of the question. Some of our customers, if they pay for freight themselves, may want to use X because they often don't realize that we have our very own port. And it is only us who use it.

Respondent: That said, we use X for shipping Z cuttings. While it would be possible to use the same vessel, it is more practical to haul it by truck to X. Besides, in this case, it is the customer who pays for the freight, so we will not gain any savings by sending it by ship.

Respondent: X port is very interested in our cargo, and if we were to become a part of X port, we would have to introduce fees, which we currently don't have, and that is to our advantage. We have enough volume for C to serve us, as well as consolidator B, and as long as the feeder lines are interested, we don't see any reason why we should start using X. Occasionally, if there are few containers we truck them to X. But usually the ships will call even if there is little freight going out.

Interviewer: You said that you were using road transport for the Nordic countries. Have you considered rail?

Respondent: Rail is not an option, because the customer needs to be very close to the rail terminal, otherwise there is too much cost in reloading and distribution. As it is now, the truck comes directly to the store. There is also no rail terminal close by in any case.

Respondent: Many of our trucks have the keys to the store and can deliver at any time, even outside working hours. We have use A Transport for many years and they have worked up a trust with the store owners, and there has never been any problem with that.

Respondent: Northern Norway is served by feeder boat or with the coastal express (Hurtigruten), because it is more practical: The towns are along the coast, it is very far to drive between and the weather in winter can be a problem.

Respondent: As to chemicals we use XXX tons/year. It arrives by sea in Oslo, comes to Y by rail, and by road to us. Our tanks can be served by ship, but we haven't used it.

Respondent: Admittedly, maybe it's because that is way we have always done it, but one reason for using road transport here is that the risk is offloaded to the operator until it is at our doorstep. We also don't want to have too much in store as part of our own risk management, which is why refilling by truck is more convenient.

Respondent: It is definitely more flexible to ship it by road, in case we need it quickly.

Respondent: Obviously, given our location, most incoming supplies can arrive by sea, and I agree that perhaps we could use sea transport more than we do, but because of longer lead times we don't consider it a viable option. That is important especially when it comes to chemicals we need in our manufacturing.

Respondent: We make good use of sea transport. For instance in many cases when we send containers with finished goods, the ship comes back with containers containing plywood, so in that case there is a good balance. The same goes for trucks to Hamburg. Much of the plywood comes

from X and Y and is taken to our consolidation warehouse, where the trucks take it back to us, so this we have a system for.

Interviewer: How about steel?

Respondent: Steel comes via boat and road. However, sending steel by boat is not a good option, because of possible corrosion, so we prefer road transport. The steel must be unblemished when it arrives, and that is why road is the best mode of transport. Currently we are using pre-cut lengths, but we are considering uncut lengths, which could increase incoming volume, and add production flexibility, and that would make sea transport a more viable option, although corrosion would still be an issue.

Interviewer: Is there a potential for improving your sea transport?

Respondent: Yes, some of the containers that currently arrive in X could have been delivered directly here.

Respondent: We have also thought about unloading incoming containers that arrive in Hamburg directly onto trucks and take them here, which could improve the flow balance for the trucks going to Hamburg. But since our containers arrive at various ports, not just Hamburg, they are difficult to collect and coordinate.

Respondent: Our internal transport has room for improvement. We have N manufacturing facilities for our different products and product components with flows of ... etc. between them. Coordinating these flows is complex task, and if say the road is closed to one of these facilities, production will come to a halt.

Respondent: Transport and logistics is not our core business, and that is why we have linked up with operators that understand what we do and the challenges we have, and who can solve any problems that occur.

Respondent: Logistics is a field that the ... industry has perhaps neglected earlier, but I think that is about to change.

Respondent: One example is Z that we receive from Y. Previously this was sent to Denmark for consolidation there, then to Norway and then here. Normally it took about a week or ten days for a truckload to arrive, now the truck leaves Y in Mday night and is here on Nday morning.

Respondent: Transportation is important. If delivery is late, it's usually because transportation is delayed. We usually manufacture on time, but it is the last link to the customer that is often the problem.

Respondent: Well, we may blame the operator, but it's not an easy job to be a truck driver, always waiting for some goods somewhere and always trying to catch up the time that has been lost. So while we can put the blame on them, we also know what challenges they are working against.

Respondent: We have little issues with delays on incoming goods, it's outgoing products that can experience problems if roads are closed especially in winter. We once tried to lower our stock down to one-month production, but that caused too many stock-outs, which is why we always make sure we have more than enough raw materials. Two months or more works well.

Respondent: What sometimes stops innovation is that when things finally work well and there are no problems, changing it (to make it more effective) is often the last thing on your mind. It is difficult to plan, because individual demand can change quickly, and being too low in capacity on an item that suddenly sees an increased demand is not a good solution.

Respondent: The customer wants all items at once, not item by item. For instance, if we don't have enough Z of a certain color we may be able to make the C, but not the D the customer wanted with C. That is not good customer service, so our stock for sale is usually around X million NOK in value, although it has been as low as C million. To us it is important to always have enough in stock.

Case 6: Producer of Bulk cargo

Respondent: We are a bulk manufacturer and we have logistics systems in place for both incoming raw materials from our suppliers and for outgoing products to our customers. There are many people working with loading and unloading, but, there are only a handful of persons who work full time with our logistics issues and who direct and operate our transport flows. We used to have a centralized operations centre in Antwerp that directed flows to all our production plants, but today all operations linked to one production plant is are directed by the production plant.

50% of what we produce is sent to the UK, and we provide approximately 50% of the market for the UK. Our shipments to the UK are handled by shipowner Y, who operates two side port ships on a weekly basis, calling at London, Glasgow and Belfast, from where all our customers are served.

Our 2nd largest market is Norway, with customers in the major cities. To Oslo it is sent by truck. Along the Western coast it is sent by ship, shipping line B once a week to Stavanger and Bergen. Last year we also served Kristiansand, but this year we do not have a customer there. East of Kristiansand road transport would be more cost-efficient than sea transport.

Interviewer: Do you have any priority on the coastal feeder line?

Respondent: We rarely have any issues with delays or capacity, and while we are dependent on the line operator, we have no contractual priority over other of their customers.

To Northern Norway we ship by sea or road, mainly based on customer preference, and often the customer will manage the transport.

Our third largest market is Denmark. Here a joint purchasing organization has a side port vessel calling once a month or so for collecting bulk from us.

Port Manager: Who is the line operator?

Respondent: The operator is Z and the vessel is called X.

Naturally, since we are located by the sea we are very competitive vis-à-vis customers who are located near the sea (near a harbor). We have a factory in the middle of G that serves most of Europe and that is cheaper than us in transport costs, but when it comes to large volumes and near-sea customers we are more competitive. For instance we have K tons distributed to Hamburg and Amsterdam, which are stored there for some of our customers.

Interviewer: Are the production costs lower here than in G?

Respondent: They're about the same, so what matters here are the transport costs.

We also have overseas cargo, and a container vessel calls every week, going to Rotterdam, from where it is distributed worldwide.

Finally, we also have smaller European customers, e.g. in Poland, Italy, Sweden. Most of this is shipped by truck, some by rail via D.

Interviewer: Do you use containers here, too?

Respondent: No, in bulk.

There is quite an imbalance in our transport system, which we use to return waste bulk from the markets we deliver bulk to. The ship from Rotterdam brings a lot and we also take in K tons from the UK.

Interviewer: is this enough to achieve balance?

Respondent: It is not enough to achieve balance, but we try to bring back as much waste bulk from the markets we deliver to in order to keep our transport costs as low as possible. We also bring back waste bulk in Norway, by truck or by ship.

Interviewer: Are there enough containers going back and forth or do you have to bring in empty containers?

Respondent: Our location is challenging when it comes to containers. There are enough containers for internal transports within our concern, but for our exports we need to bring in containers. On a weekly basis some N empty containers are landed here.

Port Manager: Are these containers that could have been used for local distribution?

Respondent: In principle, yes. The containers could have come in with goods for local/regional distribution. Unfortunately there is no large container depot in County. The containers that arrive destined for X here in H are used by us for outgoing transports.

Interviewer: So one challenge is to attract incoming goods, i.e. containers, so that there are enough containers available for outgoing transports?

Respondent: Yes. That said, we would be satisfied if there was a container depot nearby. For instance, our units in F and H can manage to acquire containers from the Oslo region and do not have such problems. Getting empty containers from Rotterdam is based on a special agreement with the shipping line. Alternatively, we could have used a side port vessel and transported our bulk products to Rotterdam (or other container ports) for stuffing there, adding additional costs and greater risk of damage to our shipments.

Port Manager: Where would you like the container depot?

Respondent: R would be a good option. In any case, it would have to be located in a port that handles a sufficient amount of container goods. We alone will never have enough incoming goods to serve our container needs.

Interviewer: Would you have enough space for a container depot on site?

Respondent: In theory, yes. We have a a property outside our factory gates that we try to develop together with logistics firms and that could serve such a purpose.

Interviewer: How do your outgoing transport operations compare to Stora Enso in Sweden? They have purpose-built containers.

Respondent: The biggest difference is that we are located at an ice-free port, which makes shipping easy. One main competitor ships by rail to A, where it is loaded onto ships to L. They have invested a

lot and created an efficient and purpose-built system that is very suited for transporting bulk from V to port in Europe. Our system is much simpler, using standard load carriers, standard side port vessels, with no asset-specific investments. The V government has invested in the rail system and in the ports; in return the company has committed to large transport volumes, so that is very different from us. H, another V bulk manufacturer, used to use side port vessels but has now started using a type of ro-ro solution, where the bulk is hauled on board and then unloaded.

