Freight Transport in 2010

An exploration of future prices and quality of freight transport in three scenarios

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Summary

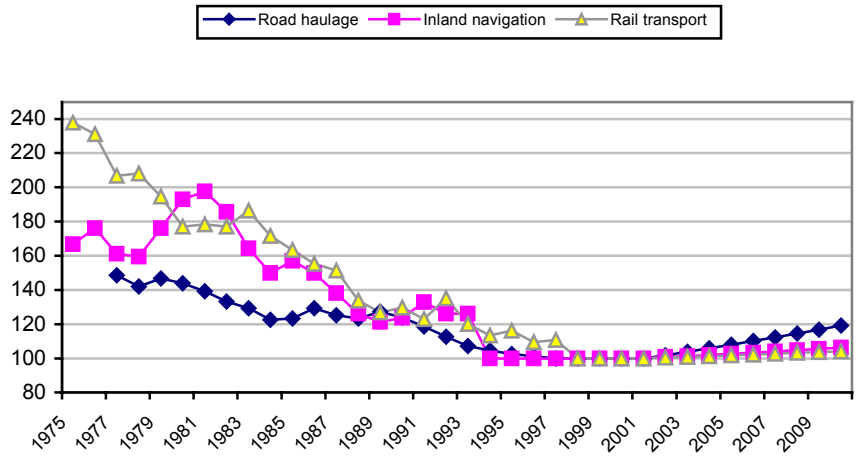
Background

Central to this report is the question what effects government policy can have on rates, transit times, and the reliability of freight transport. In this context, two policy scenarios were examined: one scenario where all social costs that are currently 'external', are passed on to freight transport, and one scenario where the freight transport will grow substantially enough as to cause a significant increase in congestion. Six modes of transport were examined, namely road haulage, inland navigation, rail transport, airfreight, deep sea shipping, and short sea shipping. Data is collected using a Delphi survey in which 68 experts participated.

Autonomous expectations

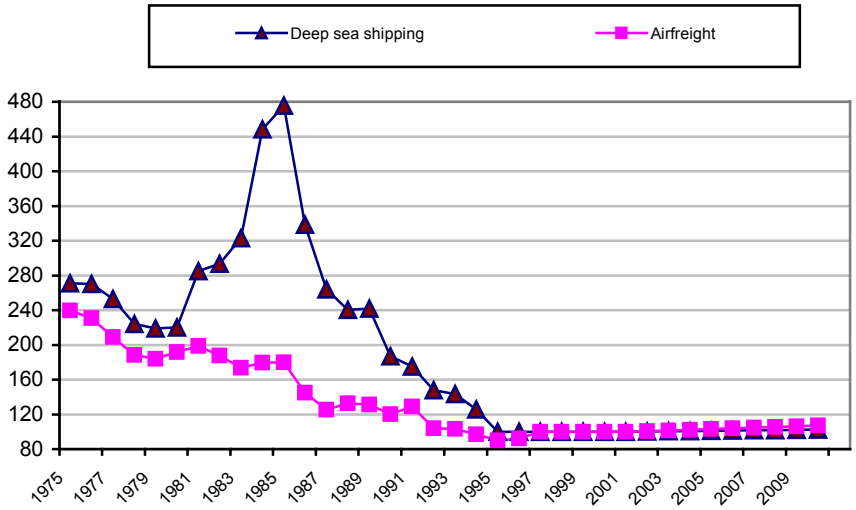
Firstly we examined how rates, transit times and reliabilities will develop autonomously between 2001 and 2010. Regarding rates, an increase is expected for all modes. As the figures show, this means a discontinuity in the historical developments in freight rates[1].

Historical and expected trends in freight rates (continental transport) in indices (2001 = 100).



[1] Unfortunately, for short sea shipping historical data on rates lacked. Yet, there are no indications that in short sea shipping, rates would have shown an upward trend.

Historical and expected trends in freight rates (intercontinental transport) in indices (2001 = 100)



The respondents to the Delphi survey expect that rates will increase notably due to increases in operating costs, such as tax increases (e.g., the German kilometer tax for heavy freight vehicles), increased scarcities on infrastructure networks, and rising labor costs. Yet, at the same time it is expected that between 2001 and 2010 carriers will improve productive efficiency and improve load factors, for instance by an increased use of planning systems, reduced fuel use, and by increased efforts to acquire cargo for return trips.

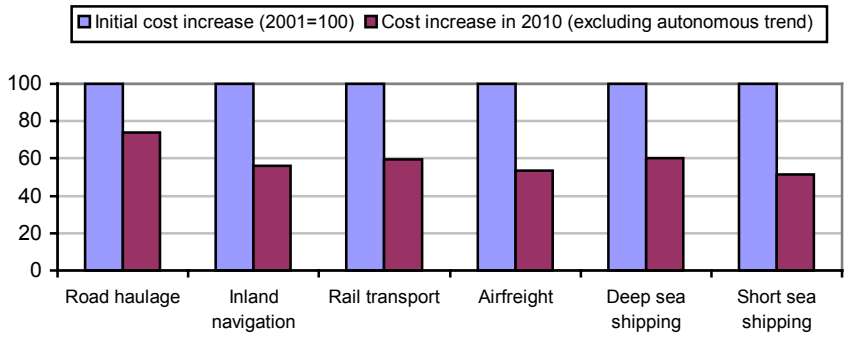
Regarding transit times, for all modes of transportation with the exception of road haulage, a reduction is expected between now and 2010. The reliability of freight transport, expressed in the number of overdue arrivals, is expected to remain the same or even improve, except for airfreight and road haulage (see the table below). Apparently, the latter modes will face increased congestion.

Expectations regarding transit times and reliability in 2010, compared to 2001

	Road haulage	**Inland navigation**	**Rail transport**	**Airfreight**	**Deep sea shipping**	**Short sea shipping**
Transit time	+ 9.6%	- 6.9%	- 4.8%	- 4.2%	- 7.5%	- 1.25%
Delivery reliability	Same/ worse	Better/ same	Better	Same/ worse	Same/ better	Better/ same

Expected effects of passing on of all external social costs (scenario 1)
If the social costs of freight transport are passed on to carriers as a ton-kilometer charge, this will lead to a relatively high increase in costs. The experts expect that by 2010 a part of the initial cost increase will be 'evaporated' by a change in operational management of carriers (see below).

Expected extent to which carriers are able to offset the cost increase caused by the ton-kilometer charge between 2001 and 2010

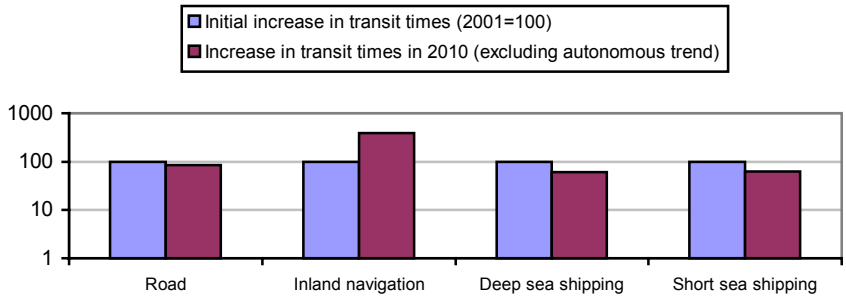


The adaptations will vary between the transport modes. For all modes except for short sea shipping, the ton-kilometer charge will reinforce the acquisition of return cargo; improving load factors by co-operation between carriers in the form of cargo exchange, is considered likely in inland navigation, rail transport, airfreight, and short sea shipping. In all waterborne transport, it is expected that shipowners will try to reduce fuel costs by slowing sailing speed. The ton-kilometer charge is eventually expected to cause a scaling-up of average firm size in rail transport, short sea shipping, and deep sea shipping. Adaptations in the size of transport means (vessels, vehicles, aircraft) are expected in inland navigation, airfreight, rail transport, and short sea shipping. Finally, road carriers, rail operators, airlines, and deep sea carriers will more often refuse small or unprofitable shipments.

Expected effects of a strong increase in congestion (scenario 2)
The effects of a hypothesized strong increase in congestion are also researched. The nature of congestion varies for each mode of transportation, however. For instance, in rail transport and airfreight, queuing is only to a limited extent possible, in contrast to the other modes, which is caused by the relatively rigid

infrastructure capacity allocation systems employed. Yet, also in rail transport and in airfreight often delays occur, but it appeared that scenarios in which transit times initially increase by tens of percentages due to congestion are unrealistic. Hence, the congestion scenario was disregarded for rail transport, whereas an adapted scenario was constructed for airfreight. For the other transport modes, a substantial increase in congestion by the end of 2001 was assumed. In road transport, congestion is assumed to occur on line infrastructure, whereas in the other modes congestion is notably assumed to exist at ports and terminals.

Expected extent to which carriers are able to offset the delays caused by a strong increase in congestion between 2001 and 2010



It is expected that the extent to which the initial delays affect transit times in 2010 varies significantly between the modes. The disproportional increase in transit times that is expected for inland navigation is in part explained by the fact that multiple ports are visited. Yet, in short sea shipping this is also the case. For all modes, a deterioration in reliability is expected. Also in this scenario, different responses of transport companies are expected. In road haulage, inland navigation, and short sea shipping, congestion will lead to a more intensive use of planning systems, whereas more in advance planning with shippers is considered likely in all modes except for airfreight. The use of larger transport means is considered likely for all sectors but inland navigation. Changes in departure times are only expected in road haulage, short sea shipping, and deep sea shipping; in the other modes, flexibility in scheduling apparently is low. In deep sea shipping and short sea shipping, more efforts to optimize load factors are expected. Finally, in road haulage it is expected that route choice will be adapted, whereas in airfreight, deep sea shipping, and in short sea shipping, other (air)ports will be called at. This is mainly explained by the fact that the scenarios assumed differences in the nature of congestion.

Preface

In the near future, a dramatic increase in freight transport from, to, and within the Netherlands is expected. Transport policy of, among others, the Dutch Ministry of Transport and the European Commission aims at both facilitating and managing the increasing transport demand. Policy instruments include for instance a selective expansion of the road network, investments in multimodal transshipment terminals, and pricing (e.g., higher taxes for road haulage). But what will these instruments mean for the functioning of the freight transport sector? And what will be the effects of these instruments on the attractiveness of the various modes of transportation? These questions are addressed in this report. The main source of information used is the outcome of a survey among a pool of experts, working at transport companies, shipping companies, universities, research institutes, interest groups, governmental agencies, and environmental groups.

This research would not have been possible without the co-operation of 68 of these experts. We are grateful for their time and efforts. The names of the respondents are listed in annex A. Apart from that, several people have provided additional help, e.g., by giving background information or by commenting on drafts of the questionnaire. In this context, we would like to thank in particular Mrs. Bontekoning (OTB/TU Delft), Mr. Both (Road Air), Mr. Ekelmans (Sony Music ISC), Mr. Kleijn and Mr. Quispel (NEA), Mr. Molin (TU Delft), Mr. Van Nieuwenhuis (Railion), Ms. Oatway (Drewry Shipping Consultants), Mr. Poppink (TLN), Mr. Van Schuylenburg (Port of Rotterdam), Mr. Vijn (Fiege Kalf Logistics), and Mr. Warffemius (Erasmus University Rotterdam).

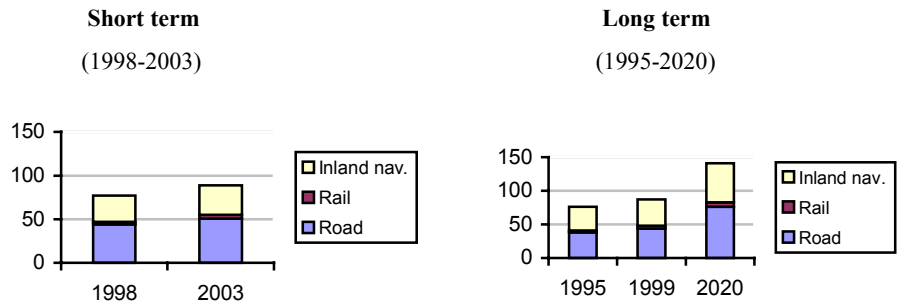
Contents

1 Introduction

1.1 Background

In the near future, a strong increase in freight transport is expected. Studies conducted by the Dutch Ministry of Transport indicate that in the short term, freight transport on Dutch territory may increase by more than 15 percent, and in the long term even with 80 percent (see figure 1). It is expected that a substantial part of the growth in freight transport will be realized by road haulage. The expected developments partly contradict current transport policy of the Dutch Ministry of Transport and the European Commission, aiming at a reduction in the growth in freight transport and a modal shift from road to intermodal transport, based on inland navigation, rail transport, and short sea shipping.

Figure 1: Prognoses freight transport on Dutch territory (in billion tonkm)



Prognoses are based on a CPB scenario with 'favorable' economic growth and the 'European Coordination' scenario, respectively. Sources: AVV, 1998: 27; AVV, 2000: 6.

In the coming years, transport policies of the above governments consist of a mix of instruments that on the one hand facilitate the growth in freight transport and on the other hand aim at regulating it. These instruments include among others a selective expansion of the road network, investments in multimodal transshipment terminals, and pricing (such as the planned surcharge based on kilometer driven in Dutch road haulage). Yet, what will these policy interventions mean for the freight transport sector? How will they affect the attractiveness of the various modes of transportation in terms of costs, speed, and reliability?

The literature contains various starting points for answering these questions. Studies conducted by Dings *et al.* (1999a) or Kågeson and Dings (1999) for instance provide insight into the possible effects of increases in fuel costs and kilometer operating costs on the operations of transport firms. Other studies show the quantitative effects of changes in carrier rates on the number of vehicle kilometers and on the modal split (e.g., Geurs and Van Wee, 1997 and Oum *et al.,* 1990). The mechanisms that underlie these changes are described in studies on modal choice of shippers (e.g., Gruppo CLAS, 1998, NEI/NEA, 1990, and Muilerman, 2001), but also in studies on adaptations in supply chains in response to higher transport costs (e.g., Groothedde and Van Haselen, 1998 or McKinnon and Forster, 2000a). Finally, Korver and Mulders (1992) and Muilerman (2001) describe the logistical responses of Dutch shippers and carriers to increased congestion on motorways.

Despite these studies, still important knowledge gaps exist, notably where it concerns the effects of specific policy interventions on future rates, transit times, and delivery reliability of freight transport. With this report we hope to contribute to the reduction of this knowledge gap.

1.2 Research questions

In this research, the following question is addressed:

"How do freight rates, transit times, and delivery reliability develop in the future and what could be the impact of transport policy on these variables?"

This question is subdivided into the following subsidiary questions:

1. How do transport costs, transit times, and delivery reliability develop autonomously?
2. By which measures can governments affect freight rates, transit times, and delivery reliability?
3. What options do carriers have to respond to these measures? Which ones are the most likely to occur?
4. Suppose the government would decide to introduce certain interventions (or abandon others), what impact could that have on transport costs, transit times, and delivery reliability?

1.3 Context of the research

This research is part of a Ph.D. project, conducted by the first author. This project, which has started in December 1998, aims to explore interactions between supply chains and freight transport. In this context, for instance the transport effects of logistical trends such as flexibilization, lead-time reductions, and just-in-time distribution are explored, as well as the effects of increasing congestion on the design of supply chains. Apart from that, the project assesses to what extent governments can affect logistical decisions of shipping firms by way of interventions in the transport sector.

1.4 Organization of this report

Chapter 2 describes the methodological approach used in this research. In chapter 3 to chapter 8, the research outcomes are treated for each transport mode (namely, road haulage, inland navigation, rail transport, airfreight, deep sea shipping, and short sea shipping). Conclusions are drawn in chapter 9. More detailed information on the survey is included in the annexes.

2 Research design

2.1 Introduction

In this research, a Delphi survey was chosen to answer the questions posed. In section 2.2, this method is briefly described. The design of the Delphi survey in this research is outlined in section 2.3. The response and the number of reaction rounds that were held, are treated in section 2.4 and 2.5. The limitations of the research are described in section 2.6.

2.2 The Delphi method

Delphi studies aim to seek consensus among a group of experts on a particular topic. In this context, the experts are asked multiple times to fill in a questionnaire anonymously. The opinions of the individual respondent are returned, together with those of the other respondents, in order to provoke a 'virtual debate' (Daniëls and Duijzer, 1988: 89-90; Van Houten, 1988: 5; Woudenberg, 1991: 133).

Delphi surveys are frequently used in situations, dominated by a high degree of uncertainty, such as futures research. In such situations, other methods like extrapolation of statistics fail and researchers often revert to the opinions of experts. Although expert consultations can also be executed by means of interviews or surveys, Delphi surveys have a number of advantages. One, an (indirect) exchange of opinions occurs, which can accentuate original opinions and make these opinions more complete. Two, compared to expert meetings, there is no influence of dominant persons, no (or less) influence of social desirable behavior or majority thinking, and time to develop or adjust opinions (Daniëls and Duijzer, 1988: 89). However, if the number of experts is small, Delphi surveys do not yield statistically representative information (Gordon, 1994: 4). Also, they tend to produce conservative estimations and enforce existing paradigms. Finally, they sometimes give little insight into the respondents' reasoning (McKinnon and Forster, 2000a: 3). Nevertheless, Delphi surveys are frequently employed in transport studies[2].

[2] See for instance Marchau (2000) for a general overview or McKinnon and Forster (2000a) for studies that focus on freight transport and logistics.

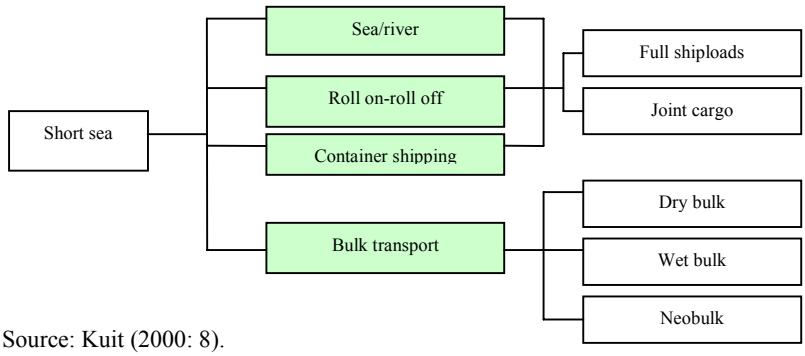
2.3 Design of the Delphi survey

In the design of our Delphi survey, special attention is paid to the potential disadvantages of Delphi research. In the treatment of several specific aspects of the survey below, this will be explained.

Focus of the survey

The research focuses on road haulage, inland navigation, rail transport, airfreight, deep sea shipping, and short sea shipping to and from the Netherlands. Each of these transport modes is however characterized by a high degree of heterogeneity. One, they serve various market segments (see for instance figure 2). Two, market conditions, and hence rates often vary per transport relation (see for instance table 1). Three, large cost differences exist between countries. Recent research for instance demonstrated that the operating costs of Italian road haulers are 44 percent higher than those of Greek colleagues (Nieuwsblad Transport Dossier, March 23, 2001)[3]. Four, costs – and hence rates- fluctuate in time, as table 2 illustrates. Five, costs and rates vary between firms; it is for instance well known that self-employed drivers often do not calculate all (labor) costs. Due to this heterogeneity, generic statements about 'the road haulage sector' or 'the inland navigation sector' are barely possible. In order to acquire more in-depth knowledge, it was decided to focus in this research on one important transport flow per mode of transportation, expressed in freight volume, cargo unit, and distance covered. For road haulage, for instance the focus is on container haulage from Rotterdam to Duisburg. The selected freight flows are treated in the following chapters.

Figure 2: Sub markets served by short sea shipping



Source: Kuit (2000: 8).

[3] Hensher and Brever (2001: 138) compare cost structures of short sea shipowners in a number of countries. They found large differences between countries; in 1994 the average share of manning costs in total costs in the VS was for instance 58 percent against only 28 percent in the UK.

Table 1: Differences in road haulage rates (among others due to traffic imbalances)

Route	FTL rate from UK (in £)	FTL rate to UK (in £)
London-Milan	800	1.400
London-Paris	350	700
London-Frankfurt	500	800
London-Amsterdam	400	700
London-Antwerp	250	400

Source: Cooper *et al.,* 1994: 262.

Table 2: Trends in the average cost structure in container shipping on the Rhine (*)

Cost components	1999, 1st quarter	1999, 2nd quarter	1999, 3d quarter	1999, 4th quarter	2000, 1st quarter	2000, 2nd quarter	2000, 3d quarter
Labor	46.0%	45.2%	44.6%	43.5%	41.9%	41.8%	40.6%
Writing off, interest	19.3%	19.0%	19.7%	19.3%	19.8%	19.7%	18.8%
Fuel, lubricants	13.2%	14.6%	14.8%	16.7%	18.7%	19.0%	21.9%
Other	21.6%	21.2%	20.9%	20.5%	19.6%	19.5%	18.7%
Total	100%	100%	100%	100%	100%	100%	100%

Note (*): data relate to Dutch shipowners. Source: NEA, 2001.

Selection of experts

Given the central research question, we selected 130 persons who have expertise with respect to:

- Pricing strategies of transport companies;
- Options that transport companies have at their disposal to respond to certain transport policy interventions;
- The most likely options to be chosen by transport companies, when confronted with certain policy interventions;
- The ultimate effects of certain policy interventions on rates, transit times, and delivery reliability.

A broad pool of experts within the transport sector, shipping firms, interest groups, academia, research institutes, the Ministry of Transport, and the environmental movement was approached. In this way, we aimed to get insight into possible biases on the part of the experts. The reason for this is that in another Delphi survey, it appeared that shippers and carriers had completely different expectations with respect to future carrier rates (Cooper *et al.,* 1994: 251), which may partly be caused by wishful thinking. We expected that the size and composition of the target group selected would yield a sufficiently representative picture of the opinions of experts in general on the research questions under study.

The experts were identified within the personal networks of the research team, via additional sources such as interest groups, congresses, and lists on the internet, and finally within firms that are active in the market segments on which this research focuses.

Scenarios

As indicated in the introduction, this research focuses on the effects of policy interventions on carrier rates, transit times, and delivery reliability of freight transport. We decided to examine two scenarios that each contain a set of policy measures and that ultimately lead to the following situations:

1. *Pricing scenario:* it is assumed that all social costs, caused by freight transport, are charged to carriers via a ton-kilometer charge[4];
2. *Strong increase in congestion:* it is assumed that investments in infrastructure will be insufficient to handle the expected future growth in both freight and passenger transport.

These policy scenarios were chosen because governments can affect carrier costs and hence rates notably through taxation, whereas transit times and reliability of freight transport depend heavily on the degree (or absence) of congestion, which in turn can be affected through (dis)investments in infrastructure. An additional argument is that the scenarios chosen are plausible for all transport modes examined in this research, which enables comparisons between transport sectors[5]. However, with respect to rail transport, a scenario describing a sharp increase in congestion appeared to be unrealistic on the transport flow chosen, and hence was left out of consideration.

Questionnaire

The questionnaire consists of two parts. The first part contains a number of propositions concerning possible developments in the transport sector that may affect rates, transit times, and reliability. Examples include the use of route and trip planning systems and co-operation between transport companies[6]. Some

[4] Various respondents have indicated that a ton-kilometer charge is not very effective or realistic, in contrast to charges based on vehicle-kilometers. Although they may be right in this, we have chosen to use ton-kilometers because the next research activities of the first author are focused on how shipping firms may respond to government interventions in freight transport, and in this context, ton-kilometer charges are considered more adequate than vehicle-kilometer charges. In the cover letter that accompanied the second reaction round, this was explained to the respondents.

[5] Prior to the selection of these two scenarios, an inventory was made of possible and planned policy interventions that may affect carrier rates, transit times, and reliability. For this purpose, a literature review was conducted (see the references), as well as several interviews.

[6] The possible developments that are included in the questionnaire are based on a literature research. The used sources are listed in the bibliography.

propositions are not realistic in the present situation, but were included in order to prevent that experts exclusively would reason from existing paradigms (see section 2.2) [7]. The propositions were largely identical to each of the six transport modes that were examined in the survey.

The experts are asked to indicate the likelihood of each of the propositions in case of (a) scenario 1, in which ton-kilometer charges are introduced, (b) a strong increase in congestion, as described in the second scenario and (c) in case none of these scenarios will occur (i.e. the autonomous scenario). An illustration of part of the questionnaire is given by figure 3.

Figure 3: Illustration of the first part of the questionnaire

[Part research on road haulage]	**No scenario** How likely do you consider these developments between now and 2010, if neither scenario eventuates?						**Scenario 2: Pricing sce** How likely (...)	
Question 1: Which developments until 2010 do you expect in container haulage from Rotterdam to Duisburg? *Possible developments:*	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely
1. The use of trip and route planning systems will increase	☐	☐	☐	☐	☐	☐	☐	☐
2. Carriers will acquire more return cargo	☐	☐	☐	☐	☐	☐	☐	☐
(...)								

The goal of the first part of the questionnaire is to explore which developments, that affect rates, transit times, and reliability, are the most likely to occur in the future according to the experts consulted. Because the experts are asked to indicate the likelihood of the set of propositions in each of the three scenarios, looking at can derive the effects of the scenarios:

- Changes in the percentage of experts who consider a particular development (very) likely or (very) unlikely;
- Changes in the relative strength of expectations: for instance derived from changes in the scores on '(un)likely' and 'very (un)likely', respectively.

[7] The experts are given the opportunity to add propositions. Given the fact that this barely occured, the set of propositions employed seems rather complete.

In the second part of the questionnaire, the experts are asked to give an estimation of rates, transit times, and reliability of freight transport in 2010. Again, distinction was made between 'autonomous' expectations and expectations with respect to the two policy scenarios. Explanations for these estimations are (partly) found in the responses to the first part of the questionnaire. With this approach, we tried to meet the criticism that Delphi surveys would give little insight into the respondent's reasoning (see section 2.2).

2.4 Response

In the first reaction round, 186 surveys were sent to 130 experts. 68 experts responded by returning one or more questionnaires (52.3 percent, i.e., 46.8 percent expressed in the number of questionnaires that were sent out). More information about the response is given in table 3.

Table 3: Response rates

Part research (by transport mode)	**Questionnaires sent out**	**Response first reaction round**		**Response second reaction round**	
		Percentage	*N*	*Percentage*	*N*
Road haulage	58	44.8%	26	31.0%	18
Inland navigation	41	46.3%	19	34.1%	14
Rail transport	33	57.6%	19	42.4%	14
Airfreight	15	46.7%	7	33.3%	5
Deep sea shipping	19	26.3%	5	21.1%	4
Short sea shipping	20	55.0%	11	30.0%	6
Total	186	46.8%	87	32.8%	61

The Delphi survey consists of six part researches, one for each of the transport modes under study. In the surveys on road haulage, inland navigation, rail transport, and short sea shipping, a relatively high response rate is realized. Also, a relatively large number of experts were involved in these surveys, which makes the outcomes less sensitive to (deviant) opinions of individual experts. In contrast, the surveys on airfreight and deep sea shipping yielded a lower response. Hence, their results should be considered with more caution.

Table 4 describes the response rates by the professional background of the respondents. The relatively low response among shippers appears to be caused primarily by a certain 'survey fatigue'. The low response among governmental

experts (notably working at the Ministry of Transport) is probably caused by a lack of time and maybe also a lack of expertise. Finally, and indication of the expertise of the Delphi participants is given in table 5

Table 4: Response by professional background of the experts

Professional background respondent	**Questionnaires sent out**	**Response first round**		**Response second round**	
		Percentage	*N*	*Percentage*	*N*
Transport sector (*)	53	49.1%	26	35.8%	19
Interest groups (**)	19	47.4%	9	21.1%	4
Consultancy/ research institute	36	61.1%	22	38.9%	14
University	18	55.6%	10	44.4%	8
Shipping firms	42	33.3%	14	31.0%	13
Government	16	25.0%	4	18.8%	3
Environmental group	2	100%	2	0.0%	0
Total	186	46.8%	87	32.8%	61

Notes (*): includes transport companies, forwarders, and terminal operators; (**): interest groups in behalf of the transport sector.

Table 5: Indication expertise respondents Delphi survey

	Number of years of experience			**Expertise with respect to more than one mode**	**Expertise from more than one job**
	> 5 years	2-5 years	< 2 years		
Number of experts	58	6	0	46	32
In percentages	91%	9%	0%	72%	50%

2.5 Number of reaction rounds

Delphi surveys typically aim at achieving a particular degree of consensus among a group of experts, which is attained by at least two reaction rounds. Ideally, a survey is stopped when complete consensus is achieved. Given the fact that this rarely occurs, reaction rounds are often stopped if experts do not change their opinions anymore (Marchau, 2000: 59-60). Yet, after each additional reaction round, non-response occurs, in which case it is not always clear to what extent the respondent would have changed his or her opinion.

Literature on Delphi surveys does not define unambiguous stopping criteria. In this research, we assumed that a ‘sufficient’ degree of consensus exists if:

- With respect to the propositions in the first part of the questionnaire, at least 60 percent of the experts have selected the same (type) of answer.

This criterion is also met when the sum of the scores for e.g. 'very likely' and 'likely' is 60 percent or more;

- The opinions on the propositions are not more or less equally divided between '(very) likely' and '(very) unlikely'[8];
- With respect to the estimations in the second part of the questionnaire at least 50 percent of the experts have selected the same predefined interval.

After the first reaction round, the scores for each of the questions in the questionnaire (in percentages) were marked on a form similar to the original questionnaire and returned to the respondents. Experts were invited to reconsider in particular those questions that had yielded insufficient consensus (as defined above). These particular questions were marked shaded (as in annex B).