Interviewer: The contracts you have with Y, are they long term and have you committed to shipping a certain volume?

Respondent: Yes, they are long-term, to ensure that we have outgoing vessels available for the investments we make here. We have committed to a certain volume, and we always strive to fulfill it. Obviously, it depends on the market situation, and we did have growth expectations when we initiated the contract 10 years ago. Unfortunately, this did not happen. There are fewer products sold now than previously, so meeting our goals is a challenge, and we have had to adjust our contracts accordingly. Although there is a declining demand for bulk, there is very little seasonal variation.

Interviewer: Who takes care of the transportation at the port where the bulk is landed?

Respondent: We have contracts with terminals, similar to what we have here. The bulk is stored in warehouse, from where it is distributed to the customer, in some cases using purpose-built vehicles, to meet the requirements set by the customers. In some case the carrier will make the special investment himself, in some cases the investment is made based on a contractual commitment from our side.

Interviewer: So the delivery to the end customer is part of your contract with the customer?

Respondent: Yes, we organize the whole chain, from when it is shipped from here to when it arrives at the customer?

Interviewer: Are there more special transports abroad than domestically?

Respondent: In general, there are very few special transports. We have one large customer in the UK that requires special handling, but in most cases the special adaptation is not more advanced than a walking floor or similar.

Interviewer: How time-sensitive are the shipments and how far in advance are the products produced?

Respondent: Everything we produce is made to order. Nothing is made to stock. We guarantee do all we can to keep the lead time the customer expects, i.e. the delivery date the customer wants. Consequently we have storage space in the port terminals near the customer that are served by sea transport, so that the customer will never be out of stock. Because sea transport requires large volumes we need storage space before it reaches the customer, and while transporting by ship is low cost, storing and handling at the terminal is high cost.

Interviewer: Do have any specifics on incoming and outgoing flows?

Respondent: Supplies are XXX, mainly arriving by truck, some by rail and very little by ship. Incoming waste bulk is K tons, half of which by ship, the other half by ship. We have K-10 tons of chemicals by ship. Outgoing are 10*K tons bulk, of which 80-85 % are sent by ship.

Interviewer: Some years ago you initiated a project together with X and Y I think it was where the idea was to ship bulk out and bring other commodities in to balance the flows. What happened?

Respondent: That is correct. It was some Y years ago that we looked at how we best could utilize the fact that we have a port terminal here, and which could give us a cost-efficient transport chain to the UK and continental Europe. We participated in the development of the project until it was commercially mature, which is when a shipping line took over.

They did not continue with it as planned, mainly because it is very challenging to combine industry goods with other goods. These goods need to have fixed delivery schedules, while industry goods is often hampered by production delays, resulting in a conflict of interest. When the bulk is not ready yet, the ship has to wait. The other goods cannot wait and this happened of enough to make the other goods shippers seek other more reliable solutions that do not cause delays. When many freight owners work together on a transport solution, it must be reliable enough for them to use it. This was not the case here.

In the end the shipping line settled for a weekly schedule from Rotterdam and in addition to our own goods the terminal now handles goods for a number of different freight owners. Some of these freight owners were also part of the initial project. However, because it took too long from project initiation to establishing the weekly schedule, much of the original synergy has been lost, which means that the shipping line has to actively promote the service in order to attract customers.

The biggest challenge is changing the mindset of the freight owners to have them switch from the transport mode they usually use. Add to that, the shipping line also serves Oslo, so at one point they may start to compete with themselves if more and more goods are shipped from here and not Oslo; a full shipload to/from Oslo is more profitable than many small loads along the coast.

Interviewer: Are there any plans to upgrade this link and call more often?

Respondent: No, I think the idea of fast ships is no longer viable anymore. Bulk will never be a product for next-day delivery, but will always remain a product for lowest-cost delivery, and can only be combined with goods that have similar requirements.

Interviewer: Do you do any slow steam?

Respondent: Well, our ships aren't that fast in the first place, but there is no planned slow steam. In some cases, depending on when the goods need to arrive or when the port is able to unload, the ship may choose to go slow, but it is not a general operational policy. That is up to the ship.

We do our best to coordinate when ships call here, according to when we are able to handle loading and unloading and we also convey information on when our goods must arrive at the destination

Interviewer: In your overall logistics operations, where do you see room for improvement?

Respondent: Our relation is with a freight carrier/forwarder and we have to rely on the carrier/forwarder for finding the most efficient solution to our transport needs, based on quality and cost.

Obviously there are some limitations as to how we would like our chain to operate. For instance, it is very difficult to combine shipping along the coast with shipments to the UK, mainly due to legal regulations. We may have waste bulk coming in from B, and we have an empty vessel arriving from the UK, but which cannot pick up the bulk in B on its way here.

We are dependent on efficient terminals in order to keep terminal costs at a minimum and to ensure reliable delivery to our customers. That also includes care during loading and unloading in order to avoid damage.

Interviewer: The terminal here is operated by your company? Have you looked into how it can be made more efficient?

Respondent: We operate the terminal when it comes to our own goods, but as to other container goods it is operated by Y. We have one very long quay that is used for bulk and which very suitable for side port vessels; we also have one quay that is used for everything else, and that quay is used more often than the bulk quay. On occasion, like today, waste bulk is unloaded at the bulk quay and then transported across our facilities to the storage area, although ideally it should have been unloaded at the other quay, but that one is occupied by a ship that unloads timber. However, investing in better quay infrastructure is too costly compared to the benefit we may derive from it...as long as what we have suffices with the operational adjustments that have to be made for loading/unloading.

Port Manager: You mentioned the area outside of the factory gates. Would you have enough space for building a better quay there?

Respondent: Yes, definitely, we have more than enough space and it is very suitable for development, but we alone are not able to fund it, nor do we have an imminent need to do so.

County council: How often do you have conflicting vessel calls?

Respondent: Quite often, once a week perhaps, but as long as we are able to solve it we don't see it as a major issue.

As to terminal equipment, Y owns the container crane, Y also has ridge decker and other equipment that we operate, but everything else is owned by us. They do not have their own personnel here.

Interviewer: Has Y made specific demands as to infrastructure/equipment in order to make a call at Y or in order to make their call more efficient (i.e. less turnaround time)?

Respondent: The container vessel and the side port vessels have priority when they call, and we adjust our operations, but that is part of our everyday routine anyway and not catering specifically to Y.

Interviewer: Your timber comes to you by road. Do the carriers mention specific challenges, e.g. road standard, axle load etc.?

Respondent: Naturally we have close links with the timber industry and we are aware of the bottlenecks the trucks encounter on their way. We have worked actively to improve the road from R. Much of our timber from Sweden comes by rail, and we have also worked actively to improve rail to make it suitable for our needs. We have not invested money in it, but we have participated in projects and spent time and energy on lobbying decision makers and authorities.

We do not see it as our responsibility to invest in the local or regional infrastructure, but as an important user of this infrastructure we try to make our voice heard wherever we can. Many do take note of this, and the need we have for efficient infrastructure. That said, the trunk road passes our gate and we have rail tracks at our doorstep, we have a port terminal with our facilities, so we are almost ideally situated as far infrastructure goes.

As mentioned, we have our own railway track, but currently there is no operator willing to run a train to our location. For instance, we send a lot of bulk to Østlandet and Oslo, every day actually, and there is more than enough waste bulk to fill a returning train. However, the way the market situation for the bulk industry is at the moment, most contracts are one-year contracts, and it is very difficult to find a train operator who is willing to invest time and money in equipment and terminals and apply for slots, not knowing whether this is perhaps for one year only. That is why road transport is the preferred mode of transport.

If the carrier/forwarder decides to haul the containers by road to H, where they are loaded onto a train, if that is cheaper, that is up to him. Our main concern is to keep our promised delivery time, especially if it is a next-day delivery. How the carrier achieves this, is not our concern.

Interviewer: Is there a difference in risk of damage depending on what mode of transport you use?

Respondent: If shipped by rail or sea, a bulk is handled some 15-20 times before it reaches the customer, and for every handling there is a risk of damage. If sent by car, nothing is touched before it reaches its destination, so yes, it makes a difference. Our customers are increasingly becoming more and more concerned – they expect products to be delivered almost free from any damage. That is perhaps the biggest challenge in our logistics chain.

Interviewer: Is the general principle that the different plants have their own transport systems and develop their own logistics solutions?

Respondent: Yes. We used to have a central logistics office, but now it is up to the production plant to make sure that they have a system in place that matches their needs.

Interviewer: So for your company as a whole it is the individual plant that manages incoming and outgoing flows ?

Respondent: Yes, more or less so. This appears to change with time. Five years ago everything was centralized; now it is decentralized, what will be in five years from now we don't know. On a side note, while we are scaling down our centralized logistics, a competitor is currently scaling up their centralization efforts.

Interviewer: According to you own numbers, approximately 80% of outgoing flows are done by sea transport. Is it possible to increase that or is that perhaps the maximum volume that can be sent via sea?

Respondent: Yes, there is very little left that could be sent by sea. That said, we don't use sea transport because we want to use sea transport. We use sea transport because it is the cheapest for us.

Port Manager: The potential for increased sea transport is perhaps more related to other freight owners who can use your established routes, so that there can be a better balance of flows.

Respondent: Yes.

Interviewer: As far as I know, there are plans for establishing a logistics hub, for instance near ... What are your thoughts about that when it comes to achieving a better balance of flows?