Eventually, for all subsidiary surveys, two reaction rounds were held for three reasons. One, a relatively high degree of consensus was realized (see table 6; for a more detailed overview, see annex C). Two, a relatively high number of experts had not changed his or her original opinion in the second reaction round (again, see table 6). Three and finally, the drop-out rate after the second reaction round was relatively high (see table 3); hence a third round would therefore give an incomplete picture of changes in the degree of consensus and the 'persistence' of non-responding experts.

Table 6: Overview of the degree of consensus and 'persistency' of respondents

	First reaction round	**Second reaction round**
Percentage of questions with 'sufficient' consensus:		
▪ *First part questionnaire (on average 17 propositions, repeated three times for the three scenarios)*	66.3%	68.6%
▪ *Second part questionnaire (3 questions, repeated three times for the three scenarios)*	48.2%	56.5%
Percentage of respondents who had no changes compared to the first reaction round	(Not relevant)	41.3%

[8] A 60-40 division between '(very) likely' and '(very) unlikely' was considered an unsufficient degree of consensus.

2.6 Limitations of the research

Despite the broad approach used, this research obviously is not all-embracing. One, the results are not necessarily representative of all transport sectors, but rather indicative. This is caused by the fact that we consider only one important transport flow for each of the six transport modes under study.

Two, the survey does not completely reveal the reasoning on which the experts have based their estimations with respect to rates, transit times, and delivery reliability, in particular in the 'autonomous' scenario. The responses on the first part of the questionnaire however are complemented with outcomes from the literature review and the interviews that were conducted prior to the survey. Additionally, respondents were given the opportunity to add what they considered to be relevant developments, but this only occurred sporadically.

Three, not all possible and relevant developments that may affect rates, transit times, and delivery reliability, have been included in the research. For instance, an increase in containerization of (continental) freight transport, facilitated by an expansion of the terminal network, could lead to a substantial reduction in costs. However, in this research a given load unit was used to reduce the complexity of the questionnaire and to maintain a level of comparison of the responses.

Four, for the sake of simplicity load characteristics such as volume density, were passed over. These characteristics may be of influence on the results of, for instance, a ton-kilometer charge; a shipper of low value bulk freight will be more sensitive to prices than a shipper of high-tech products.

Finally, in particular the scenario where all social costs of freight transport are passed on, is not realistic by definition. In a Delphi survey held in 1999, 42 percent of the participating experts expected that road transport would never have to pay the entire social costs, whilst 30 percent expected this would not occur until 2010 (McKinnon and Forster, 2000b)[9,10]. In this research a certain hypothetical character of the scenarios (observed from the current point of view) do not pose a problem. The aim of this research is not to predict the future, but to get an insight into the direction of the effects of possible policy scenarios.

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[9] The experts who participated in the Delphi-survey of McKinnon and Forster are comparable with those that have participated in our survey.

[10] Aside from the political sensitivity, problems of a feasibility nature may also account for this (consider for instance the Mannheim Act that prohibits levying fees on the Rhine, which in turn will probably have consequences for introducing levies on other transport modes).

3 Road haulage

3.1 Introduction

The part research into road haulage relates to container transport from Rotterdam to Duisburg. Container transport was selected because it represents a large section of the market within road haulage. The largest part of container transport by road has the port of Rotterdam either as origin or destination. Germany is an important relation; in 1997 15 percent of the total container road haulage to and from the Netherlands involved transport between Germany and the Netherlands (AVV, 1998: 143)[11]. The relation Rotterdam-Duisburg was selected because of the availability of data on rates, transit times, and reliability.

Table 7 shows some data about container road haulage between Rotterdam and Duisburg. These were also added to the Delphi-survey. It should be mentioned that the data are indicative, for instance, tariffs will be lower for a larger shipper. Apart from that, the data represents only a moment in time.

Table 7: Background data container road haulage Rotterdam-Duisburg(*)

Variable	Value
Rate per container (both 20' and 40')	fl. 1,200.- (from the Meusse Plateau)
Door-to-door transit time (240 km.)	6 hours (incl. 2 hours loading and unloading)
Reliability (number of trips with less than 15 minutes delay at arrival)	98%
Cost structure:	
- Labor	47%
- Fuel, lubricants	15.5%
- Writing-off	8.5%
- Interest	8.5%
- Repairs, maintenance	4.5%
- Other	16%

Note (*): all data early 2001 and including loading and discharging. Sources: MCA (1999; updated); TLN (1999: 82); oral information from TLN and some anonymous sources.

3.2 Autonomous expectations

On average, expert expect that rates for container road haulage between Rotterdam and Duisburg will show a real increase of 19.2 percent in the period

[11] This relatively low percentage can be explained by the fact that the statistics from AVV relate to the entire container transport to and from the Netherlands, including (intercontinental) sea freight.

of 2001 to 2010. This expected increase in rates is relatively higher than was expected in the comparable Delphi-survey held in 1999 by McKinnon and Forster. In this survey an increase in road rates of 11 percent between 1999 and 2005 was predicted (McKinnon and Forster, 2000b). The following could cause these differences:

- McKinnon and Forster concentrated on all road transport in Europe, not just container transport between Rotterdam and Duisburg;
- Between both Delphi-surveys a period of about 1.5 years has elapsed, during which the price of diesel rose considerably. It is possible these increases were not foreseen during the survey of McKinnon and Forster.

The expected increase in rates causes a discontinuation of the historical trend in road transport rates. From 1977 onwards the real rates for international road haulage (by Dutch carriers) have actually dropped by on average 2 percent per annum (Dings *et al.,* 1999c: 31). It must be noted that these figures are based on the total revenue of international road haulage divided by the total number ton-kilometers. This means that they may not by definition be representative of container road transport between Rotterdam and Duisburg.

The, by the respondents, expected net increase in rates has as basis a large number of factors. The fact that the difference with the scenario whereby the external costs of road transport are passed on is relatively small (see section 3.3), can be an indication that the experts expect an increase in taxes such as the German kilometer levy[12]. Possibly, restrictions of road haulage such as prohibitions on weekend transport may play a role. Finally, the shortage of personnel, which can lead to higher wages, will also have an effect. Specific factors that can be derived from the reactions on the first part of the questionnaire are:

- Rising costs that will be passed on more frequently;
- It is expected that the efficiency of road transport will increase (which will have a downward effect on rates) because of:
  - Increase of the usage of trip and route planning systems;
  - More trips will be planned in advance with shippers;
  - More acquisition of return freight;
  - Increase of freight exchange between carriers;
- Fuel consumption will probably decrease;
- Carriers from low-cost countries are expected to carry more freight, assuming their liberties remain unchanged;

[12] This kilometer levy for heavy vehicles amounts to approximately 37 cent per kilometer, which amounts to an increase in costs of fl. 88. - for the route Rotterdam-Duisburg.

- It is expected that the number of large transport companies will increase, e.g. through mergers. Because of economies of scale, larger enterprises may be able to operate more efficiently (for instance, by allocating more freight to different vehicles) or may negotiate more favorable rates.

It is further expected that the transit time of road haulage from Rotterdam to Duisburg will increase by 9.6 percent in 2010. This is contrary to the trend from the Seventies onwards where road transport managed to realize an increasingly higher speed on the road network (MUConsult, 2001: 54). Almost 60 percent of the experts expect that the reliability will remain the same, whilst 38 percent expect a worsening (see Annex B). Apparently an increase in congestion is expected, which was also expressed by BOVAG-RAI and the ANWB recently (Nieuwsblad Transport, 25 July 2001).

Up to 2010, the following trends are expected that will be of influence on the transit times and reliability:

- Increase in the use of trip and route planning systems;
- Efficiency improvements (dealt with previously), which will lead to the deployment of fewer vehicles (and hence a higher frequency);
- Changes in departure times to reduce the transit time (for instance, departing earlier and more overnight transport). This will of course be limited by the demands of the shipper.

These trends will eliminate in part the negative effects of increasing congestion.

3.3 Expected effects of the ton-kilometer charge

Description of the scenario

The European Commission decides to pass on all external social costs of freight transport. As from the end of 2001, all freight forwarders will pay all costs related to transport, including the cost of infrastructure, environmental impact and traffic hazards. Passenger transport will not be levied for the moment. The social costs are passed on as an extra charge per ton-kilometer, which will be imposed on all transport companies that operate within the EU. The charge will amount to 12.2 cent per ton-kilometer for freight transport by road (cf. a reasonably recent research of CE into the marginal social costs of transport (see Dings *et al.,* 1999b: 94)).

For container transport from Rotterdam to Duisburg this scenario means a cost increase of fl. 370.- per container (given an average load of 12.6 ton[13]), which coincides with 40 percent of the current revenue per container. In this scenario it is assumed that the planned German kilometer levy will be canceled.

The average expectation of the experts is that rates will increase by 48.7 percent in 2010[14]. as a result of the ton-kilometer charge. Considering the expected autonomous increase of 19.2 percent in rates and the initial effect of the ton-kilometer charge (40 percent increase in costs), it is expected that transport companies will be able to absorb about 25 percent of the initial cost increase due to the ton-kilometer charge between 2001 and 2010. The foundations of these developments are the same as mentioned in the autonomous scenario, albeit that the ton-kilometer charge is expected to enhance the following trends:

- Passing on of cost increases;
- Acquisition of return freight;
- Outsourcing of smaller and/or unprofitable cargos;
- More cargo exchange between carriers;
- More haulage by enterprises from low wages countries.

It is expected that the ton-kilometer charge will lead to a slight increase in transit times in respect to the autonomous scenario (9.6 as opposed to 8.8 percent). It is not entirely clear what the foundation of this is. Possibly, an increase in acquisition of return cargo may lead to a certain amount of delay.

The experts expect that the ton-kilometer charge will have a positive effect on reliability; 76 percent expect that the reliability will remain the same as opposed to 58 percent in the autonomous scenario. Most likely, it is assumed that the ton-kilometer charge will: (a) reinforce the pressure on carriers to improve transport efficiency in terms of load factors, reducing the number of trucks on roads; (b) cause a shift of road transport to other modes of transportation; and (c) cause a better spread of traffic over the road network (through overnight transport and adaptations in departure scheduling). An explanation for the latter effect might be that the experts have assumed that the ton-kilometer charge will vary in time (e.g., higher during rush hours due to congestion surcharges), which however is not explicitly mentioned in the scenario description.

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[13] Based on estimations of incoming and outgoing flow of containers and swap bodies by road transport between Rijnmond (i.e., the Rotterdam region) and the hinterland in 2010 (Deelen *et al.,* 1999: 26-27).

[14] Experts working at (interest groups in behalf of) transport companies are a little more pessimistic about the effects of the ton-kilometer charge on rates. They expect an increase in rates of 58.3 percent; experts working at (interest groups in behalf of) shipping companies and the other experts expect an increase of 46.5 percent and 46.1 percent, respectively.

3.4 Expected effects of a strong increase in congestion[15]

Scenario description

In this scenario, congestion increases dramatically, as the planned investments in roads appear to be insufficient to facilitate the growth in both passenger and freight transport. With that, the number of queues, as well as their length, increase. Between 2001 and 2010, the average speed on the motorway network drops to 50 km/h. Outside rush hours, the average speed is higher; during rush hours traffic sometimes stands still for almost an hour or more. We assume that container haulage from Rotterdam to Duisburg will take at least 80 minutes longer, which means an increase in the door-to-door transit time of 22 percent compared to currently (incl. loading and discharge).

The experts expect that this scenario will lead to an increase of rates of 29.4 percent in 2010, which is 10 percent more than the autonomously expected increase in rates. The increased congestion will mean an additional intensification of the use of planning systems, will lead to more exchange of cargo between carriers, stimulate the use of larger vehicles, and finally will lead to more co-operations between carriers and firms that are specialized in cargo acquisition and consolidation (e.g., forwarders)[16].

The transit time is expected to increase by, on average, 28.3 percent, which is almost 20 percent more than in the autonomous scenario. Apparently, carriers are considered to be barely able to offset the initial increase of transit times of 22 percent, produced by the scenario. Another explanation could be that the experts consider our estimated lead time extension of 22 percent too low, for instance because drivers have to take additional rests.

Finally, the experts unanimously expect deterioration in delivery reliability, which is remarkable given the increased importance shippers attach to this

[15] The scenario is based on model calculations by the Ministry of Transport (Ministerie van Verkeer en Waterstaat, 2001a). For comparison: in 1999, on most motorways in the Netherlands a driving speed during rush hours of more than 80 kilometer per hour was realized; within the Randstad a number of motorways realized a lower speed (namely, between 60 and 80 kilometer per hour) (ministerie van Verkeer en Waterstaat, 2001a: 50-51).

[16] Experts working at (interest groups in behalf of) carriers are slightly more pessimistic about the effects of this scenario on rates. They expect a rate increase of 36.8 percent, against a 27.5 and 26.1 percent increase, expected by those working at (interest groups in behalf of) shippers and other experts, respectively.

variable (see for instance Muilerman, 2001: 156). Apparently, in case of dramatically increasing congestion, carriers can no longer guarantee arrival times, despite the fact that experts expect that in such circumstances, the following trends will appear more intensively as compared to the autonomous scenario:

- The use of planning systems;
- Cargo exchange between carriers;
- Planning in advance of transports in co-operation with shippers;
- The use of larger vehicles;
- Changes in departure times (e.g., more overnight transport);
- Changes in route choice.

3.5 Comparison between the scenarios

The experts expect that the ton-kilometer scenario will have the largest effects on rates. Apart from the quantification of the scenarios, an explanation can be found in the options carriers have at their disposal to respond to this scenario. The ton-kilometer charge will reinforce the autonomously expected trends of (a) passing cost increases on in higher rates; (b) a more active acquisition of return cargo; (c) outsourcing of small or unprofitable cargoes; and (d) an increased market share of carriers from low-cost countries. In contrast, dominant developments in case of strongly increasing congestion are reinforcements of the autonomously expected trends of (a) increased use of planning systems; (b) in advance planning with shippers; (c) more acquisition of return cargo; (d) outsourcing of small or unprofitable cargoes; (e) the use of larger vehicles; (f) changes in departure times; (g) more transport at night; (h) changes in route choice; and (i) co-operation with firms that are specialized in cargo acquisition and consolidation. Also, in this scenario it is expected that the market share of carriers from low-cost countries will increase even more. Hence, carriers may seem to have more options at their disposal than in case of a strong increase in congestion.

4 Inland navigation

4.1 Introduction

In inland navigation from, to, and within the Netherlands, three large transport flows are (Brolsma, 2000; CBS, 1998: 21; 64; CBS, 1999: 30):

- Domestic bulk transport (notably building materials);
- International bulk transport, notably to Germany (e.g, iron ore);
- International container transport, in particular from Rotterdam to Germany.

In this part research, we have chosen to focus on container shipping, since this type of transport competes with other modes of transportation and hence is better comparable than for instance bulk transport. The relation Rotterdam-Mannheim is selected because transport models of NEA have show that this is an important transport flow. Table 8 represents several indicative figures about this transport.

Table 8: Background information container shipping Rotterdam-Mannheim (*)

Variable	Value
Rate per container (40')	fl. 695.-
Quay-quay transit time (587 km.)	140 hours (incl. 36 hours loading & 8 hours discharge; multiple ports)
Reliability (number of sailings that arrives with less than 4 hours delay)	87.5%
Cost structure (208 TEU 'Europe' vessel, 80% loaded):	
- Labor	25%
- Fuel, lubricants	6%
- Writing-off	11%
- Loading and discharge	42%
- Other	16%

Note (*): all data early 2001 and including loading and discharging. Sources: MCA (1999; updated); NEA (2001); oral information from NEA and from an anonymous shipowner.

4.2 Autonomous expectations

The experts involved in this part research expect that the rates on the selected transport flow will increase by 6.3 percent until 2010, excluding inflation. This does not coincide the results of a similar Delphi survey that was conducted in 1999 by McKinnon and Forster, who report an expected drop in inland navigation rates of 0.5 percent between 1999 and 2005 (McKinnon and Forster,

2000b). Besides the explanations that were offered in section 3.2, an additional explanation could be that McKinnon and Forster focused on both inland navigation and intra-European short sea transport. Just like in the part research into road haulage, the expected increase in rates will mean a discontinuation of the trend in international inland navigation rates which, as from 1980, have shown a drop of on average 4 percent per annum (Dings *et al.,* 1999c: 31).

The respondents to this survey expect that operating costs will increase in future, which will be passed on to shippers. Cost increases can for instance be found in wages, which, due to the ongoing shortage of labor, may have to rise in order to attract enough personnel. Apart from that, the experts foresee several trends that lead to a higher efficiency and hence reduce operating costs:

- Increased use of planning systems;
- More sailings will be planned in advance in co-operation with shippers;
- More acquisition of return cargo;
- Use of larger vessels;
- Reduction in fuel use.

With respect to transit times, an average reduction of 6.9 percent is expected. Opinions are divided on how reliability may develop; 56 percent expect an improvement, 33 percent do not expect any change, and the rest considers deterioration in reliability performance likely. Explanations that emerge from the survey results are that the use of planning systems will increase and that more sailings will be planned in advance. The experts have not reached consensus on whether or not departure times will be adapted. It should be noted however that departure times are to a large extent determined by arrival times of deep sea carriers and the schedules of terminal operators.

4.3 Expected effects of the ton-kilometer charge

Scenario description

As described in the previous chapter, in this scenario the European Commission decides to pass all external social costs produced by freight transport on to transport companies. In inland navigation, this means that by the end of 2001, shipowners will be charged a levy of 4.4 cents per tonkilometer, in conformity with the study of CE, mentioned in the previous chapter (Dings *et al.*, 1999b: 94).

This scenario implies that in the container shipping from Rotterdam to Mannheim, shipowners are confronted with a cost increase of on average fl. 387.50 per container (given a load of 15 ton[17]), which coincides with 56 percent of the current revenue per container.

The experts expect that , due to the ton-kilometer charge, in 2010, real rates (without inflation) will be 37.6 percent higher than what they are currently[18]. Given the autonomously expected increase in rates of 6.3 percent in 2010 and the initial cost increase of 56 percent due to this scenario, carriers are apparently considered to be able to absorb a substantial part of the ton-kilometer charge. An explanation can be found among others in the following expected trends:

- The autonomously expected increased use of planning systems and increased in advance planning with shippers;
- More efforts to obtain return cargo, as compared to the autonomous scenario;
- It will become likely that carriers will exchange cargo in order to raise load factors of vessels;
- Larger vessels will be employed;
- Fuel use will be reduced to a larger extent than in the autonomous scenario;
- Perhaps more often maintenance and (replacement) investments will be postponed, although the opinions are still divided.

Transit times are expected to decrease less sharply than in the autonomous scenario (4.5 percent against 6.9 percent). A possible explanation is that increased efforts are expected to be undertaken in order to improve load factors, which may take additional time. Another explanation is that the average speed will be reduced. Reduction in fuel use is namely considered (very) likely and it is a well-known fact that fuel use and speed are related (see for instance Weekblad Schuttevaer, April 2001). This indicates that shippers who purchase transport services are more sensitive to an increase in rates than to an increase in transit times; similar results were found in for instance a study of HCG (HCG, 1992). Compared to the autonomous scenario, the experts are less optimistic about the reliability of inland navigation. This may be related to the expected increased measures to raise load factors, which may cause a delay.

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[17] Based on estimations of the incoming and outgoing flow of containers and swap bodies by rail between Rijnmond (i.e., the Rotterdam region) and the hinterland in 2010 (Deelen *et al.,* (1999: 52).

[18] Experts working at (interest groups in behalf of) carriers and shippers are more optimistic about the effects of the ton-kilometer charge than the other experts (expected increase of 18.8 percent and 25 percent respectively, against an expected increase of 53.1 percent). Because the 'other' experts are over-represented in the survey, this may lead to a certain bias the results.

4.4 Expected effects of a strong increase in congestion[19]

Scenario description

This scenario assumes substantially increasing congestion, which is caused by a mismatch between infrastructure provision and the growth in inland navigation. Delays notably occur in the port of Rotterdam, where inland vessels are loaded. Delays are caused by increased pressure on the port, for which port infrastructure is not always designed, and by increasing capacity shortages at terminal operators. In 2010, vessels engaged in container shipping from Rotterdam to Mannheim stay on average 12 hours longer in Rotterdam to be loaded than in 2001. Apart from that, regularly unforeseen, additional delays occur of 8 hours or more.

The experts expect that this scenario will lead to an increase in real rates of on average 30.6 percent in 2010[20]. Transit times will increase on average by 26.4 percent, which does not only mean a substantial increase as compared to the two preceding scenarios, but also compared to the initial delay caused by this scenario of 12 hours or 8.6 percent of the total quay-quay transit time. Apparently, delays have effects elsewhere in the transport chain, for instance because vessels have to wait longer at other terminals for discharging (recall from table 8 that in container shipping to Mannheim, multiple terminals are visited). This can also be derived form the fact that 94 percent of the experts expect that reliability will deteriorate. Measures that are expected to be undertaken in order to compensate for delays (e.g., increased use of planning systems, co-operation with shippers about future sailings, and where possible, rescheduling of departures) will not turn this trend.

[19] This scenario is constructed as follows. First, we ascertained to what extent congestion is realistic on the transport flow chosen (i.e., Rotterdam-Mannheim). Internal studies by the Ministry of Transport indicated that even in case of a dramatic growth in inland shipping, no or barely no delays will occur. The capacity on both the fairways and the inland terminals are amply sufficient. In contrast, both the ministry and a shipowner have indicated that delays often occur at terminals in the port of Rotterdam, and that it is plausible that these delays increase in future as a consequence of a growth in inland navigation.

[20] Experts working at (interest groups in behalf of) shippers and the other experts are more pessimistic about the effects of a strong increase in congestion than the experts that work at (interest groups in behalf of) transport companies (expected increases in rates of 40 percent, 32.8 percent, and only 12.5 percent, respectively).

4.5 Comparison between the scenarios

The two policy scenarios are expected to provoke different responses of transport companies. Trends, which are considered likely in all scenarios including the autonomous scenario, are an increased use of planning systems, a higher utilization of vessels (due to more in advance planning and more acquisition of return cargo), and the use of larger vessels. Besides, in all three scenarios, it is considered unlikely that departures may be postponed in order to obtain a higher load factor. The experts differ in opinions with respect to trends relating to:

- The market share of transport companies from low-cost countries;
- Co-operation between transport companies and firms, specialized in cargo acquisition and consolidation;
- The number of terminals that will be called at en route (which may affect load factors);
- The average company size;
- Postponement of maintenance and (replacement) investments;
- Changes in departure times.

If a ton-kilometer charge is introduced, this will give even more an impetus to carriers to pass cost increases on to shippers. Also, more cargo will be exchanged between carriers. Postponement of maintenance and (replacement) investments, unlikely in the other scenarios, becomes less unlikely. An increase in rates in response to increased transport demand becomes explicitly unlikely, whereas in the other scenarios opinions are divided with respect to this issue. Finally, the ton-kilometer charge will reinforce the trends of more return cargo acquisition and a reduction in fuel use.

Increased congestion in the Rotterdam port, as described in the preceding section, will notably lead to more cargo exchange between carriers and will provide an additional incentive for carriers to make more use of planning systems and to plan sailings more in advance with shippers.

5 Rail transport

5.1 Introduction

The main share of rail transport with an origin or destination in the Netherlands is international of nature. According to Dutch railway company Railion, the largest transport flows in this respect are:

- Bulk transport: iron ore and coals from Rotterdam to the German Ruhr and Saarland areas. As an indication, weekly three to four trains leave to the Saarland area, carrying 3,800 tons of ore each;
- Container transport: shuttle trains from Rotterdam to Northern Italy. Daily, four to five trains leave with each 65-80 TEU[21].

Similar in the part researches into road transport and inland navigation, we decided to focus on container transport. The transport flow selected is Rotterdam-Milan, for reasons of data availability.

Table 9: Background information container transport by rail Rotterdam-Milan (*)

Variable	Value
Rate per container (40')	fl. 1,180.-
Door-to-door transit time (about 1,000 km.)	3 days (incl. 5,5 hours loading and 2 hours discharging)
Reliability (number of shuttles with less than 1 hour delay at arrival)	60%
Cost structure (shuttle, 80 TEU max., load factor of 80%):	
- Labor	36%
- Fuel, lubricants	8%
- Writing-off	6.5%
- Repairs, maintenance	6.5%
- Loading and discharging	20%
- Other	23%

Note (*): all data early 2001 and including loading and discharging. Sources: Kuit (2000; updated); oral information from an anonymous source.

5.2 Autonomous expectations

The experts consulted expect that by 2010, the real rates of container transport from Rotterdam to Milan, excluding inflation, will be 4.2 percent higher than what they are now. This differs from the marginal increase in rail tariffs of 0.1 percent between 1999 and 2005, as was found by McKinnon and Forster (for

[21] A TEU is a twenty feet equivalent, which equals one 20 feet container.

possible explanations, see section 3.2). The expected increase in rates will mean a radical change in the historical trend in international rail transport rates, since as from 1956, these rates (expressed in revenue per ton-kilometer) have decreased by 3 percent per annum (Dings *et al.,* 1999c: 31)[22].

The expected increase in rates will be caused by a number of factors. It is likely that the gradual introduction of an infra levy in the Netherlands but also in other EU countries, will be one of them. Specific factors affecting rates, which were mentioned by the respondents, include:

- It is expected that rates will be raised due to higher operating costs and in response to an increased demand for transport;
- On the other hand, efficiency gains are expected which lead to lower rates, due to (a) an increased use of planning systems; (b) higher load factors due to increased co-operation between shippers and carriers, the acquisition of more return cargo, and increased cargo exchange between carriers; (c) the use of transport equipment with a larger capacity; (d) lower fuel use, and (e) a scaling-up in the rail transport sector;
- New entry by other rail operators, which may lead to lower rates.

Apart from this, the experts expect that the transit time of rail transport from Rotterdam to Milan will be reduced by 4.8 percent in 2010, whereas the currently relatively low reliability will also be improved. Explanations for these expectations may be the foreseen introduction of the BB21 safety system, which will increase capacity of the rail network significantly, and the expected increase in the use of planning systems.

5.3 Expected effects of the ton-kilometer charge

Scenario description

It is assumed that the ton-kilometer charge that will be levied on rail transport will not include total infrastructure costs, in contrast to those levied on the other modes of transportation. The reason is that otherwise rail transport would become disproportionally expensive, which conflicts the policy goals of a modal shift from road to rail. In this context, the charge for rail transport is set at 5.36 cents per ton-kilometer (cf. Dings *et al.*, 1999b: 94).

[22] It should be noted that the data on the historical trend in rail rates are indicative of the rates in international container transport, since they include also bulk transport.

For the shuttle container services from Rotterdam to Milan, the scenario implies a cost increase of on average fl. 885.- per container (given an average load of 16.5 ton[23]), which equals 75 percent of the current revenue per container.

The experts consulted expect that the ton-kilometer charge will lead to an increase in rates of some 49 percent in 2010[24]. Given the fact that the ton-kilometer charge initially (i.e., in 2001) implies a cost increase of 75 percent expressed in revenues, and given the expected autonomous rise in rates of 4.2 percent, this means that carriers are expected to absorb a substantial share of the cost increase. Explanations can be found in the fact that the experts expect that the following trends will be intensified:

- Acquisition of return cargo;
- Cargo exchange between rail operators, leading to a higher load factor of the shuttle trains;
- Increased outsourcing of small or unprofitable cargoes;
- Use of larger trains;
- Lower fuel use;
- Increase in average firm size, which may point to the existence of economies of scale in case of increasing costs per ton-kilometer.

Apart from that, 30 percent of the respondents expect carriers to postpone more often departure of trains, in order to realize a higher load factor or the acquisition of sufficient return cargo. Apparently, it is expected that at least certain shippers prefer an increase in transit times to an increase in rates. Most experts however consider this strategy unlikely, which can be explained by the fact that flexibility in rail transport is low, since rail capacity allocation via 'slots' takes place primarily months prior to actual departure.

It is expected that in this scenario, by 2010 the average transit time will be decreased by 6.2 percent as compared to the current situation, or 5.8 percent, compared to the situation in 2010 in the 'autonomous' scenario. The reliability will improve more than in the autonomous scenario. A possible explanation for these two expectations is that the higher load factors of trains and the expected use of larger trains will lead to a relief in infrastructure use, which reduces the chance of delays, although delays are notably caused by passenger transport.

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[23] Based on estimations of the incoming and outgoing flow of containers and swap bodies by rail between Rijnmond (i.e., the Rotterdam region) and the hinterland in 2010 (Deelen *et al.,* 1999: 57-58).

[24] The opinions among the experts barely differ. Experts working in the transport sector (including interest groups) and experts working at shipping companies (or interest groups of shippers) expect an increase in rates of 45.8 percent, whereas the other experts expect an increase of 50 percent.

Apart from that, the respondents may have expected that carriers will try to compensate the higher costs (due to the ton-kilometer charge) by an improved service.

5.4 Comparison between the 'autonomous' and the ton-kilometer charge scenario

The preceding section described several autonomously expected developments in rail transport from Rotterdam to Milan that, due to the ton-kilometer charge, are expected to occur even more intensively. These developments are notably related to a reduction in operating costs and an improvement of the efficiency.

Irrespective of both scenarios, the respondents expect an increase in competition in (European) rail transport. Finally, in both scenarios the experts consider it unlikely that carriers will call at more terminals in order to improve load factors. This would be contrary to the concept of shuttle trains, which aims at a high speed by reducing the number of stops (e.g., for shunting).

6 Airfreight

6.1 Introduction[25]

In airfreight from and to the Netherlands, in 1999 most freight was transported between Schiphol and Asia (30 percent of a total of 1.2 million tons; AAS, 2000). Since more detailed statistics lack, an anonymous airfreight forwarder was asked to indicate a transport flow with a large volume, which with respect to rates does not deviate too much from other airfreight. This yielded the Amsterdam – Tokyo route.