Respondent: As I have said, we are more or less self-sufficient with the logistics systems we have in place. However, the location of a logistics hub will matter to us, and especially whether it is linked to a port or not. Obviously a location south of H without a port will have no effect on our flows; we will essentially continue as before. Should the hub be located North of H with a port that will have many advantages to us. Firstly, this can create an efficient terminal with commercial sea transport because of larger goods volumes. Secondly, this can help establishing a container depot. Thirdly, this may lead to general infrastructure improvements to and from the port, which will be to our benefit. So a location there will matter a lot to us. Nonetheless, we will probably continue to use our own port for most of our goods flows, but some of our flows may make use of the terminal, depending on where they are destined to.

Interviewer: Has this issue been analyzed more in detail, e.g. have any calculations been made as to the actual benefit of having a logistics hub nearby?

Respondent: No. Undoubtedly there will be a positive effect, but we haven't looked at how much or what investments we would need to make to take advantage of it. At this stage it is qualified guess rather than a quantified number.

Interviewer: Have any other of you looked at this?

Port Manager: What **Respondent** says is correct. We are in the middle of planning the new logistics hub, but haven't looked at this company in particular, although it is clear that a hub at K would be able to serve them; some vessels may even call at both ports, H and K.

How to address the uncertainty of how the freight market is going to evolve is important when establishing a logistics hub. One of the issues we face is that many planning processes do not look more than 2-5 years into the future, while we argue that we need to look 5-10 or maybe even 15 and more years into the future when deciding on where to place it and how much space that needs to be set aside for future development of the hub.

Another issue is the definition of what a port is. A port for logistics hub is a container port, a ro-ro port, a port for mixed goods, etc. all separated from each other, in order to be efficient and to not hamper future extensions.

A third challenge is changing the mindset of the freight forwarders, who are currently very interested in looking at the road-rail link, but who seem oblivious towards the road-sea link, which is where I think much of future goods flows will be.

Large freight owners like us can play an important role here, and if large freight owners can come together and cooperate they should be able to find common solutions for sea transport. This will attract smaller freight owners, which are then be able benefit from using an already established solution, which in turn will help to increase the quality (frequency) of the service. I know that Y Logistics is interested in participating in such discussion, provided that they are realistic.

County Council: One issue with forecasting future goods flows is that too often historical trends are simply projected into the future. Modal trends are ignored.

Port Manager: Yes, that is the weakness of today's modeling tools for goods flows. They do not take into account external circumstances.

Interviewer: Correct. Shifts in modal trends or coordination between modes are not handled very well, or not at all.

Port Manager: Yes. The uncertainty that is inherent in today's modeling tools is not communicated well enough to the decision-makers.

Respondent: I would like to make two points here. One, this location was one of the candidates for establishing a logistics hub, but was deemed as too far from H. Two, the revision of the National Transport Plan will have to prioritize between many different conceptual studies for infrastructure projects along the coast, including the logistics hub, some with conflicting agendas, and it remains to be seen which will win and which will lose, which that will win for political reasons and which that will win for rational reasons.

Interviewer: One issue that I like to focus on is mindset and the effect of better coordination between freight users. More coordination could lead to higher volumes, better balance of flows and higher service frequency, would it not?

Respondent: Undoubtedly, a higher frequency increases the potential for commercial goods (i.e. consumer goods) and time-sensitive goods like groceries. However, many consumer goods besides groceries are not time-sensitive and there is not a need for increased frequency to attract this kind of goods. What is more important than frequency is regularity. My experience is that having regular deliveries is increasingly gaining a larger following than having fast deliveries, so there is a slow change of mindset here. Many of the business that used road transport and only used to think road transport now see that there is a sea alternative in our terminal. We can see that by the looking goods that crosses our terminal, which we know used to be transported by road previously.

Regardless of whether this company is still here 20 years from now or not, I believe that the terminal will still stay, because the goods will still continue to flow, and because there is a terminal that offers economies of scale for the freight forwarders.

Interviewer: As I see it, the main challenge here is coordination with other freight owners.

Respondent: Yes. The goal is to have the most efficient transport system. We do not enough goods on our own and we are dependent on other freight owners to receive competitive offers from freight forwarders, and that is a challenge, yes.

Another challenge is the position of Oslo as the main hub for Norway. A truckload from here to Oslo costs a lot less than a truck load from Oslo to here. This makes transporting bulk to Oslo cheap, but it is expensive to transport waste bulk back to us, which adds another burden to achieving balance of flows.

Port Manager: Why is that?

Respondent: There is lot more goods going from Oslo to H than back, so there is a surplus of cars going to Oslo, which keeps prices down.

Port Manager: One issue with Oslo as a national hub is capacity. At some point, the Alnabru rail terminal will reach capacity, which will either put more goods on the road, but sooner or later they will also reach capacity, which leaves sea transport directly to H as the best alternative. However, this change is not done overnight, and it will take perhaps 5-10 or even more years to accomplish this structural change of where goods to and from destinations in Norway enters the country.

This also requires changing the port structure, such that there are fewer port calls, thus making sure there is enough volume to serve some selected Norwegian ports.

9. Appendix 2: Intervjuguide 1 - Intermodale transportkjeder som er initiert av agenter/samlastere på vegne av vareeiere/kunder

Intervjuets hensikt

Agentinitierte intermodale transportkjeder er definert som intermodale transportløsninger som er initiert av transportleverandører. Disse transporterer store volumer på oppdrag for flere kunder, og de benytter intermodal transport aktivt.

Dette prosjektet har som mål å undersøke hvordan slike intermodale løsninger har blitt utviklet og gjennomført, og hva som gjør at transportbedrifter eller vareeiere tar initiativ til å benytte slike løsninger. Vi er interessert i å undersøke hvordan løsningene ser ut, hvem som har vært de involverte aktørene, hvordan disse har bidratt, og hvordan risiko og finansiering har blitt fordelt.

Vi ønsker å gjennomføre dybdeintervjuer med relevante personer som har direkte erfaring med denne type løsninger, både i utviklings- og driftsfasen.

Tabellen nedenfor viser hvilke hovedspørsmål som vi har definert, og hva slags informasjon som vi gjennom intervjuene er ute etter å innhente.

| Spørsmål | Gir kunnskap om: |
|---|--|
| 1. Hvorfor, hvordan og av hvem blir overgangen til intermodale transportløsninger initiert? | <ul style="list-style-type: none">- Hva utløser ideen – svar på en strategisk trussel eller en mulighet?- Forventet gevinst (pengemessig og annet)- Hvem foreslår ideen og hvem er hovedforkjemper i startfasen?- Hvordan blir ideen presentert i egen bedrift og for kunder?- - Hva var den første reaksjonen? |
| 2. Hvordan ser prosessen rundt utviklingen og implementeringen av løsningene ut? | <ul style="list-style-type: none">- Erfaringer fra den første promoteringen av løsningen- Historikk- Milepæler og trinn i prosessen- Hvilke aktører (personer, funksjoner, avdelinger) har vært involvert i de ulike trinnene og hvilke roller har de hatt?- Problemer underveis og hvordan disse ble løst, både internt og hos kunder og samarbeidspartnere- Hva var/er nøkkelen til suksess?- Hva bidrar til dynamikken i prosessen/løsningen? |
| 3. Hvordan er den intermodale løsningen utformet? | <ul style="list-style-type: none">- Særskilte krav og trekk ved utformingen- Viktigheten av kostnader, serviceevne og miljøpåvirkning- Medvirkende organisasjoner- Ledelse og koordinering- Kontraktsrelasjoner (type kontrakt, med hvem, tidshorisont)- Risikohåndtering (reservemuligheter) |
| 4. Hvilke eksterne faktorer fremmer eller hindrer utviklingen av intermodale løsninger? | <ul style="list-style-type: none">- Faktorer som virker fremmende- Barrierer og hindringer- Hvordan barrierer og hindringer utvikler seg over tid, er dette avhengig f eks av de medvirkende aktørene? |

| | |
|-------------------------|---|
| | <ul style="list-style-type: none"> - Samarbeid og koordinering med andre befraktere - I hvilken grad er godsflyten balansert og hvordan problemer - med flytbalansen ble løst (fokus på retningsbalanse)? - Myndighetenes rolle |
| 5. Resultater så langt? | <ul style="list-style-type: none"> - Serviceytelse, kostnadseffektivitet, transportkvalitet, sluttkundetilfredshet, miljøpåvirkning - Andre verdifulle resultater, eller konklusjon om å ikke videreføre intermodale løsninger. |

Intervjuets struktur

Intervjuet er delt inn i seks seksjoner, med følgende hovedtrekk:

Generell bakgrunnsinformasjon: Den første delen har som mål å samle inn bakgrunnsinformasjon om bedriften, dens transportoperasjoner, miljøpolitikk og om/hvordan denne er knyttet til bedriftens transportoperasjoner.

Intermodale løsninger og "organisasjon": Denne delen fokuserer på å skaffe et klart overblikk over den intermodale løsningen som er valgt av bedriften, herunder geografisk dekningsområde, typer frakt, og typer tjenester. I tillegg vil noen spørsmål fokusere på forretningsmodellen for eller organiseringen av den intermodale løsningen, dvs. hvilke aktører som er involvert, hvordan ansvar, risiko og fortjeneste er fordelt, hvilken tidshorisont løsningen er tenkt for, hvordan samarbeidet skjer og hvordan den intermodale løsningen blir ledet.

Insentiver og drivkrefter for etableringen av intermodale løsninger: Her ønsker vi å forstå hvilke insentiver og drivkrefter som får en bedrift til å velge intermodale løsninger og hvilke faktorer som fremmer utviklingsprosessen av en slik løsning.