Table 10: Background information airfreight Amsterdam-Tokyo (*)

Variable	Value
Rate per pallet (2,500 kilo)	fl. 11,250.-
Airport-airport transit time (distance 6,000 miles or 9,650 km)	60 hours (of which 48 hours loading, discharge and customs)
Reliability (number of flights with less than 3 hours delay at arrival)	95%
Cost structure (full freighter B747, max. 100 ton load capacity)(**):	
- Fuel, lubricants	36%
- Writing-off/overhead/labor	28%
- Maintenance	14%
- Loading and discharge	13%
- En-route charges and landing charges	9%

Notes (*): data early 2001 and including loading and discharging; (**): average cost structure of flights to the Far East. Sources: anonymous forwarder and airlines; they are asked to verify data originating from Avmark (cost structure) and Nieuwsblad Transport (rates).

6.2 Autonomous expectations

The respondents expect real rates in 2010 to be 7.1 percent higher than what they are now. The opinions do not differ much; 43 percent of the experts foresee no change in rates whereas the remaining 57 percent expect an increase between zero and 25 percent. The average expected rise in rates is in line with the survey of McKinnon en Forster (2000b), who found an increase in real airfreight rates of 5.7 percent between 1999 and 2005. Yet, this trend would imply a radical change compared to the historical trend as rates have shown an average decrease of 5.6 percent per annum over the past 40 years (Dings *et al.,* 1999c: 41).

[25] As observed in section 2.4, the results have to be interpreted with some caution, due to the relatively small number of respondents that were involved in this part research.

The experts have indicated to expect the following developments in airfreight from Schiphol to Tokyo, which may explain the expected increase in rates:

- Increased operating costs. According to the forwarder who was interviewed prior to the survey, cost increases may stem from labor shortages (leading to higher wages), stricter environmental regulations (e.g., a tax on kerosene), and increased scarcity of infrastructure. Apart from that, shippers increasingly demand real-time information on the status of their shipments, which may lead to additional investments in tracking-and-tracing equipment;
- Increase in rates in response to an expected increased demand for airfreight services;
- The use of more full freighters instead of combined passenger/airfreight aircraft;
- Lower fuel use;
- The addition of hubs to airfreight networks in order to improve consolidation opportunities and hence load factors.

With respect to the average airport-airport transit time between Schiphol and Tokyo, a reduction of 4.2 percent is expected in 2010, as compared to early 2001. It is not clear what will cause this; possible explanations are an expected use of faster aircraft[26] or faster loading, discharging, or customs procedures. 71 percent of the respondents expect that the reliability of airfreight will remain the same, whereas 21 percent foresees a deterioration, probably caused by increased congestion on airports.

6.3 Expected effects of the ton-kilometer charge

Scenario description

Again, it is assumed that by the end of 2001, ton-kilometer charges are introduced in order to 'internalize' all social costs caused by freight transport. In airfreight, the charge will be 13.1 cents per ton-kilometer (cf. Dings *et al.*, 1999: 94).

[26] Over the past 40 years, cruising speed of aircrafts has increased lapwise from 600 to 750 kilometers per hour, an average of 0.5 percent per annum (MUConsult, 2001: 54).

This scenario implies that airfreight from Schiphol to Japan will be levied a charge of fl. 3,160.- per pallet (given an average load of 2,5 ton[27]), which equals almost 30 percent of the current pallet revenue.

The respondents expect that airfreight rates in 2010 will be 23.2 percent higher than what they are currently, it should however be noted that there is a relatively large variance in opinions[28]. Given the autonomously expected increase in rates by 2010 of 7.1 percent and the initial increase in operating costs of about 30 percent, the experts apparently expect that some 14 percent of the ton-kilometer charge can be absorbed. This can at least partly be explained by the following expected developments that deviate from the 'autonomous' scenario:

- More exchange of cargo between airlines;
- Refusal of unprofitable shipments;
- Lower use of full freighters; probably airlines will try to combine more freight transport with passenger transport;
- Intensified reduction in fuel use.

The addition of hubs in the airfreight network is considered less likely in this scenario, as compared to the autonomous scenario, which may be related to the expectation that less full freighters will be employed.

In the ton-kilometer charge scenario, transit times are expected to remain the same as currently, and hence will not decrease, as is expected in the autonomous scenario. The underlying reasons do not completely become clear from the survey results. It is expected that reliability will remain unchanged; possible explanations therefore could be (a) reduced congestion at airports (although this largely depends on passenger transport), and (b) efforts that may be undertaken to improve reliability in order to compensate for the higher rates caused by the ton-kilometer charge.

[27] The assumed average weight of 2.5 ton per pallet originates from the anonymous forwarder.

[28] Experts that work at airlines and forwarders are more pessimistic about the impact of ton-kilometer charges on rates than the other expert (expected increase of 31.3 percent and 12.5 percent, respectively).

6.4 Expected effects of a strong increase in congestion[29]

Scenario description

Intercontinental airfreight transport from and to Europe is assumed to grow dramatically between 2001 and 2010, which causes capacity problems. The main causes of this trend are the ongoing globalization and increased time pressure in logistics. Schiphol airport as well as many Japanese airports have attained their capacity limits. Carriers however estimate that if there were no capacity shortages, they could have executed 25 percent more flights than what is possible in this scenario.

The experts that participated in this part research, expect that the congestion scenario will lead to a real increase in rates of 28.6 percent in 2010, compared to 2001[30]. The main factors that underlie this estimation and that appear from the survey are:

- It is considered very likely that rates will be raised due to the increased scarcity of aircraft, causing a shift in market power;
- Unprofitable shipments are very likely to be refused. Carriers will hence focus on those shipments that yield the highest revenue per volume (see also Busscher, 2000: 9);
- The congestion will raise operating costs;
- Airlines will more often fly to other Japanese airports and from there transport the cargo by road transport;
- More often than now, carriers and shippers will plan in front flights, which may lead to higher load factors and reduce rates;
- Larger aircraft will be employed;
- Fuel use will be reduced to a higher extent than in the autonomous scenario.

[29] In aviation, capacity problems related to infrastructure are of another nature than in case of other transport modes. The main reason is that a limited number of slots is available at airports; once these are exhausted, airlines have to find other airports. In addition, queuing, either on the ground or in the air, is only to a very limited extent possible. Yet, often delays occur but according to the Air Traffic Control the Netherlands, it is not realistic that in future they will increase so far that increases in transit times are produced with tens of percentages (which in contrast is possible in most other transport modes that are examined in this research). In order to construct a realistic congestion scenario, we have chosen for this scenario. Its quantification however is hypothetical, since data lack to make a more plausible estimation.

[30] Experts working ate transport companies again are more pessimistic than the other expert (31.3 and 12.5 percent increase in rates, respectively).

In the congestion scenario, it is considered unlikely that cargo will be exchanged between carriers. Neither is it expected that hubs will be added to the network, which may be explained by the resulting additional increase in transit times.

Transit times are expected to increase between 2001 and 2010 by on average 20.8 percent; it should be noted however that the opinions vary. 86 percent of the experts consider a deterioration in reliability likely, whereas 14 percent expects reliability to remain the same as in 2001.

6.5 Comparison between the scenarios

The preceding sections have described a diversity of responses of carriers to the two policy scenarios employed in this part research. Remarkably, in none of the two scenarios do the experts involved in the survey expect that carriers will more actively try to acquire return cargo, make more intermediate landings by adding hubs to their networks, or make more use of companies that are specialized in the acquisition of cargo. It is possible that the expert anticipate an increased scarcity of airfreight capacity, which will make cargo acquisition or the improvement of load factors not problematic. Finally, except for the autonomous scenario, it is considered unlikely that a scaling-up in the sector via mergers and acquisitions will occur.

7 Deep sea shipping

7.1 Introduction[31]

Transport by sea from and to the Netherlands is dominated by the transport of bulk freight, such as ores, scrap, and crude oil. In 2000, the total incoming and outgoing goods flow in Rotterdam mounted to almost 158 million tons, of which 73 percent consisted of bulk freight. Containers and flats[32] had a share of 21 percent (GHR, 2001: 3). The container statistics however include not only intercontinental shipping, but also feeder transport and short sea shipping. In this part research, we focus on intercontinental shipping (i.e., deep sea). Within this transport sector, two large transport flows involve the transport of iron ore from Brazil to Rotterdam, and container shipping between Rotterdam and Singapore[33]. Again, we have chosen to focus on container shipping; several characteristics of this type of transport are given in table 11. It should be noted that these data are notably indicative, since rates tend to vary on a monthly base and because research has taught that cost structures of container carriers differ heavily between shipowners (see for instance Prince, 2001).

Table 11: Background information container shipping Rotterdam-Singapore (*)

Variable	**Value**
Rate per container (40')	fl. 3,060.- (incl. fl. 350.- fuel surcharge)
Quay-quay transit time (distance 9.650 km)	20 days (including 0.5 day loading and discharge)
Reliability (number of sailings with less than 1 day at arrival)	95%
Cost structure (container vessel, 5-6.000 TEU capacity)(**):	
- Writing-off, labor, fuel (***)	43%
- Loading and discharging and port dues	18%
- Administration	4%
- Rent and repositioning of containers	35%

Note (*): data early 2001 and including loading and discharging; (**): cost structure is an average in the container shipping from and to Northern-America (more specific data lacked or were outdated); (***): bunker costs (i.e., fuel) make up about half of these costs. Sources: anonymous shipowner and Prince (2001: 63-67; adapted).

[31] As indicated in section 2.4, the results of this subsidiary survey should be considered with some caution, due to the relatively small number of experts involved.

[32] Flats are sideless containers that are used for unconventional cargo such as machinery and yachts. In empty condition, they can be 'folded'. However, since they cannot be stacked, their rates are usually higher than those that are charged in case of normal containers.

[33] Source: GHR (2001: 10; 13) and additional information of the Rotterdam ort Authority.

7.2 Autonomous expectations

On average, the experts involved in this part research expect carrier rates to increase between 2001 and 2010 by 2.5 percent without inflation. This expectation is in line with the results of the Delphi survey conducted by McKinnon and Forster (2000b), who found an expected increase in deep sea container rates between Europe and South-East Asia of 1.4 percent in 2005 compared to 1999. Despite the marginal rate increase, again this points to a radical change in the trend in rates, since over the past 20 years, rates in real terms have decreased by on average 5.5 percent per annum (Dings *et al.,* 1999c: 41).

The average transit time of container shipping from Rotterdam to Singapore will, according to the experts, decrease by 7.5 percent in 2010, compared to the current situation. With respect to reliability of arrivals, 60 percent of the experts expect no changes compared to the current situation, whereas 40 percent expects an improvement. Foreseen developments that underlie these expectations, are:

- A raise of rates in response to an increased demand for intercontinental container services;
- An increased use of planning systems;
- More acquisition of return cargo;
- More cargo exchange between carriers (for instance within so-called conferences[34]), which may improve load factors;
- The use of larger vessels
- A reduction in fuel consumption;
- Changes in departure times in order to guarantee a reliable arrival;
- The choice to call at other ports in order to avoid delays;
- An increase in average firm size in the deep sea sector.

[34] Conferences are co-operations between shipowners that operate on certain transport relations (e.g., between Europe and Africa), which aim at guaranteeing regular services and stable tariffs. Partners agree upon rates and share freight requests. Under free market conditions, high fixed costs of shipowners in combination with seasonal fluctuations in demand would otherwise lead to unstable services and heavily varying rates.

7.3 Expected effects of the ton-kilometer charge[35]

Scenario description

The European Commission succeeds in levying charges on intercontinental shipping from and to the European Union. The charges comprise all external social costs of transport (including for instance pollution), and is implemented via ton-kilometer surcharges. They are introduced by the end of 2001 and amount to 1.47 cent per ton-kilometer for intercontinental shipping.

This scenario implies that carriers in container shipping from Rotterdam to Singapore are faced with a cost increase of fl. 2,300.- per container, given an average load of 16.25 ton[36], which is equal to 75 percent of the current revenue per container.

The Delphi participants expect that in 2010, the real rates in this scenario will be 47.5 percent higher than what they currently are[37]. Given the autonomously expected increase in rates of 2.5 percent in 2010 and the initial cost increase of the ton-kilometer charge of 75 percent of current rates, this means that it is expected that a relatively large share of the ton-kilometer charge will be absorbed. In this context, relevant expected developments include:

- Rates will be raised in response to an increased transport demand;
- The autonomously expected increased use of planning systems will be intensified;
- Shipowners and shippers will jointly plan sailings more in advance, which may lead to a better vessel utilization;
- Intensified acquisition of return cargo;
- Small or unprofitable cargoes will be outsourced;
- More efforts will be undertaken to reduce fuel use;
- Unanimously, a scaling-up in the sector is expected.

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[35] For the calculation of the external social costs of deep sea shipping, the report *De juiste prijs voor het verkeer* of T&E (1993: 15), which is based on *Getting the prices right* (Kågeson, 1993) is used. The data in these sources are not completely representative, since they are based on ro-ro vessels. More specific data however lack. The data are to some extent outdated; yet, we assumed that social cost reduction which may have occured (e.g., due to lower emissions) have been compensated by opposite effects (e.g,, inflation since 1993).

[36] Average load, based on total container transport by sea from Rotterdam to Singapore/South-East Asia (CBS, 2000; GHR, 2000), corrected for the share of 20' containers.

[37] Experts that work in the transport sector expect an increase in rates of 18.8 percent, whereas the other experts expect that rates will increase by 12.5 percent.

Apart from that, it is expected that the autonomous trends of cargo exchange, the use of larger vessels, and changes in departure times in order to guarantee reliability will also occur in this scenario.

According to the experts, in 2010 the average transit time will increase by 2.5 percent, which is 10 percent higher than is expected in the autonomous scenario. An important cause can be found in a reduction in speed in order to economize on fuel costs (which make up about 20 percent of total costs)[38]. Apart from that, measures that aim at improving load factors may contribute to the expected 'delay'.

On average, reliability is expected to remain the same as in 2001. The reason is probably that, in contrast to the autonomous scenario, it is not expected by the experts that shipowners will call at other ports. Apparently, they expect that due to the ton-kilometer charge, congestion in Rotterdam and Singapore will decrease.

7.4 Expected effects of a strong increase in congestion[39]

Scenario description

In this scenario, deep sea shipping from and to Europe grows dramatically between 2001 and 2010, mainly die to a further globalization of the world economy. The result is an increased pressure on the main sailing routes and within ports, despite investments in port infrastructure and terminals. Additionally, the construction of the Second Meusse Plateu in Rotterdam is postponed, causing significant delays. More and more shipowners face difficulties in coordinating agreements with terminal operators and desired sailing schedules. Apart from that, regularly unforeseen delays occur, which is caused by the growth in vessels calling at the ports and tight plannings of many terminal operators. In container shipping from Rotterdam to Singapore, the average period a vessel stays in ports for loading and discharging, increases from half a day to 3 days. Regularly, unforeseen delays of half a day or more occur due to capacity problems at terminals.

[38] A vessel shipping at an average speed of 14 knots can reduce annual fuel consumption almost by half when reducing speed with 3 knots per hour (De Wit and Van Gent, 1996: 269).

[39] The description and quantification of this scenario have been validated at the Rotterdam Port Authority.

The respondents expect that in this scenario, rates will increase by 15 percent in 2010[40]. The average transit time will be 7.5 percent higher than currently and 15 percent higher than what is expected in the autonomous scenario. Given the fact that the initial delay as described in the scenario is 25 percent (i.e., an additional 5-day delay in ports, on an initial transit time of 20 days in 2001), this means that shipowners are expected to avoid part of the delay. The results of the survey show that this may be caused by a mix of measures, including the choice for other ports, postponement of departure until a higher load factor or more return cargo is acquired, the use of larger vessels, and rescheduling of sailings. Finally, 80 percent of the experts expect that reliability will deteriorate.

7.5 Comparison between the scenarios

Remarkable results that appear from this subsidiary survey are:

- Raising rates immediately after cost increases is (very) likely in the ton-kilometer charge scenario and unlikely in the congestion scenario, whereas opinions are divided for the autonomous scenario. Currently, however, shipowners regularly publish the introduction of surcharges due to higher bunker or currency costs (so-called BAF's and CAF's). Apparently, not every cost increase is an acceptable reason for shippers to raise rates;
- Only in case of the ton-kilometer charge, more in advance planning with shippers and outsourcing of unprofitable cargoes are likely;
- A more intensive acquisition of return cargo, postponement of departure until a higher load factor or return cargo is obtained, and a reduction in fuel use are likely in the autonomous scenario and the ton-kilometer charge scenario, but not in the congestion scenario. A plausible explanation is that these measures may lead to additional delays, which in case of the congestion scenario, is not desirable;
- Avoiding congestion by calling at other ports is (very) likely, except in case of the ton-kilometer charge scenario;
- Increased exchange of cargo among shipowners is considered likely in all scenarios. Without doubt, this is related to the fact that deep sea carriers often co-operate in conferences.

[40] Experts working in the transport sector are significantly more optimistic about the effects of the ton-kilometer charge on rates than the other experts (an increase of 12.5 percent against one of 69.2 percent).

8 Short sea shipping

8.1 Introduction

Short sea shipping concerns intra-European transport by sea, with both origin and destination in Europe. By this, short sea shipping differs from so-called feeder shipping, which can be regarded as before and after transport in intercontinental shipping. In 1997, the main short sea flows from and to the Netherlands had origins and destinations in Scandinavia and the UK, respectively (AVV, 1998: 129).

Different types of cargo are shipped on the above transport relations. The share of container shipping is limited[41]. Since data on a more detailed level lack, we asked the Dutch Information Center for Short sea shipping to indicate the main transport flows in terms of origin/destination and type of cargo. This yielded the transport of wood and forest products (e.g., pulp) from Scandinavia to the Netherlands (mainly to Delfzijl and Rotterdam). We selected Sweden as the country of origin. Indications of this type of transport are summarized in table 12.

Table 12: Background information short sea shipping of wood and forest products from Sweden to the Netherlands (*)

Variable	Value
Rate per ton (converted; normally per m^3)	fl. 35.25
Quay-quay transit time (average distance 1,800 km)	7 days (of which 3 days loading and discharging)
Reliability (number of vessels with less than 0.5 day delay at arrival)	90%
Cost structure (standard vessel, max. 3,000 ton load capacity):	
- Fuel, lubricants	10%
- Labor	30%
- Loading and discharging and port dues	40%
- Writing-off, overhead, other	20%

Note (*): all data early 2001 and including loading and discharging. Source: multiple anonymous shipowners. In case different data were provided, averages are calculated.

[41] In 1995, 5 million tons of containerized freight was transported from the Netherlands to UK. An equal amount of containers was transported from the Netherlands to Scandinavia (De Vries, 2000: 17). These data however also include feeder transport.

8.2 Autonomous expectations

It is expected by the experts that in 2010, rates will show a real increase of on average 3.4 percent as compared to 2001, which is relatively higher than the estimated 0.5 percent increase between 1999 and 2005, found by McKinnon and Forster (2000b). Possible explanations for these different outcomes are described in section 4.2. Unfortunately, no historical data on short sea rates are available; hence it is not clear whether or not the expectations will mean a change in the historical development in these rates. However, there is no reason to assume that short sea rates, in contrast to the other transport modes, would not have shown a downward trend. The transit time is expected to decrease by 1.25 percent, whereas a majority of 64 percent of the experts expects that reliability will improve; the remaining 36 percent does not expect any change.

The following developments that are considered likely in short sea shipping from Sweden to the Netherlands in the near future, may offer an explanation for the above expectations:

- It is expected that cost increases will occur, which will be passed on to shippers. No specific causes of such cost increases are given, but it is likely that also in short sea shipping, labor shortages will lead to higher wages;
- The increasing demand for transport is expected to lead to higher rates;
- The use of planning systems will probably be intensified;
- The experts expect that more sailings will be planned in advance with shippers, in order to optimize load factors of vessels;
- Unanimously, an increase in return cargo acquisition is expected;
- Larger vessels will be employed;
- Fuel use is expected to be reduced;
- Departure times will more often be adapted in order to guarantee the planned arrival times;
- It is expected that the average firm size will increase, e.g., through mergers.

8.3 Expected effects of the ton-kilometer charge

Scenario description

Again, it is assumed that by the end of 2001, ton-kilometer charges are introduced, in order to 'internalize' all external social costs that are caused by transport. For seaborne transport, the charge will amount to 1.47 cents per ton-kilometer.

This scenario implies that short sea shipowners that transport wood and forest products from Sweden to the Netherlands will be confronted with a cost increase of fl. 26.50 per ton, or, expressed in revenue per ton, of 75 percent. The experts expect the following effects of this scenario:

- In 2010, real rates will be 42 percent higher than in 2001, and 38.6 percent higher than in the autonomous situation in 2010[42];
- The average transit time will increase by 1.25 percent in 2010, an increase of 2.5 percent compared to the autonomous scenario;
- The reliability of arrivals will improve or remain the same.

Compared to the autonomous scenario, the following changes in the sector are expected:

- Raising rates as a consequence of cost increases and the increasing transport demand becomes very likely;
- More cargo will be exchanged between shipowners;
- The use of larger vessels becomes even more likely;
- Unanimously, a reduction in fuel use is expected;
- The trend toward a scaling-up in firm size will be reinforced.

8.4 Expected effects of a strong increase in congestion[43]

Scenario description

It is assumed that until 2010, short sea shipping will show a dramatic growth. An important cause is that shippers more often have their cargo transported by sea, in order to avoid the highly congested road network. The effect is that pressure in ports and on the main sailing routes increases, despite investments in port infrastructure and terminals. More and more often, vessels have to wait before they can be loaded or discharged. This is in particular problematic to short sea shipowners, since they generally call at multiple ports per voyage. Vessels that transport wood and forest products from Sweden to the Netherlands stay on average one day longer in ports, compared to 2001 (an increase in transit times of 14 percent). Apart from that, unforesee delays often occur, due to delays in transshipment of other vessels and the narrow margins in terminal operators' plannings.

[42] Experts working at transport companies are more pessimistic than the other experts (average expected increase of 45.3 percent compared to one of 25 percent).

[43] This scenario is based on the scenario that is used for the part research into deep sea shipping and data on the current situation in short sea shipping, which originated from several anonymous shipowners.

The opinions are divided about the effects of this scenario (see annex B). on average, rates in 2010 are expected to rise by 20.5 percent in 2010 (excluding inflation)[44]. Transit times will increase by 6.25 percent compared to early 2001 and by 7.5 percent compared to the autonomous scenario. The initial effect of this scenario however is an increase in transit times of 14 percent. Finally, 91 percent of the experts consider it likely that reliability will become worse.

Explanation for these expectations can be found in among others the following trends that the experts expect in this scenario:

- The use of planning systems will be intensified;
- More than currently, sailings will be planned in advance by shipowners and shippers;
- The acquisition of return cargo will increase;
- There will be a strong tendency toward cargo exchange between shipowners, which may further optimize load factors;
- Larger vessels are expected to be employed;
- A reduction in fuel use is considered less likely than in the ton-kilometer scenario. This may mean that delays will be compensated by a higher speed, which however raises fuel use (see section 7.3);
- Departure times will be adapted, both in order to reduce transit times and to safeguard a reliable arrival;
- Shipowners will call at other ports in order to avoid congestion;
- The expected scaling-up in the sector becomes even more likely.

8.5 Comparison between the scenarios

From the preceding sections, is has become clear that different responses are expected in the scenarios under study. Summarized, these responses are:

- Planning of sailings in advance with shippers is likely in the autonomous scenario and the congestion scenario, but is unlikely in case of a ton-kilometer charge. It is unclear why;
- Cargo exchange between shipowners is likely in case of the congestion scenario and the ton-kilometer charge scenario;
- In case of sharply increasing congestion, shipowners are expected to outsource small and unprofitable cargoes, change departure times for the sake of transit time reduction, and choose other ports.

[44] Experts working at (interest groups in behalf of) carriers expect an increase of 28.9 percent, whereas the other experts expect no changes in rates.

9 Conclusions

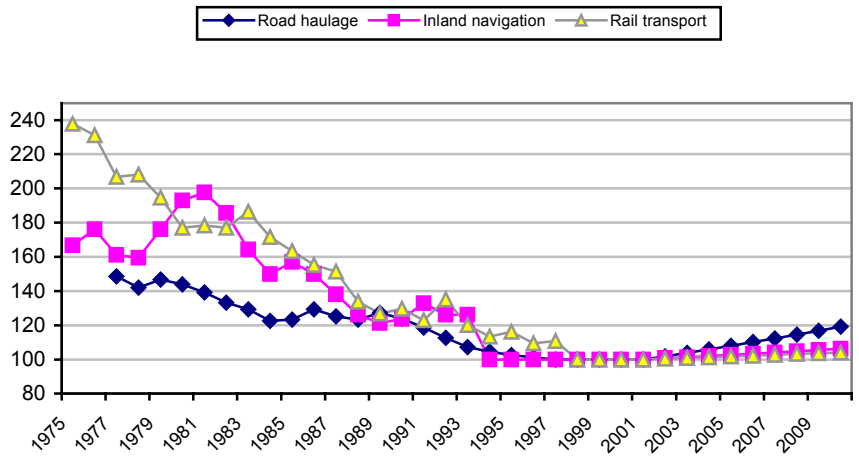
Introduction

This research explored the effects of policy interventions on rates, transit times, and reliability of freight transport. In this context, two policy scenarios were examined. In the first scenario, a levy is introduced to pass all external (i.e., unpaid) social costs on to freight carriers. In the second scenario, infrastructure provision is insufficient to facilitate the growth in transport, leading to a strong increase in congestion. The effects of these two scenarios are assessed for road transport, inland navigation, rail transport, airfreight, intercontinental shipping, and short sea shipping. Since these modes serve various markets, and rates, transit times, and reliability vary heavily both in time and place, we focused on the main transport flows (e.g., container rail transport from Rotterdam to Milan). Data were collected using a Delphi survey in which 68 experts participated.

Autonomous expectations

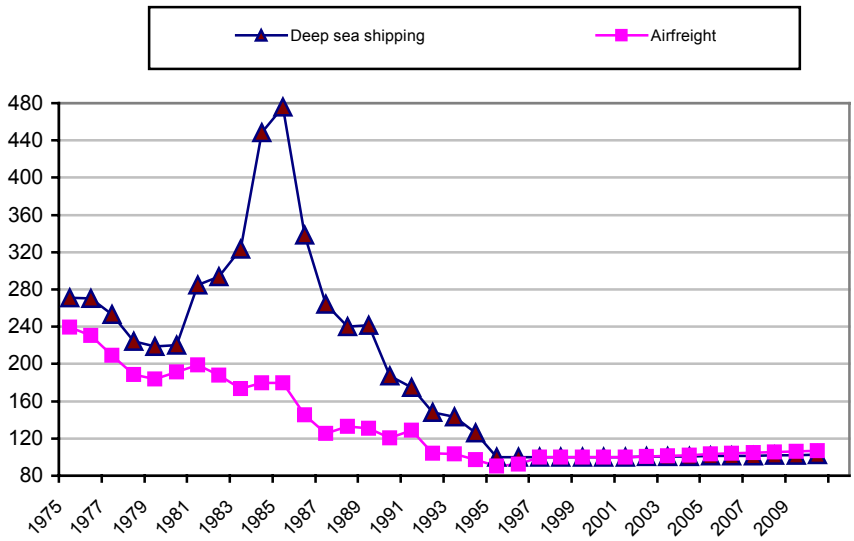
First, an inventory was made of expectations of autonomous trends in rates, transit times, and reliability of freight transport between 2001 and 2010. Regarding rates, an increase is expected for all modes. As figure 4 and 5 show, this means a discontinuity in the historical developments in freight rates[45].

Figure 4: Historical and expected trends in freight rates (continental transport) in indices (2001 = 100).



[45] Unfortunately, for short sea shipping historical data on rates lacked. Yet, there are no indications that in short sea shipping, rates would have shown an upward trend.

Figure 5: Historical and expected trends in freight rates (intercontinental transport) in indices (2001 = 100)



It should be noted that the data on historical rates are notably indicative, as they are based on average rates in the different modes of transportation[46]. However, no evidence was found of very deviant developments in rates of the specific transport flows that we examined.

The respondents to the Delphi survey expect that rates will increase notably due to increases in operating costs, such as tax increases (e.g., the German kilometer tax for heavy freight vehicles or the infrastructure levy in rail transport), increased scarcities on infrastructure networks, and rising labor costs. Yet, at the same time it is expected that between 2001 and 2010 carriers will improve productive efficiency, for instance by an increased use of planning systems, reduced fuel use, and by increased efforts to acquire cargo for return trips. By these measures, load factors can be improved.

[46] The historical data are derived from Dings *et al.* (1999c), who, in turn, used data provided by specialized and often-consulted data sources, such as NEA (road haulage), Drewry Shipping Consultants and UNCTAD (deep sea shipping), AVMARK (airfreight), CBS (road haulage and inland navigation), as well as data provided by transport companies (i.e., European airlines and Railion). Since data of rates between 1997/1998 and 2001 lacked, we assumed that no changes occurred. The data between 2001 and 2010 originate from the Delphi survey. Experts were asked to estimate real rates in 2010, expressed in indices (2001 = 100). Based on these estimations, we calculated compounded annual growth rates for the period between 2001 and 2010.

Regarding transit times, for all modes of transportation with the exception of road haulage, a reduction is expected between now and 2010. The reliability of freight transport, expressed in the number of overdue arrivals, is expected to remain the same or even improve, except for airfreight and road haulage (see table 13). Apparently, for the latter modes an increased congestion is foreseen.