Barrierer eller problemer i utviklingen/implementeringen av intermodale løsninger: I motsetning til ovennevnte fokuserer denne delene på problemområder og utfordringer knyttet til valg av intermodale løsninger.

Utvikling og implementering av intermodale løsninger: Denne delen forsøker å kartlegge historikken i utviklingsprosessen. Spesielt skal det identifiseres om det finnes felles trinn (ved å studere flere case) og beskrive trinnene ved å nevne hvilke aktører, ressurser og aktiviteter som er involvert.

Resultater: Denne delen skal angi hvilke verdier som ble realisert, hvordan logistikksystemet har fungert og hvordan dette antas å påvirke fremtidige transportvalg.

Intervjuspørsmål

Generelle bakgrunnsspørsmål: bedriften, transporter og miljøinnsats

Denne informasjonen kan delvis hentes fra hjemmesiden, bedriftens presentasjonsmaterieell eller annen litteratur.

Spørsmål vil også avhenge av type bedrift og virksomheten den driver

- Hva er bedriftens kjernevirksomhet?
- Hvilke logistikk- og transportrelaterte aktiviteter/tjenester utføres av andre aktører? Hvorfor?
- Hvem kjøper dere tjenester fra?
- Hvordan blir de forskjellige transportalternativene evaluert? Basert på hvilke kriterier blir transportavgjørelser tatt? Hvorfor akkurat disse kriteriene? Brukes det spesielle verktøy (programvare) for innkjøp? Hvor viktig er kostnad (pris) når transporttjenester kjøpes?
- Hvordan måler dere hvor godt logistikk- /transportsystemet fungerer?
- Har det vært store endringer i logistikkoperasjonene hos dere de siste årene?
- Hva har vært den generelle trenden når det gjelder logistikk- og transportoperasjoner?
- Hvordan jobber dere med miljøspørsmål?

Diskuter følgende problemstillinger: bedriftens miljøstrategi (er den dekkende for alt som har med transport å gjøre?); evaluering/kartlegging av miljøpåvirkning (dekker dette også selve transportutøvelsen?)

- Hvordan inngår bedriftens bruk av miljørettede tiltak (for eksempel bruk av intermodal transport) i markedsføringen av bedriftens tjenester og produkter over sluttbrukere? Er det et behov for slik markedsføring? Hvorfor??
- Har det vært press utenfra med tanke på hvordan bedriftens transportoperasjoner drives?

Drøft: myndigheter/forretningsforbindelser/kunder/konkurrenter.

- Er innføring den intermodale løsningen et resultat av miljømessige hensyn?

Intermodal løsning og organisasjon

- Hva er bedriftens generelle erfaring med intermodal transport?
- *Diskuter: Hvor lenge har dere brukt intermodal transport? Har det vært flere prosjekter/løsninger? Suksess? Resultat?*

Vedrørende den løsningen som brukes mest:

- Mellom hvilket start- og målpunkt går transporten?
- Hva slags gods blir transport med den intermodale løsningen?
- *Spesifikt for transportoperasjonen:* Beskriv hvordan den løsningen ser ut? *Snitt lengde på de ulike lenkene, hva slags transportmiddel på de ulike lenkene, antall omlastningspunkter. Størrelse/volum som transporteres? Avstand mellom intermodale terminaler? Fraktdistanse før og etter den intermodale strekningen? Hvor mange forsendelser behøves? Rutetid/-plan? Hvilke lastbærere brukes (tillater systemet bruk av ulike lastbærere?) Hvor balansert er flyten med tanke på retningsbalanse?*
- Er det betydelige svingninger i godsvolumene? Er det enkelt å øke/reducere kapasiteten i systemet?
- Hvilke krav til service er satt? (*avbrudd, framføringstid, bestemte lastbærere, leveranse innenfor arbeidstid etc*)
- Brukes intermodal transport for å transportere hele godsflyten mellom disse to lokasjonene, eller bare deler av den? Hvorfor?

- Finnes det en reserveløsning? Hvem er ansvarlig for den? Hva er løsningen? Hvorfor finnes den? Blir den ofte brukt? Hvem er de aktørene i denne intermodale transportkjeden? Hva er deres ansvar/roller?
- Hvilke investeringer har dere foretatt for å muliggjøre denne intermodale løsningen? Hvilke investeringer har andre aktører/deltakere gjort?

Hvem eier lasteenhetene? Hvem har investert i terminalen? Hvem eier tog/vogner? Etc.

Vedrørende intermodale transporter mer generelt:

- Når kunder eller dere som befrakter velger transportløsning, ser dere an til hva andre aktører også velger?
- Hvordan prissettes de intermodale løsningene? Hvem bestemmer prisen? Er prisen avhengig av godsvolum? Hvordan blir dette i så fall kommunisert til markedet?
- Hvordan kontraktsfestes selve bruken av de intermodale løsningene? Avtaleperiode, avtalelengde, servicegrad, pris, reforhandlingsklausuler.
- Har det vært noen prosess med fordeling av faste kostnader mellom aktørene ved intermodale løsninger? I så fall, hvordan har den prosessen forløpt?
- Hvilke kontrakter finnes mellom aktørene som er involvert i å levere den intermodale løsningen?
- Hva er kontraktsperiodens lengde med de ulike leverandørene av intermodale tjenester?
- Har det vært nødvendig med langsiktige investeringsprosjekter for å få realisert transportløsningene? Hvis ja, hvem er ansvarlig for slik finansiering og finnes det medfinansiering? Finnes det støtte fra myndighetene?
- Har den intermodale løsningen blitt utviklet i samarbeid med andre befraktere (for konsolidering og balansering av godsflyten)? Har andre befraktere brukt denne løsningen? Hvis ja, er den fritt tilgjengelig for alle, eller bare en utvalgte partnere eller en utvalgt gruppe befraktere?
- Hvem er ansvarlig for å styre og koordinere den intermodale kjeden og de involverte aktørene? Er det mulig å identifisere en slik aktør og hvilket ansvar har denne aktøren?
I det foregående er vi ute etter å få innsikt i hvordan fellesløsninger velges, hvordan kontrakter utformes mht betingelse (f eks om det er innslag av todelte tariffer), risikodeling, og om prissettingen finner sted via forhandlinger, om prissettingen er avhengig av antall aktører etc. Dette gjelder både for AIITC og CIITC.
- Har det vært gjennomført tiltak for å forbedre systemet (eller ytelsen)? Hvilke aktører var involvert i disse initiativene?
- Er hver aktør faktisk klar over de andre aktørene som er involvert i levering av den intermodale løsningen eller er det bilaterale relasjoner (kontrakter) mellom hver av aktørene og lederen? Er frakteierne klar over hvordan løsningen fungerer?
- Finnes det minstekrav i kontraktene med transporttjenesteleverandørene?

Insentiver og drivkrefter for etablering av intermodale løsninger

- Hva mener dere har vært drivkreftene i implementeringen av en intermodal løsning?
- Hvordan har disse endret seg i løpet av prosessen: fra initiering til implementering og videre utvikling?
- Hva har vært hovedårsaken som har drevet fram endringer i løsningen?

Mulig dynamikk: endringer hos tilbydere av logistikk- og transporttjenester, endringer i geografisk dekningsområde, godstype, volum, befrakterbase, lasteenheter, lokalisering av fasiliteter, lastehåndteringsutstyr, miljøkrav, CSR...

- Ble den intermodale løsningen laget for å erstatte en eksisterende løsning eller er det en nyutviklet løsning for å møte etterspørsel?
- Hvis det erstattet en eksisterende løsning, hvilke svakheter hadde denne?
- Hvem tok initiativet til en intermodal løsning? Hvem var forkjempere for en slik løsning?
- Er bruk av intermodale løsninger del av bedriftens miljøstrategi? Har dere satt mål her?
- Er bruk av intermodale løsninger en del av kundenes transportpolicy?
- Hvordan ble ideen om intermodal transport presentert internt i bedriften?

- Hvordan blir intermodal transport presentert overfor kunden?
- Hva var den forventede gevinsten (pengemessig og annet)?
- Har offentlig sektor på noe vis bidratt til eller fremmet implementeringen av intermodale løsninger?
- Hva mener du er forutsetningene for en vellykket intermodal transportkjede?
- Hva mener du er særtrekkene til en vellykket intermodal transportkjede?
- Har andre befraktere blitt tilbudt tjenesten for å utnytte ledig kapasitet (utgående og/eller returen)?

Utvikling og implementering

- Når og hvordan begynte dere å tenke på å innføre intermodal transport?
- Hvor lang tid tok planleggingen og implementeringen?
- Har innføring av den intermodale løsningen ført til strukturelle endringer i logistikken hos dere (for eksempel lokalisering av fasiliteter)?
- Har innføring av den intermodale løsningen ført til strukturelle endringer i kvalitet eller service når det gjelder transporttjenester (frekvens på forsendelser, leveringstid, punktlighet)?
- Er det mulig å skille mellom ulike faser/trinn i utviklingen av den intermodale løsningen? Hva er milepælene? Eller er det en løpende prosess fra start til slutt?
- Hvilke aktiviteter foregår i hvert trinn eller som en del av den løpende prosessen?
- Hvor lang tid tok det fra den første ideen til ferdig implementering?
- Hvilke aktører var involvert i de forskjellige trinnene av prosessen: initiering, planlegging og implementering av løsningen?
- Ble det gjennomført et pilotprosjekt før fullskala implementering?
- Hva har vært mest vanskelig med det å utvikle og implementere en ny intermodal transportkjede?
- Var det noen enkeltstående personer som hadde spesielt stor innflytelse på avgjørelser og implementeringen av den intermodale løsningen?
- Var det en ledende eller hovedansvarlig deltaker i prosjektet?

Barrierer for etablering eller problemer med utvikling og implementering av intermodale løsninger

- Hvordan har den intermodale løsningen utviklet seg?

Den har utviklet seg gradvis over tid eller implementert som en ny løsning

- Hvilke problemer har dere støtt på i implementeringen?
- Hva har vært de viktigste barrierene for implementeringen av den intermodale løsningen?

Muligens diskutere følgende problemstillinger: intern motstand, mangel på kunnskap eller erfaring, mangel på partnere, motstridende mål blant partnerne, behov for finansiering, teknisk gjennomførbarhet, kvaliteten på transporttjenestene, lønnsomhet, nærhet til intermodale terminaler, manglende/utilstrekkelig tjenestetilbud, internasjonale forhold (samordning av tidsluker, forskjellige standarder/regelverk), motstand hos partnere, egenskaper ved godsflyten, manglende intern støtte.

- Hvordan har dette endret seg i løpet av prosessen, fra initiering til innføring?
- Har det vært noen problemer mellom aktørene i fordelingen av ansvar, risiko og gevinst?
- Hva var oppfatningen av intermodal transport før den intermodale løsningen ble tatt i bruk? Har bedriften tidligere erfaringer med bruk av intermodal transport?
- Hva er ulempene med bruk av intermodal transport?
- Hva mener du er den største hindringen for vekst i bruk av intermodal transport?
- Er samarbeid med andre befraktere en farbar veg for å utnytte kapasiteten i systemet? Hva er problemene i et slikt samarbeid?
- Har implementeringen av en intermodal løsning hatt noen virkning på servicen overfor sluttkunde/vareeier.

- Er du enig i utsagnet om "at en feilaktig oppfatning eller manglende erfaring er årsaken til at intermodale transporter er lite brukt"?

Prosjekresultater

- Har implementeringen av intermodale løsninger medført kostnadsbesparelser?
- Har det blitt foretatt en miljømessig vurdering (av CO2-utslipp og andre eksternaliteter) av en intermodal løsning sammenlignet med den tidligere løsningen? Hvis ja, var det vesentlige forskjeller?
- Hvilke andre effekter har dere erfart når det gjelder logistikksystemets funksjon og ytelse?
- Hva er de største fordelene med intermodal transport?
- Hva er de største ulempene med intermodal transport?
- Har den intermodale løsningen tilfredstilt transportbehovene og kravene til transporten?
- Er løsningen fremdeles i bruk? Hvis løsningen er avsluttet, hva var årsaken til det?
- Har erfaringen endret kundenes oppfatning av intermodale transporter?
- Basert på nåværende erfaring, vil dere vurdere å sette i gang andre intermodale prosjekter?

10. Appendix 3: Intervjuguide 2 - Intermodale transportkjeder som er initiert av store vareeiere/kunder

Intervjuets hensikt

Kundeinitierte intermodale transportkjeder innebærer at der er store vareeiere som anvender intermodal transport. For disse er vi også interessert i å kartlegge forsøk på å få til intermodale løsninger som av ulike grunner har strandet.

Dette prosjektet har som mål å undersøke hvordan slike intermodale løsninger har blitt utviklet og gjennomført, og hva som gjør at vareeiere tar initiativ til å benytte slike løsninger. Vi er interessert i å undersøke hvordan løsningene ser ut, hvem som har vært de involverte aktørene, hvordan disse har bidratt, og hvordan risiko og finansiering har blitt fordelt.

Vi ønsker å gjennomføre dybdeintervjuer med relevante personer som har direkte erfaring med denne type løsninger, både i utviklings- og driftsfasen.

Tabellen nedenfor viser hvilke hovedspørsmål som vi har definert, og hva slags informasjon som vi gjennom intervjuene er ute etter å innhente.

| Spørsmål | Gir kunnskap om: |
|---|--|
| 1. Hvorfor, hvordan og av hvem blir overgangen til intermodale transportløsninger initiert? | <ul style="list-style-type: none">- Hva utløser ideen – svar på en strategisk trussel eller en mulighet?- Forventet gevinst (pengemessig og annet)- Hvem foreslår ideen og hvem er hovedforkjemper i startfasen?- Hvordan blir ideen presentert i egen bedrift og for kunder?- - Hva var den første reaksjonen? |
| 2. Hvordan ser prosessen rundt utviklingen og implementeringen av løsningene ut? | <ul style="list-style-type: none">- Erfaringer fra den første promoteringen av løsningen- Historikk- Milepæler og trinn i prosessen- Hvilke aktører (personer, funksjoner, avdelinger) har vært involvert i de ulike trinnene og hvilke roller har de hatt?- Problemer underveis og hvordan disse ble løst, både internt og hos kunder og samarbeidspartnere- Hva var/er nøkkelen til suksess?- Hva bidrar til dynamikken i prosessen/løsningen? |
| 3. Hvordan er den intermodale løsningen utformet? | <ul style="list-style-type: none">- Særskilte krav og trekk ved utformingen- Viktigheten av kostnader, serviceevne og miljøpåvirkning- Medvirkende organisasjoner- Ledelse og koordinering- Kontraktsrelasjoner (type kontrakt, med hvem, tidshorisont)- Risikohåndtering (reservemuligheter) |
| 4. Hvilke eksterne faktorer fremmer eller hindrer utviklingen av intermodale løsninger? | <ul style="list-style-type: none">- Faktorer som virker fremmende- Barrierer og hindringer- Hvordan barrierer og hindringer utvikler seg over tid, er dette avhengig f eks av de medvirkende aktørene? |

| | |
|-------------------------|---|
| | <ul style="list-style-type: none"> - Samarbeid og koordinering med andre befraktere - I hvilken grad er godsflyten balansert og hvordan problemer - med flytbalansen ble løst (fokus på retningsbalanse)? - Myndighetenes rolle |
| 5. Resultater så langt? | <ul style="list-style-type: none"> - Serviceytelse, kostnadseffektivitet, transportkvalitet, sluttkundetilfredshet, miljøpåvirkning - Andre verdifulle resultater, eller konklusjon om å ikke videreføre intermodale løsninger. |

Intervjuets struktur

Intervjuet er delt inn i seks seksjoner, med følgende hovedtrekk:

Generell bakgrunnsinformasjon: Den første delen har som mål å samle inn bakgrunnsinformasjon om bedriften, dens transportoperasjoner, miljøpolitikk og om/hvordan denne er knyttet til bedriftens transportoperasjoner.

Intermodale løsninger og "organisasjon": Denne delen fokuserer på å skaffe et klart overblikk over den intermodale løsningen som er valgt av bedriften, herunder geografisk dekningsområde, typer frakt, og typer tjenester. I tillegg vil noen spørsmål fokusere på forretningsmodellen for eller organiseringen av den intermodale løsningen, dvs. hvilke aktører som er involvert, hvordan ansvar, risiko og fortjeneste er fordelt, hvilken tidshorisont løsningen er tenkt for, hvordan samarbeidet skjer og hvordan den intermodale løsningen blir ledet.

Insentiver og drivkrefter for etableringen av intermodale løsninger: Her ønsker vi å forstå hvilke insentiver og drivkrefter som får en bedrift til å velge intermodale løsninger og hvilke faktorer som fremmer utviklingsprosessen av en slik løsning.

Barrierer eller problemer i utviklingen/implementeringen av intermodale løsninger: I motsetning til ovennevnte fokuserer denne delene på problemområder og utfordringer knyttet til valg av intermodale løsninger.

Utvikling og implementering av intermodale løsninger: Denne delen forsøker å kartlegge historikken i utviklingsprosessen. Spesielt skal det identifiseres om det finnes felles trinn (ved å studere flere case) og beskrive trinnene ved å nevne hvilke aktører, ressurser og aktiviteter som er involvert.

Resultater: Denne delen skal angi hvilke verdier som ble realisert, hvordan logistikksystemet har fungert og hvordan dette antas å påvirke fremtidige transportvalg.

Intervjuspørsmål

Generelle bakgrunnsspørsmål: bedriften, transporter og miljøinnsats

Denne informasjonen kan delvis hentes fra hjemmesiden, bedriftens presentasjonsmaterieell eller annen litteratur.

Spørsmål vil også avhenge av type bedrift og virksomheten den driver

- Hva er bedriftens kjernevirksomhet?
- Hva er bedriftens organisasjonsstruktur?
- Hva er de inngående/utgående transportbehovene)? Hvem er ansvarlig for inngående og utgående transporter?
- Hvilke logistikk- og transportrelaterte aktiviteter/tjenester utføres internt? Hvorfor? Hvilke avdelinger/enheter er involvert?
- Hvilke logistikk- og transportrelaterte aktiviteter/tjenester utføres eksternt? Hvorfor?
- Hvem kjøper dere tjenester fra?
- Hva er vanlig planleggingstid for en transportløsning? Hva er kontraktstiden for eksterne tjenesteleverandører?
- Hvordan blir de forskjellige alternativene evaluert? Basert på hvilke kriterier blir transportavgjørelser tatt? Hvorfor akkurat disse kriteriene? Brukes det spesielle verktøy (programvare) for innkjøp? Hvor viktig er kostnad (pris) når transporttjenester kjøpes?
- Hvordan måler dere hvor godt logistikk- /transportsystemet fungerer?
- Har det vært store endringer i logistikkoperasjonene hos dere de siste årene?
- Hva har vært den generelle trenden når det gjelder logistikk- og transportoperasjoner?
- Hvordan jobber dere med miljøspørsmål?