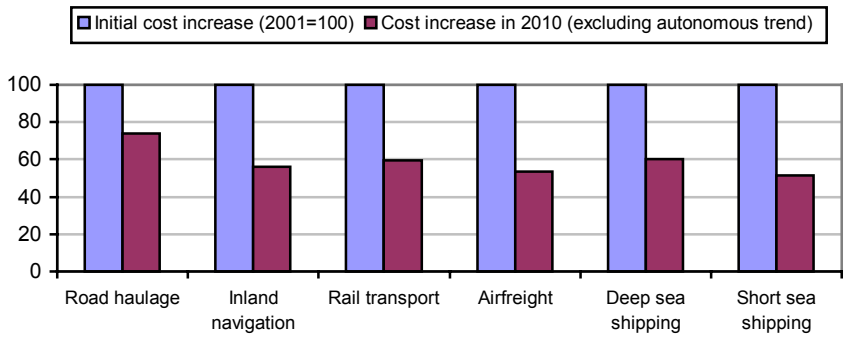
Table 13: Average expectations regarding transit times and reliability in 2010, compared to 2001

	Road haulage	**Inland navigation**	**Rail transport**	**Airfreight**	**Deep sea shipping**	**Short sea shipping**
Transit time	+ 9.6%	- 6.9%	- 4.8%	- 4.2%	- 7.5%	- 1.25%
Delivery reliability	Same/ worse	Better/ same	Better	Same/ worse	Same/ better	Better/ same

Expected effects of passing on of all external social costs (scenario 1)

If the external social costs that are caused by freight transport are passed on to carriers by means of a ton-kilometer surcharge, this will initially lead to a substantial cost increase. The scenario assumes an introduction of ton-kilometer charges by the end of 2001. By 2010, however, the Delphi respondents expect that a significant part of the initial cost increase will be offset due to adaptations in the operational management of carriers (see figure 6).

Figure 6: Expected extent to which carriers are able to offset the cost increase caused by the ton-kilometer charge between 2001 and 2010



The actual adaptations vary between the transport modes. Here, only the main responses will be treated. For all modes except for short sea shipping, the ton-kilometer charge will reinforce efforts that are undertaken to acquire return

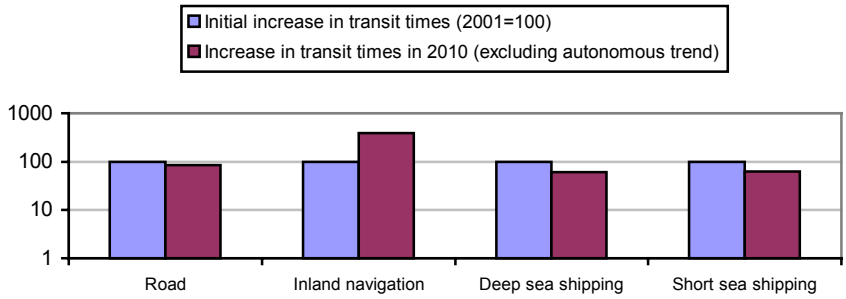
cargo. Improving load factors by co-operation between carriers in the form of cargo exchange, is considered likely only in inland navigation, rail transport, airfreight, and short sea shipping. In inland navigation, short sea shipping, and deep sea shipping, it is expected that shipowners will try to economize on fuel use by slowing sailing speed. The ton-kilometer charge is eventually expected to cause a scaling-up of average firm size in rail transport, short sea shipping, and deep sea shipping. Adaptations in the size of transport means (vessels, vehicles, aircraft) are expected in inland navigation, airfreight, rail transport, and short sea shipping. Finally, it is expected that road carriers, rail operators, airlines, and deep sea carriers will more often refuse small or unprofitable shipments. Thus, options available to respond to a ton-kilometer charge, as well as their feasibility, differ between transport sectors.

Expected effects of a strong increase in congestion (scenario 2)

The effects of a hypothesized strong increase in congestion are also researched. It should be noted that the nature of congestion varies for each mode of transportation, however. For instance, queuing is only to a limited extent possible for rail transport and airfreight, in contrast to the other modes. This is mainly caused by the relatively rigid infrastructure capacity allocation systems employed in these transport sectors. Once 'slots' are deployed, queuing in order to wait for new slots is barely possible. Yet, often delays occur, but both in rail transport and in airfreight, it appeared that scenarios in which transit times initially increase by tens of percentages due to congestion are unrealistic. Hence, the congestion scenario was disregarded for rail transport, whereas an adapted scenario was constructed for airfreight.

For the remaining transport modes, the scenario described a substantial increase in congestion by the end of 2001. Even for these modes, the nature of congestion differs. In road transport, congestion is assumed to occur on line infrastructure, whereas in the other modes congestion is notably assumed to exist on nodal infrastructure (i.e., ports and terminals). As figure 6 shows, the respondents expect that the extent to the initial delays affect transit times in 2010 varies significantly between the modes. Remarkably, for inland navigation a disproportional increase in transit times is expected. This is only in part explained by the fact that in the transport flow in inland navigation under study (i.e., container shipping from Rotterdam to Mannheim), multiple ports are visited; in short sea shipping this is also the case. Another remarkable result is that for all modes of transportation, a deterioration in reliability is expected, despite the increasing importance shippers attach to this transport quality.

Figure 7: Expected extent to which carriers are able to offset the delays caused by a strong increase in congestion between 2001 and 2010



Similar to the ton-kilometer charge scenario, different responses of transport companies are expected. The strong increase in congestion will provide an additional stimulus to carriers in road haulage, inland navigation, and short sea shipping to intensify use of planning systems, whereas more in advance planning of departures with shippers is considered likely in all modes except for airfreight. The use of larger transport means is expected in all sectors but inland navigation. Changes in departure times, including more overnight transport, are only expected in road haulage, short sea shipping, and deep sea shipping; in the other modes, flexibility in scheduling apparently is low. Only in case of deep sea shipping and short sea shipping will increased congestion lead to more efforts to optimize load factors. Finally, in road haulage it is expected that route choice will be adapted, whereas in airfreight, deep sea shipping, and in short sea shipping, other (air)ports will be called at. The latter differences in responses are obviously due to differences in the scenarios (see previous page).

Reflection on methodological approach

The main source of information in this research was a Delphi survey. Although this technique is regarded as adequate in situations where large uncertainties exist, such as prospective research, they suffer from a couple of potential methodological pitfalls. One, in case of a small group of experts, they do not yield statistically representative outcomes. In most of our part researches, however, a relatively large group of experts responded, which makes the outcomes less sensitive to (deviant) opinions of individual experts. Yet, the part researches on deep sea shipping and airfreight yielded a relatively small number of respondents, but also for these part researches, on a relatively large part of the questionnaire consensus was achieved.

Two, Delphi surveys sometimes do not yield insight into the respondents' reasoning. This was given explicit attention, by asking experts not only about their estimations of how rates, transit times, and delivery reliability would be affected in each of the policy scenarios under study, but also by asking them to express the likelihood of a number of possible developments in the transport sector that may explain their estimations. Additionally, they were given the opportunity to add developments to the questionnaire. Since this was done only incidentally, we expect that the Delphi set-up has provided sufficient information in order to explain the answers given.

Three and finally, Delphi surveys tend to enforce existing paradigms and to produce conservative outcomes. This potential pitfall was 'combated' by adding propositions to the questionnaire that describe certain trends in the freight transport sector that currently are not always realistic (e.g., cargo exchange between carriers in road transport).

Yet, a number of points deserve to be mentioned. One, no complete consensus (as predefined by us) was achieved. However, we decided to stop after the second reaction round since non-response would otherwise give a biased picture (and lead to complete consensus, neither). Moreover, since the research concerns the future, it may well be that regarding some issues, too much uncertainty exists. Two, it appears that the answers given vary with the experts' professional background (see table 14). The direction of this deviation is not unambiguous, however. Finally, we focused on one important transport flow per mode of transportation. Additional research is required to test the validity of the outcomes to other transport flows.

Table 14: Differences in experts' expectations regarding the impact of the two policy scenarios on rates, according to professional background

	Road haulage	**Inland navigation**	**Rail transport**	**Air-freight**	**Deep sea shipping**	**Short sea shipping**
Transport sector						
- Scenario 1	+	- -	≈	-	+	++
- Scenario 2	+	- -	*n.a.*	-	-	++
Shippers						
- Scenario 1	-	- -	≈	*n.a.*	*n.a.*	*n.a.*
- Scenario 2	-	+	*n.a.*	*n.a.*	*n.a.*	*n.a.*
Other						
- Scenario 1	-	++	≈	+	-	- -
- Scenario 2	-	+	*n.a.*	+	+	- -

Note: + : higher rate increase expected; - : lower rate increase expected; ≈: almost equal increases expected; ++ : substantially higher rate increase expected; - - : substantially lower rate increase expected; *n.a.:* no data, either because the scenario does not apply or because no such experts had responded.

References

AAS (2000). *Verkeer en Vervoer: Vracht,* Schiphol: Amsterdam Airport Schiphol (also available at http://www.schiphol.nl).

AVV (1998). *Vervoer-Economische Verkenningen 1998-2003,* Adviesdienst Verkeer en Vervoer, The Hague: Sdu Uitgevers.

AVV(2000). *Jaarrapport Goederenvervoer, editie 1999,* Rotterdam: Adviesdienst Verkeer en Vervoer.

AVV (2001). *NVVP Beleidsopties verkend. Deel 2: goederenvervoer,* Rotterdam: Adviesdienst Verkeer en Vervoer.

Bleijenberg, A.N. (1998). "Ruimtelijk-economische flexibiliteit en prijsgevoeligheid van het goederenwegvervoer", *Tijdschrift Vervoerswetenschap,* vol. 33, n°. 1, pp. 19-29. (**)

Brolsma, J.U. (2000). *Intern memo containervervoer via de binnenvaart,* The Hague: Ministerie van Verkeer en Waterstaat.

Bus, L.M., J. Bozuwa, R. Piers, H.M. de Loor, M.M.J.M. Pelt, W.N.G.M. Veraart, en P. van der Vlist (1999). *Groei Goed? Onderzoek naar de groei van het goederenvervoer en de mogelijkheden tot beïnvloeding,* deel 2: sector analyse en achtergronden, Rotterdam/Diemen: NEI/Bakkenist. (**)

Busscher, J. (2000). "Brandstofperikelen", *Luchtvracht,* vol. 31, no. 308 (november), pp. 8-10. (**)

CBS (1998). *Statistieken Binnenvaart 1997,* Heerlen: CBS.

CBS (1999). *Nederland en de scheepvaart op de binnenwateren,* Voorburg/Heerlen: CBS.

CBS (2000). *Container statistics 1999,* Voorburg/Rotterdam: CBS/Gemeentelijk havenbedrijf Rotterdam.

Cooper, J., M. Browne en M. Peters (1994). "Will Transport Prices Fall?", in: Cooper, J., M. Browne en M. Peters, *European Logistics. Markets, Management and Strategy,* 2nd ed., Oxford: Blackwell, pp. 251-291. (**)

Coyle, J.J., C.J.L. Bardi en C.J. Langley (1996). *The Management of Business Logistics,* St. Paul: West. (**)

Crowley, J.A. (1998). "Virtual logistics: transport in the market space", *International Journal of Physical Distribution & Logistics Management,* vol. 28, n°. 7, pp. 547-574. (**)

Daniëls, J.J.M.C. en G. Duijzer (1988). "Discussie", in: J.J.M.C. Daniëls en G. Duijzer (Eds.), *Delphi: methode of mode?,* Amsterdam: SISWO, pp. 81-88.

Deelen, C. T. Dekker en R. Snijders (1999). *Integrale verkenningen voor haven en industrie. Werkdocument verkeer en Vervoer,* Rotterdam: Gemeentelijk havenbedrijf Rotterdam.

Dings, J.M.W., B.A. Leurs, M.J. Blom, E.H. Bückmann, L.M. Bus, H.W.J. van Haselen en S.A. Rienstra (1999a). *Prijselasticiteiten in het goederenwegvervoer* (hoofdrapport), Rotterdam/Delft: NEI/CE. (**)

Dings, J.M.W., P. Janse, B.A. Leurs en M.D. Davidson (1999b). *Efficiënte prijzen voor het verkeer,* Delft: CE.

Dings, J.M.W., D. Metz, B.A. Leurs en A.N. Bleijenberg (1999c). *Beter aanbod, meer goederenvervoer?,* Delft: CE.

EC (1998). *Fair Payment for Infrastructure: a Phased Approach to a Common Transport Infrastructure Charging Framework for the EU,* Brussel: Europese Commissie. (*)

Foddy, W.H. (1996). *Constructing questions for interviews and questionnaires. Theory and practice in social research,* Cambridge: Cambridge University Press.

Futures Group (1994). *Scenarios,* publication of the United Nations Development Programme's African Futures Project, phase II.

Geurs, K.T. en G.P. Van Wee (1997). *Effecten van prijsbeleid op verkeer en vervoer,* Bilthoven: Rijksinstituut voor Volksgezondheid en Milieu.

GHR (2000). *Rotterdam port statistics,* Rotterdam: Port of Rotterdam.

Ginkel, J.C. van, L.M. Bus en D.P. Janssen (1995). "Effecten van doorberekening van infrastructuur- en externe kosten aan goederenvervoer", *Tijdschrift Vervoerswetenschap,* vol. 30, n°. 1, pp. 23-42. (**)

Gordon, Th.J. (1994). "The Delphi method", in: J.C. Glenn (ed.), *Futures Research Methodology,* Washington: American Council for United Nations University.

Groothedde, B. en H.W.J. Van Haselen (1998). *Strategisch Model Integrale Logistiek en Evaluatie,* Delft: TNO Inro. (**)

Gruppo CLAS (1998). *The fundamental variables which affect decisions concerning intermodal transport,* LOGIQ project, Brussel: Europese Commissie.

HCG (1992). *De reistijdwaardering in het goederenvervoer. Rapport hoofdonderzoek,* The Hague: Hague Consulting Group.

Hensher, D.A. en A.M. Brever (2001). *Transport. An economics and management perspective,* Oxford: Oxford University Press.

Hillestad, R.J., W.E. Walker, M.J. Carillo, J.G. Bolten, P.G.J. Twaalfhoven en O.A.W.T. van de Riet (1996). *FORWARD-Freight Options for Road, Water, and Rail for the Dutch,* final report, Santa Monica/Delft: RAND/European-American Center for Policy Analysis. (*)

Holzapfel, H. (1995). "Potential forms of regional economic cooperation to reduce goods transport", *World Transport Policy & Practice,* vol. 1, n°. 2, pp. 34-39. (**)

Houten, H.J. van (1988). "Vijf variaties op het Delphi-thema", in: J.J.M.C. Daniëls en G. Duijzer (Eds.), *Delphi: methode of mode?,* Amsterdam: SISWO, pp. 5-34.