Diskuter følgende problemstillinger: bedriftens miljøstrategi (er den dekkende for alt som har med transport å gjøre?); evaluering/kartlegging av miljøpåvirkning (dekker det også selve transportutøvelsen?)

- Hvordan inngår bedriftens bruk av miljørettede tiltak (for eksempel bruk av intermodal transport) i markedsføringen av bedriftens tjenester og produkter over sluttbrukere? Er det et behov for slik informasjon?
- Har det vært press utenfra med tanke på hvordan bedriftens transportoperasjoner drives?

Drøft: myndigheter/forretningsforbindelser/kunder/konkurrenter.

- Er innføring den intermodale løsningen et resultat av miljømessige hensyn?
-

Intermodal løsning og organisasjon

- Hva er bedriftens generelle erfaring med intermodal transport?

Diskuter: Hvor lenge har dere brukt intermodal transport? Har det vært flere prosjekter/løsninger? Suksess? Resultat?

Vedrørende den løsningen som brukes mest:

- Mellom hvilket start- og målpunkt går transporten?
- Hva slags gods blir transport med den intermodale løsningen?
- *Spesifikt for transportoperasjonen:* Beskriv hvordan den løsningen ser ut? *Snitt lengde på de ulike lenkene, hva slags transportmiddel på de ulike lenkene, antall omlastningspunkter. Størrelse/volum som transporteres? Avstand mellom intermodale terminaler? Fraktdistanse før og etter den intermodale strekningen? Hvor mange forsendelser behøves? Rutetid/-plan? Hvilke lastbærere brukes (tillater systemet bruk av ulike lastbærere?) Hvor balansert er flyten med tanke på retningsbalanse?*
- Er det betydelige svingninger i godsvolumene? Er det enkelt å øke/reducere kapasiteten i systemet?

- Hvilke krav til service er satt? (*avbrudd, framføringstid, bestemte lastbærere, leveranse innenfor arbeidstid etc*)
- Brukes intermodal transport for å transportere hele godsflyten mellom disse to lokasjonene, eller bare deler av den? Hvorfor?
- Finnes det en reserveløsning? Hvem er ansvarlig for den? Hva er løsningen? Hvorfor finnes den? Blir den ofte brukt? Hvem er de interne aktørene i den intermodale transportkjeden? Hva er deres ansvar/roller?
- Hvem er de eksterne aktørene i denne intermodale transportkjeden? Hva er deres ansvar/roller?
- Hvilke investeringer har dere foretatt for å muliggjøre denne intermodale løsningen? Hvilke investeringer har andre aktører/deltakere gjort?

Hvem eier lasteenhetene? Hvem har investert i terminalen? Hvem eier tog/vogner? Etc.

Vedrørende intermodale transporter mer generelt:

- Når dere velger transportløsning, ser dere an til hva andre aktører også velger? Samarbeider dere med andre vareeiere?
- Hvordan prissettes de intermodale løsningene? Hvem bestemmer prisen? Er prisen avhengig av godsvolum? Hvordan blir dette i så fall kommunisert til markedet?
- Hvordan kontraktsfestes selve bruken av de intermodale løsningene? Avtaleperiode, avtalelengde, servicegrad, pris, reforhandlingsklausuler.
- Har det vært noen prosess med fordeling av faste kostnader mellom aktørene ved intermodale løsninger? I så fall, hvordan har den prosessen forløpt?
- Hvilke kontrakter finnes mellom aktørene som er involvert i å levere den intermodale løsningen?
- Hva er kontraktperiodens lengde med de ulike leverandørene av intermodale tjenester?
- Hvis det er nødvendig med langsiktige investeringsprosjekter, hvem er ansvarlig for slik finansiering og finnes det medfinansiering? Finnes det støtte fra myndighetene?
- Har den intermodale løsningen blitt utviklet i samarbeid med befraktere eller andre vareeiere (for konsolidering og balansering av godsflyten)? Har andre befraktere eller vareeiere brukt denne løsningen? Hvis ja, er den fritt tilgjengelig for alle, eller bare en utvalgte partnere eller en utvalgt gruppe befraktere?
- Hvem er ansvarlig for å styre og koordinere den intermodale kjeden og de involverte aktørene? Er det mulig å identifisere en slik aktør og hvilket ansvar har denne aktøren?
I det foregående er vi ute etter å få innsikt i hvordan fellesløsninger velges, hvordan kontrakter utformes mht betingelse (f eks om det er innslag av todelt tariffer), risikodeling, og om prissettingen finner sted via forhandlinger, om prissettingen er avhengig av antall aktører etc. Dette gjelder både for AIITC og CIITC.
- Har det vært gjennomført tiltak for å forbedre systemet (eller ytelsen)? Hvilke aktører var involvert i disse initiativene?
- Er hver aktør faktisk klar over de andre aktørene som er involvert i levering av den intermodale løsningen eller er det bilaterale relasjoner (kontrakter) mellom hver av aktørene og lederen? Er frakteierne klar over hvordan løsningen fungerer?
- Finnes det minstekrav i kontraktene med transporttjenesteleverandørene?

Insentiver og drivkrefter for etablering av intermodale løsninger

- Hva mener dere har vært drivkreftene i implementeringen av en intermodal løsning?
- Hvordan har disse endret seg i løpet av prosessen: fra initiering til implementering og videre utvikling?
- Hva har vært hovedårsaken som har drevet fram endringer i løsningen?

Mulig dynamikk: endringer hos tilbydere av logistikk- og transporttjenester, endringer i geografisk dekningsområde, godstyp, volum, befrakterbase, lasteenheter, lokalisering av fasiliteter, lastehåndteringsutstyr, miljøkrav, CSR...

- Ble den intermodale løsningen laget for å erstatte en eksisterende løsning eller er det en nyutviklet løsning for å møte etterspørsel?

- Hvis det erstattet en eksisterende løsning, hvilke problemer hadde denne?
- Hvem tok initiativet til en intermodal løsning? Hvem var forkjempere for en slik løsning?
- Hvorfor ikke bare kjøpe intermodale løsninger, hvorfor involvere bedriften i utviklingen av løsningen?
- Er bruk av intermodale løsninger del av bedriftens miljøstrategi? Har dere satt mål her?
- Er bruk av intermodale løsninger en del av bedriftens transportpolicy?
- Hvordan ble ideen om intermodal transport presentert internt i bedriften?
- Hvordan blir intermodal transport presentert overfor eventuelle andre brukere?
- Hva var den forventede gevinsten (pengemessig og annet)?
- Har offentlig sektor på noe vis bidratt til eller fremmet implementeringen av intermodale løsninger?
- Hva mener du er forutsetningene for en vellykket intermodal transportkjede?
- Hva mener du er særtrekkene til en vellykket intermodal transportkjede?
- Har andre befraktere blitt tilbudt tjenesten for å utnytte ledig kapasitet (på utgående og/eller returen)?

Utvikling og implementering

- Når og hvordan begynte dere å tenke på å innføre intermodal transport?
- Hvor lang tid tok planleggingen og implementeringen?
- Har implementeringen av den intermodale løsningen ført til strukturelle endringer i logistikken hos dere (for eksempel lokalisering av fasiliteter)?
- Har implementeringen av den intermodale løsningen ført til strukturelle endringer i kvalitet eller service når det gjelder transporttjenester (frekvens på forsendelser, leveringstid, punktlighet)?
- Er det mulig å skille mellom ulike faser/trinn i utviklingen av den intermodale løsningen? Hva er milepælene? Eller er det en løpende prosess fra start til slutt?
- Hvilke aktiviteter foregår i hvert trinn eller som en del av den løpende prosessen?
- Hvor lang tid tok det fra den første ideen til ferdig implementering?
- Hvilke interne aktører var involvert i de forskjellige trinnene av prosessen: initiering, planlegging og implementering av løsningen?
- Hvilke eksterne aktører var involvert i de forskjellige trinnene av prosessen: initiering, planlegging og implementering av løsningen?
- Ble det gjennomført et pilotprosjekt før fullskala implementering?
- Hva har vært mest vanskelig med det å utvikle og implementere en ny intermodal transportkjede?
- Var det noen enkeltstående personer som hadde spesielt stor innflytelse på avgjørelser og implementeringen av den intermodale løsningen?
- Var det en ledende eller hovedansvarlig deltaker i prosjektet?

Barrierer for etablering eller problemer med utvikling og implementering av intermodale løsninger

- Hvordan har den intermodale løsningen utviklet seg?

Den har utviklet seg gradvis over tid eller implementert som en ny løsning

- Hvilke problemer har dere støtt på i implementeringen?
- Hva har vært de interne barrierene for implementeringen av den intermodale løsningen?
- Hva har vært de eksterne barrierene for implementeringen av den intermodale løsningen?

Muligens diskutere følgende problemstillinger: intern motstand, mangel på kunnskap eller erfaring, mangel på partnere, motstridende mål blant partnerne, behov for finansiering, teknisk gjennomførbarhet, kvaliteten på transporttjenestene, lønnsomhet, nærhet til intermodale terminaler, manglende/utilstrekkelig tjenestetilbud, internasjonale forhold (samordning av tidsluker, forskjellige standarder/regelverk), motstand hos partnerne, egenskaper ved godsflyten, manglende intern støtte.

- Hvordan har dette endret seg i løpet av prosessen, fra initiering til gjennomføring?
- Har det vært noen problemer mellom aktørene i fordelingen av ansvar, risiko og gevinst?
- Hva var oppfatningen av intermodal transport før den intermodale løsningen ble tatt i bruk? Har bedriften tidligere erfaringer med bruk av intermodal transport?
- Hva er ulempene med bruk av intermodal transport?
- Hva mener du er den største hindringen for vekst i bruk av intermodal transport?
- Er samarbeid med andre befraktere en farbar veg for å utnytte kapasiteten i systemet? Hva er problemene i et slikt samarbeid?
- Har implementeringen av en intermodal løsning hatt noen virkning på servicen overfor sluttkunde.
- Er du enig i utsagnet om "at en feilaktig oppfatning eller manglende erfaring er årsaken til at intermodale transporter er lite brukt"?

Prosjektresultater

- Har implementeringen av intermodale løsninger medført kostnadsbesparelser?
- Har det blitt foretatt en miljømessig vurdering (CO₂-utslipp og andre eksternaliteter) av en intermodal løsning sammenlignet med den tidligere løsningen? Hvis ja, var det signifikante forskjeller?
- Hvilke andre effekter har dere erfart når det gjelder logistikksystemets funksjon og ytelse?
- Hva er de største fordelene ved intermodal transport?
- Har den intermodale løsningen tilfredstilt transportbehovene og kravene til transporten?
- Er løsningen fremdeles i bruk? Hvis løsningen er avsluttet, hva var årsaken til det?
- Har erfaringen endret bedriftens oppfatning av intermodale transporter?
- Basert på nåværende erfaring, vil dere vurdere å sette i gang andre intermodale prosjekter?

11. **Appendix 4: Selected parts of the Project Proposal (overview and description of research questions)**

INTERMODAL FREIGHT TRANSPORT 2007

Joint Call

from Austria, France, Norway, Sweden, and Switzerland

Common Proposal Form *Stage 2: full-proposal*

Deadline for full-proposals: January 7th, 2008; 12:00 am

PLEASE NOTE: The Norwegian part of this project is shown in **bold**. A brief elaboration of the Norwegian part as an addition to the main proposal is given in ***bold italics***.

PROJECT INFORMATION

| | | | | | |
|-----------------------------------|--|-------------------------------------|---------------------------|------------------------------------|--|
| Acronym | CA-CHAINS | | | | |
| Project title | Customer and Agent Initiated Intermodal Transport Chains | | | | |
| Project Coordinator | Professor Arne Jensen | Email | arne.jensen@handels.gu.se | | |
| Address | Dept. of Business Administration P.O. Box 610, 405 30 Göteborg Sweden | Tel. | +46 31 786 1484 | | |
| | | Fax. | +46 31 786 5244 | | |
| Organisation | Göteborg University Dept. Business Administration | Country | Sweden | | |
| Project Costs (KEuro) (excl. VAT) | | Requested Funds (KEuro) (excl. VAT) | | | |
| Planned Starting date | 01/03/08 | Duration (in months) | 24 | Total person power (Persons*month) | |

CONSORTIUM DESCRIPTION

| CONSORTIUM OVERVIEW | | | | | | | |
|---|--|---------|---|---------------------|--|------------------------------------|---|
| Partner name | Legal Status ²³ (see footnote) | Country | Activity Type ²⁴ (see footnote) | Size (Employees) | SME Status ²⁵ (see footnote) | Total person months in the project | Total Cost in the project (KEuro) (excl. VAT) |
| Partner 1 (Coordinator) Göteborg University, Dept. Business Administration | GOV | SE | HE, RES | | | | |
| Partner 2: Molde University | GOV | NO | HE, RES | | | | |
| Partner 4: | | | | | | | |
| Partner 5: | | | | | | | |
| Partner 6: | | | | | | | |
| Partner 7: | | | | | | | |
| Partner 8: | | | | | | | |
| | | | | TOTAL | | | |

²³ GOV-Governmental, INO-International Organisation, JRC-Joint Research Centre, PUC-Public Commercial Organisation, PRC-Private Commercial Organisation including Consultant, EEIG-European Economic Interest Group, PNP-Private Organisation (Non Profit)

²⁴ HE-Higher Education, RES-Research, IND-Industry, OTH-Others

²⁵ Please specify the SME Status of Industry Partners S – small, M – Medium size company (Definition of small and medium sized enterprises according EC 2003/361/EG from 6th of May 2003, (ABl. L 124, 20.5.2003, S 36-41).

Project Summary (max 1 500 characters)

[Project Summary (max 1 500 characters)]

The research within project "Customer and Agent Initiated Transport Chains" focus two new evolving segments for intermodal transport in Europe, customer and agent initiated intermodal transport chains. These segments represent a high market potential for intermodal transport and it is vital that new knowledge can be created that represent all the special characteristics of these two segments. The most critical barrier to the exploitation of the potential of the two segments is lack of knowledge in organisational, market, operational and technological dimensions of how to initiate and design processes for transport system development and realisation. The purpose of our research proposal is to create such knowledge. In terms of method, action research will be used where possible. This means that the researcher will make contribute to transport system development and create general scientific knowledge at the same time.

This knowledge is a necessary platform for analyses and development of efficient transport systems for the two segments for all analysts and decision makers in the sector such as public transport policy makers and analysts, private company strategists from carrier as well as shipper companies, and also for the academic sector as regards education and continued research and development. In summary, the ultimate aim of our proposed research is the production of new knowledge of high relevance for all parties involved in intermodal transport. Such knowledge is important for all countries and regions in Europe, particularly in regions where transport economies of scale is difficult to bring about in intermodal transport such as countries participating the ERA-NET.

Detailed Description of the Project

“Customer and Agent Initiated Intermodal Transport Chains”

1 The research issue and its motivation

1.1 Traditional mechanisms for consolidating intermodal freight flows.

Intermodal transport systems demand large goods volumes in order to reach a competitive combination of cost efficiency, transport quality and good environmental properties. How large goods volumes that are required depends among other things on the demands for transport frequency, the current intermodal technology and the competitive power of all-road truck transports. Volumes can be consolidated by different mechanisms. Traditionally, they have been consolidated by the market's interchange processes, where the main carrier (rail- or shipping company) or his agent is selling the main transport plus terminal handling to the next link. This link has often consisted of carriers or forwarders responsible for connecting transports and sale of the whole transport (from door to door) to the end customer. This way of consolidating goods can mainly be said to represent a traditional, market based coordination mechanism, which accounts for the main part of the intermodal goods flows.

1.2 Customer initiated intermodal transport chains.

A significant and growing potential for intermodal transport is based in large actors' strategic planning. These actors are either large, often internationally operating, manufacturers or trading companies with goods flows in logistics networks between manufacturing and/or distribution units or large transport coordinators (forwarders, shipping agents, ports) with large flows in international transport networks. The strategic incentives to switch to intermodal transport is the insight that environmental effects, congestion and increasing lack of energy will bring, relatively speaking, more expensive road transports of lower quality at the same time as intermodal transports slowly will increase in competitive power in different aspects.

Even if these actors in total are large and powerful shippers, each individual actor's goods flows in specific relations will often be insufficient as a base for the design of competitive intermodal transport chains. Thus, consolidation of these actors' goods flows is needed. Today, large shippers and transport coordinators increasingly take the initiatives to cooperation, or analysis of cooperation, aiming at establishing intermodal transport chains and systems. This could lead to different forms of partnerships, consortia, etc., here referred to as customer initiated intermodal transport chains. These chains will have to be specifically designed to match the collective requirements of a few big and powerful customers in terms of costs, speed, reliability, frequency, and equipment.

1.3 Agent initiated transport chains.

Another potential is represented by small shippers who do not have sufficient volumes and negotiating power to take initiatives of their own to coordination, but who are positively inclined towards intermodal transport, should the opportunity arise. These buyers need support for the coordination, for instance in the form of external help to establish a coordinating network for a so called line train system. In order to implement a line train system, a strategy is required to overcome the organisational and economic barriers to entry. Earlier, attempts have been made to implement line based combined transport based on one company's perspective and the analysis indicates that more customers are required in order to generate a sufficient volume in the establishment phase. A strategy is needed where volumes, terminals and lines are opened and added to the system successively at the same time as the quality of the transport system can be maintained. Coordination of transports requires that different transport buyers' demands can be adjusted to make utilisation of different kinds of scale economies in the transport system possible. Consolidation of goods for this type of intermodality probably requires that projects are initiated by a suitable external “change agent” (or group of such agents) and they are run by some kind of coordinating network of goods customers and traffic operators. Agent initiated intermodal transport systems could be used as a term for establishment processes of this kind.

2 Aim and research questions

2.1 Aims

This project has two main aims. One is to increase our knowledge and understanding of the initiation and development of two new segments of intermodal transport chains: Customer and agent initiated intermodal transport chains. A second aim is to contribute to the development of customer and agent initiated intermodal transport chains by action driven research. These aims can be considered as instrumental for realising an overall aim which is to contribute to increased market shares for intermodal transport nationally and trans-nationally by providing two new evolving segments of combined transports with sufficient competitive power in the market place.

Our instrumental aims is directly related to one of the prioritised research issues of the ERA-Net joint call, namely “(2) lack of efficiency in and acceptance of the intermodal freight transport system”. Indirectly, it may also address “(1) time and cost in the terminal handling” if revealed as a barrier to the two study segments.

Regarding “2.3 Topics of the joint call”, our research action addresses “Flexible and modular intermodal freight concepts” as the focal field, but may also cover aspects of the other R&D fields when relevant for the segments we are going to study.

2.2 Research questions

Both customer and agent initiated intermodal transport chains are new phenomena at an early stage of development. Therefore, it is important and possible to develop new knowledge that can contribute to understanding these processes and stimulate their future development. It is important to know how the processes start and develop, intra-organisationally as well as inter-organisationally. In this context, it is essential to identify obstacles and barriers that make a transition to customer and agent initiated intermodal transport solution difficult. Also, it is important to identify and develop factors that could constitute driving forces. The research will cover the development and design of intermodal transport chains that are tailored to the requirements of the two categories of shippers. The research may cover organisational, economical, technological, and technical issues.

One kind of obstacle that transport buyers sometimes point out in this context is the risk of goods damage and increased lead time variations. A constructive way of attacking these obstacles is to ask oneself if small changes in the shippers’ logistics systems could contribute to reducing them. The changes could concern packing, load carriers and load handling routines in order to prevent damage to the goods and certain changed planning in the logistics systems combined with more information in both directions to minimize lead time variations or to prevent their negative consequences.

The project will consider the following research questions (RQs) related to customer and agent based intermodal transport chains:

- RQ 1. Why, by whom and how are customer and agent based intermodal transport chains initiated and what do the first phases of the process look like?
- RQ 2. Are there factors in the market structure of the transport sector or in the shippers’ markets that can make the development of customer and agent initiated transport chains difficult (development barriers)?
- RQ 3. What analytical concepts and tools could facilitate for transport policy makers and company strategists when analysing the potentials and prospects of specific cases of customer and agent initiated transport chains?
- RQ 4. When do main carriers (railway operators, shipping companies) and other transport producers enter into the picture?
- RQ 5. How are consortia formed and contracts drawn up?
- RQ 6. How and to what extent are infrastructure owners, municipalities, regions, and catalytic agencies (national and supra-national) involved in the process?
- RQ 7. What transport quality dimensions will be more important than others for the shippers in

customer and agent initiated transport chains

- RQ 8. What aspects of information system integration between critical links in the intermodal transport chains will facilitate the development of customer and agent initiated transport chains?
- RQ 9. What technologies and technical components can support the development of customer and agent based intermodal transport chains (ITUs, railway wagons, handling equipment, terminals, locomotives, IT for shipment tracing and tracking
- RQ 10: What public transport policy measures and company strategic guidelines and decision rules can be recommended from our research?

For organising research activities and allocating research responsibilities the research questions are grouped into the following sub-projects which collectively are intended to cover the entire project:

Sub-project 1: The structure and dynamics of the development processes (RQ1, RQ4, RQ5, RQ6, RQ7, RQ8, and RQ10)

Sub-project 2: Development barriers in the market structure (RQ2 and RQ3)

3 Methodology

The research will use case studies as the main method. The cases will consist of observed customer and agent initiated intermodal transport chain initiatives in the first place, but also potential chains with good conditions for development will be studied. Where possible, action based research will be used as a method. This means that the researchers, to some extent, will influence the process under study and, at the same time, draw objective scientific conclusions from the process. So, action based case studies as well as traditional, non-interfering case studies will be used as main methods for creating knowledge together with supporting theory. The research questions formulated above are both interrelated and sequential. Therefore it seems natural to see the mode of attack as consisting of two steps which, however, may be partly overlapping. In the first step the key words are system description and problem spotting, whereas the second step will be more devoted to explanation and problem solving.

Case study research is flexible when it comes to data collection methods. Data from markets will be collected mainly by questionnaires. Organisational data will be collected by in depth personal interviews, expert interviews, company reports, and observation. Technological information will be collected using observation and measurement. All the sub-projects will rely on existing knowledge, such as the one described in the state-of –the-art-section.

Data manipulation will depend on the specific research question under study. We will use qualitative and quantitative methods for data analysis, particularly multivariate methods; the so called HIT model developed at the logistics and transport research group by Flodén will be used for strategic evaluation of intermodal chain performance in cost, quality, and environmental terms; and discrete event simulation techniques will be used for evaluating logistics flows, particularly in sub-systems for technology development.

The choice of relevant and informative cases is an essential step in case study research. Space does not permit listing all the possible cases that have been identified for research. The cases that are described below are all willing to contribute to the project. They represent a sufficient spectrum of customer and agent based initiatives in different phases of development. They are grouped here according to sub-project, but cases will be used for more than one sub-project if they can provide relevant input to the main project. Letter of intents for the more important partners are attached with this application.

Research related to sub-project 2:

Development barriers in the market structure

Established models. A formal mode choice model is provided in Sunde (2002). This paper studies the market for road haulage and multimodal freight transport, taking into account the behaviour of both carriers and shippers. On the demand side there is a large number of shippers, each dispatching a rather small cargo volume. As a consequence, shippers are assumed to behave atomistically (rather than strategically) treating freight rates and service frequencies as exogenous. On the supply side, there is free entry. It turns out that there are multiple equilibria of which some are stable and some not. If the market equilibrium is to involve multimodal freight transport, such services have to attract a sufficiently large volume of cargo. In other words, there is a 'critical mass' of cargo volume that must be surpassed.

In the model presented in Sunde (2002), multimodal freight transport may not exist due to lack of coordination or cooperation amongst shippers and carriers. It is argued that this lack of coordination and cooperation may call for public intervention. More specifically, it is argued that some kind of 'obstetric aid' is warranted in order to establish multimodal freight transport services and to make them survive the 'infancy' period.

However, the incentives for shippers (and carriers) to coordinate or cooperate is not taken explicitly into account in Sunde (2002). In this respect, the model presented in Haugen & Hervik (2004) is relevant as it explicitly considers the incentives for shippers to coordinate their transports. They consider the choice between road haulage and a public freight transport service from the perspective of the shippers. Although they do not consider multimodal freight transport as such, the public freight transport service may be interpreted as a (part of) a multimodal freight transport service, ie. a liner service. There are significant economies of scale involved in public (multimodal) freight transport whereas road haulage is characterized by congestion. As there are only two agents involved, the shippers mode choice decisions is assumed to constitute a (non-cooperative) game. It turns out that in general, there are multiple equilibria of which some may involve public (multimodal) freight transport and some do not. For some parameter values for instance, the public (multimodal) freight transport service is not an equilibrium (or at least not a unique equilibrium) even though it could bring about lower costs than the equilibrium outcome being pure road haulage; this is an example of a 'prisoners dilemma' type of equilibrium. Thus, even with as few as two shippers involved, it is not trivial to obtain coordination amongst them that will bring about public (multimodal) freight transport. Introducing uncertainty (regarding the demand for cargo transport) reinforces this problem (and may in fact cause the public / multimodal freight transport to be pareto-inferior).

Model extensions. The above mentioned models are starting points for a further study on the issue of cooperation and coordination between shippers. The basic non-cooperative game theoretical model could be made more realistic in a number of ways. For instance, the model presented in Haugen & Hervik (2004) could include a more explicit formulation of multimodal freight transport. The game could also be extended to include more players such as more shippers, carriers and possibly intermediate agents (ie. forwarders). Such modifications could shed some light into the robustness of the results produced so far.

As is well known, when games produce equilibria that are not pareto-optimal (ie. "prisoners dilemma" type of equilibria), the agents have incentives to coordinate their behaviour. This could be achieved through formal agreements (contracts) which specifies how their actions should be coordinated and how the surplus from doing so should be divided amongst them.

This makes cooperative game theory and theories of bargaining relevant as a supplement to the non-cooperative game theoretical models.

In cooperative game theory, it is (implicitly) assumed that the contracts can be enforced at no cost, prohibiting “free-riding”. In practice, this is often far from trivial. This is especially true if there is asymmetric information involved so that merely detecting any deviations from what has been agreed upon is hard or perhaps impossible. If such problems are prominent, it may be impossible to reach an agreement which is credible. More generally, any “transaction costs” may be prohibitive.

Even if a contract could be enforceable at less than prohibitive enforcement or “transaction” costs, asymmetric information could still prevent such contracts from being reached. The reason is that the split of the “pie” may depend on the information that the agents claim or reveal about their benefits from entering into such a contract (or rather their well-being if no such contract is agreed upon). Realising this, agents may be reluctant to reveal truthfully their real benefits as this could be detrimental to their split of the “pie”. If all or most agents conceal their true benefits, the result may be that no agreement would be reached. In fact, taking the initiative to the establishment of a multimodal freight transport service may act like a signal that one's benefits from such a service would be significant (or else one would not take the effort). As a consequence, agents may be reluctant to take any initiative (First mover disadvantage).

An important extension is to introduce multiple periods, effectively turning the game into a dynamic game. As is well known, the outcome of a dynamic game may differ significantly from that of a static (one-shot) game. A dynamic game with sequential moves introduces the possibility of strategic behaviour in early periods in order to manipulate the outcome of the game in later periods (an already mentioned example is the case where agents conceal their benefits in order to obtain a more favourable (larger) split of the “pie”). Perhaps even more important in this respect is the fact that dynamic games also make cooperation more likely in circumstances in which it may be individually rational for players to deviate from what has been agreed upon. The reason is that this introduces the possibility of punishing agents in the future for behaving opportunistically at present. If this threat of punishment is credible, an agreement may be self-enforcing despite being legally non-enforceable.

Supplementary research. The theoretical models may provide a theoretical framework for an empirical survey-type of study amongst agents in the freight transport market. Such a study has previously been carried out by Hervik & Rekdal (2001). A survey-type of study may confirm or reject some of the hypotheses put forward in the theoretical literature, but it may also reveal issues that are not considered in the (more or less stylized) theoretical models. Thus, a survey-type of study may provide a valuable test of the (hypotheses put forward in the) theoretical models, but also give impetus to the development of new theories and models. As such, a survey-type of study is complementary to the theoretical models. *Because of the complexity in the nature of the research problem, the survey will preferably be carried out by means of in-depth personal interviews.*

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