Kågeson, P. (1993). *Getting the Prices Right,A European Scheme for Making Transport Pay its True Costs,* Stockholm: European Federation for Transport and Environment. (**)

Kågeson, P. en J. Dings (1999). *Electronic Kilometer Charging for Heavy Goods Vehicles in Europe,* Brussel: European Federation for Transport and Environment. (**)

Kuit, C. (2000). *Heeft short sea vervoer op Italië toekomst?,* Rotterdam/Rhoon: HES/Voorlichtingsbureau Short sea shipping.

Marchau, V.A.W.J. (2000). *Technology Assessment of Automated Vehicle Guidance. Prospects for Automated Driving Implementation,* Delft: Delft University Press.

MCA (1999). *AWAK: andere wegen, andere kosten, rekenmodel,* Eindhoven: Stichting MCA.

McKinnon, A.en M. Forrester (2000a). *European Logistical and Supply Chain Trends: 1999-2005. Full Report of the Delphi 2005 Survey,* Edinburgh: Heriot-Watt University.

McKinnon, A.en M. Forrester (2000b). *European Logistical and Supply Chain Trends: 1999-2005. Detailed Results of the Delphi 2005 Survey,* Edinburgh: Heriot-Watt University (also available at http://logistics.som.hw.ac.uk/delphi).

Ministerie van Verkeer en Waterstaat (1996). *Transport in balans,* The Hague: Ministerie van Verkeer en Waterstaat. (*)

Ministerie van Verkeer en Waterstaat (1999). *Perspectievennota Verkeer en Vervoer,* The Hague: Ministerie van Verkeer en Waterstaat. (*)

Ministerie van Verkeer en Waterstaat (2000). *Van A naar Beter. Nationaal verkeers- en vervoersplan 2001-2020. Gespreksagenda goederenvervoerbeleid,* The Hague: Ministerie van Verkeer en Waterstaat. (*)

Ministerie van Verkeer en Waterstaat (2001a). *NVVP Beleidsopties verkend,* The Hague: Ministerie van Verkeer en Waterstaat. (*)

Ministerie van Verkeer en Waterstaat (2001b). *Overzicht projecten Transactie/Modal Shift* (at http://www.transactie-modalshift.nl/), The Hague: Ministerie van Verkeer en Waterstaat. (**)

Ministerie van Verkeer en Waterstaat (2000-2001). *Transactie Bulletins,* The Hague: Ministerie van Verkeer en Waterstaat. (**)

MUConsult (2001). *De remmen los. Historische ontwikkeling van de prijs/prestatieverhouding in het vervoer,* Amersfoort: MUConsult.

Muilerman, G.J. (2001). *Time-based logistics, an analysis of the relevance, causes and impacts,* Delft: TRAIL/Delft University Press. (*)(**)

Mulder, K., C. van de Wijer en V.A.W.J. Marchau (1996). "Prospects for external sources of vehicle propulsion, results of a Delphi survey", *Futures,* vol. 28, n° 10, pp. 919-945.

NEA (2001). *Indices van kosten en vrachtprijzen naar marktsegment,* Brussel: Europese Commissie (also available at http://www.europa.eu.int/comm/transport/iw/nl/iv_nl/iv_nl_nl.html).

NEI/NEA (1990). *Vervoerwijzekeuze in het goederenvervoer,* Rotterdam/Rijswijk: NEI/NEA. (**)

NEI (1999). *REDEFINE: Relationshipship between Demand for Freight Transport and Industrial Effects,* final report, by order of the European Commission, Rotterdam: NEI (project coordinator). (**)

Oum, T.H., W.G. Waters II, en J.S. Yong (1990). *A Survey of Recent Estimates of Price Elasticities of Demand for Transport,* Washington: World Bank.

Prince, Th. (2001). "Easy as ABC", *Containerisation International,* maart 2001, pp. 63-67.

Runhaar, H.A.C. en B. Kuipers (1999). "The Role of Transport Prices in Goods Transport. An Analytical Framework", *Proceedings TRAIL Congress* (December 1999), Delft: TRAIL Research School. (**)

Ruijgrok, C.J. (2001). "Ontwikkelingen in de logistiek en hun effecten op het vervoer", *Tijdschrift Vervoerswetenschap,* vol. 36, n°. 4, pp. 42-45. (**)

Swanborn, P.G. (1987). *Methoden van sociaal-wetenschappelijk onderzoek,* 2^{e} ed., Meppel: Boom.

T&E (1993). *De juiste prijs voor het verkeer. Samenvatting van de Europese studie 'Getting the prices right' en resultaten voor Nederland,* Brussel: European Federation for Transport and Environment.

The Futures Group (1994). "Scenarios", in: J.C. Glenn (ed.), *Futures Research Methodology,* Washington: American Council for United Nations University.

TLN (1999). *Transport in cijfers,* Zoetermeer: Transport en Logistiek Nederland.

Vries, C.J. (2000). *Goederenvervoer over water,* Assen: Van Gorcum & Comp.

Wit, J. de en H. van Gent (1996). *Economie en transport,* Utrecht: Lemma. (**)

Woudenberg, F. (1991). "An evaluation of Delphi", *Technological Forecasting and Social Change,* n° 40, 131-150.

References that are marked with a (*) are used in the selection and construction of the two policy scenarios. Sources marked with a (**) are used in the formulation of possible developments in freight transport (question 1 of the survey questionnaire). Additional sources were Nieuwsblad Transport, Logistiek.nl, the LogistiekKrant, Cargoweb Newsletter, and several interviews with carriers, interest groups in behalf of the transport sector, the Ministry of Transport, and the Transport Research Center.

ANNEXES

Annex A: List of respondents

- Mr. C. den Hartog (AVV; Transport Research Center)[b]
- Mr. D. Rouwenhorst (AVV; Transport Research Center)[a]
- Mr. H.W.E. Vroon (AVV; Transport Research Center)[c, e]
- Mr. S. Vonk (Amasus Chartering)[d]
- Mr. R. Erdmann (director e-commerce/marketing, Aspa Office Equipment)[a]
- Mr. A.P. van den Wall Bake (director, Bake Business Support)[b]
- Mrs. M. van Helvoirt (CBRB; interest group in inland navigation)[b]
- Mr. K.H.L. Gerretse (general manager logistics & transport, Corus Logistics and Transport)[b]
- Mr. H. Dijkman (Central Planning Bureau; CPB)[a, b, c]
- Mr. G.K.H. Hes (former director Tell Circle Consultancy)[a]
- Mr. C. de Geus (Danzas Rail Cargo)[c]
- Mr. W. Vrijland (director supply chain technology, Dow Benelux)[b, c]
- Mr. M. Page (director, Drewry Shipping Consultants)[f]
- Mr. A. Guinier (director, ECSA)[d]
- Mr. J. Nater (ECT)[b, f]
- Mr. L.M. van der Lugt (Erasmus University Rotterdam/ETECA)[d, f]
- Mr. M.H.O.M. Philips (EVO; shippers' interest group)[b, c]
- Mr. M.R.J. Speldenbrink (Hartel Shipping and Chartering) [d]
- Mrs. drs. H. van Raalte (director, HR Logistiek)[a, b]
- Mr. B. Schuurman (logistics manager, Intergamma)[a]
- Mr. J. Verlaan (JGT De Jong & Graus)[a]
- Prof. A.J. Vermunt (University of Brabant/NDL/KMA)[a]
- Mr. P. Hoppenbrouwers (director corporate network control, Koninklijke Frans Maas Groep)[a]
- Mr. W. Ploos van Amstel CPIM (KPMG Consulting/Free University of Amsterdam)[a]
- Mr. P.M. Blok (KPMG-BEA)[a, c]
- Mr. R. Lenoir (KPMG-BEA)[a]
- Mr. B. Wiegmans (KPMG-BEA)[b]
- Mr. P. Keemink (Interforest terminal Rotterdam)[d]
- Mr. H.E. Runia (KNV; interest group in road haulage)[a]
- Mr. M.J.A. Hijne (logistics manager, Loders Croklaan)[a, b]
- Mr. H. de Valk (revenue manager Europe, Martinair Holland)[e]
- Mr. W. de Wit (vice president Industry Affairs, Martinair Holland)[e]
- Dr. M.J. Kleijn (consultant, NEA)[a]
- Mr. M. Quispel (consultant, NEA)[b]
- Mr. H. Vrenken (consultant, NEA)[c]

- Mr. H. Pols (director NPRC, Cooperation of Dutch bargemen that are active on the Rhine)[b]
- Mr. E.R. Kampinga (NIWO; interest group in road haulage)[a]
- Mr. L.A. de Haas (Olympic Airlines)[e]
- Mr. J.W. Konings (OTB; Delft University of Technology)[a, b, c]
- Mr. Y. Hoogland (Panalpina)[e]
- Mr. R. Maas (warehouse and distribution manager, Polynorm)[b, c]
- Dr. H.A. van Klink (Industry Knowledge Team, Rabobank International)[d, f]
- Mrs. C.A. de Jongh (director, Railforum Nederland)[c]
- Mr. J. Aerts (Railion Benelux)[c]
- Mr. G.J. Nieuwenhuis (manager international sales intermodal transport, Railion Benelux)[c]
- Mr. G.M. Bertholet (terminal manager, Rail Service Center Groningen)[c]
- Mr. K. Pals (Rhinecontainer)[b]
- Mr. M. van het Hoff (sales department, Singapore Airlines Cargo)[e]
- Mr. J. Brouwer (Spliethoff's Chartering Office)[d]
- Dr. D.A. van Damme (Technical University of Eindhoven)[a]
- Mr. P. Poppink (TLN; interest group in road haulage)[a]
- Prof. C.J. Ruijgrok (department of Logistics, TNO-Inro)[a, b, c]
- Dr. P. Zwaneveld (department of Logistics, TNO-Inro)[c]
- Prof. P.H.L. Bovy (scientific director, TRAIL Research School)[a]
- Mr. J. Groeneveld (Trailstar)[c]
- Mr. G. van den Wall Bake (route development Asia, Transport Management International)[e]
- Mr. K. de Waardt (director, VERN; interest group in road haulage)[a]
- Mr. J.H.M. Steijn (VNO-NCW; shippers' interest group)[b, c]
- Mr. S. van 't Verlaat (director, Information Center Shortsea Shipping)[d]
- Prof. P. Rietveld (Free University of Amsterdam)[a, c]
- Mr. J. Teekman (director cargo acquisition, Wagenborg Shipping)[d]
- Mr. E. Wagenborg (director, Wagenborg Shipping)[d]
- Mr. R. Klatten (sales department, Wim Bosman Groep)[a]
- Mr. D. Pol (Business Development, Wijnne-Barends)[d]
- Mr. M. van Muijen (ZHM; environmental group)[b, c]

Two experts indicated that they wanted to stay anonymous.

Legend:

[a]: Part research road haulage
[b]: Part research inland navigation
[c]: Part research rail transport
[d]: Part research short sea shipping
[e]: Part research airfreight
[f]: Part research deep sea shipping

Annex B: Detailed survey results

Results part research into road haulage (n = 26)

Question 1: How likely do you consider the following developments in container haulage from Rotterdam to Duisburg between 2001 and 2010?

	No scenario How likely do you consider this development between now and 2010, if neither scenario eventuates?						**Scenario 1** How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						**Scenario 2** How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
Possible developments: *(Shaded are questions on which a sufficient degree of consensus existed)*	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
1. Carriers will base their rates more on real costs; hence, cost increases will more often be passed on to shippers	19%	62%	8%		8%	4%	58%	38%				4%	19%	73%				8%
2. Carriers will raise rates in response to the increasing demand for transport services	12%	12%	54%	4%	4%	15%	12%	15%	46%	4%		23%	12%	19%	38%	4%		27%
3. Trips will take longer due to congestion; carriers will not undertake measures to reduce these delays	4%	12%	46%	15%	15%	8%	4%	8%	54%	15%	8%	12%	4%	12%	42%	27%	4%	12%
4. The use of trip and route planning systems will increase	23%	54%	15%			8%	31%	50%	8%			12%	42%	31%	15%			12%
5. Load factors of trucks will improve because carriers will schedule trips more in advance in co-operation with shippers	12%	50%	27%		8%	4%	19%	42%	27%		4%	8%	31%	27%	27%		8%	8%
6. Carriers will acquire more return cargo	8%	65%	23%			4%	19%	58%	15%			8%	4%	77%	12%			8%
7. Carriers will exchange cargo in order to reduce empty running and to improve load factors	12%	58%	19%	8%		4%	27%	38%	15%	8%	4%	8%	12%	62%	12%	8%		8%
8. More often, small or unprofitable cargoes will be outsourced	8%	46%	27%		8%	12%	27%	35%	19%		4%	15%	27%	35%	19%		4%	15%

Possible developments: *(Shaded are questions on which a sufficient degree of consensus existed)*	**No scenario** How likely do you consider this development between now and 2010, if neither scenario eventuates?						**Scenario 1** How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						**Scenario 2** How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
9. Carriers will more often than now postpone departure until a higher load factor or return cargo is obtained	8%	8%	73%	8%		4%	12%	8%	65%	4%		8%	4%	23%	62%	4%		8%
10. Carriers will use larger trucks		42%	27%	19%	8%	4%	19%	23%	27%	19%	4%	8%	15%	42%	23%	8%	4%	8%
11. Maintenance and (replacement) investments will be postponed more frequently		8%	54%	19%		19%	4%	12%	50%	15%	4%	15%		4%	65%	12%	4%	15%
12. Carriers will reduce fuel use (e.g., by more economical engines)	8%	69%	12%	8%		4%	15%	65%	4%	8%		8%	12%	62%	12%	8%		8%
13. Carriers will more often change departure times in order to reduce transit times	4%	58%	27%	8%		4%	12%	54%	27%			8%	50%	31%	12%			8%
14. Carriers will more often change departure times in order to guarantee delivery reliability	4%	65%	23%	4%		4%	15%	54%	27%			4%	62%	23%	8%			8%
15. Carriers will drive more often overnight	4%	65%	19%	4%	4%	4%	12%	69%	12%			8%	58%	35%				8%
16. Carriers will choose other routes	4%	35%	42%	4%	4%	12%	15%	31%	38%	4%		12%	38%	27%	19%			15%
17. Carriers from low-cost countries will obtain a larger market share (assumed that their liberties remain unchanged)	15%	50%	12%	12%	4%	8%	23%	46%	4%	8%	8%	12%	27%	35%	8%	12%	4%	15%
18. Carriers will more often co-operate with firms that are specialized in cargo acquisition and consolidation		42%	35%	8%	8%	8%	8%	38%	35%	4%	4%	12%	8%	50%	23%	4%	4%	12%
19. The number of large firms will increase (e.g., due to mergers)	19%	46%	19%	4%		12%	12%	50%	15%	4%		19%	15%	46%	15%	4%		19%

Due to rounding off, totals may sometimes be more or less than 100%

Results part research into road haulage (continued)

Question 2: Which rates, transit times, and delivery reliability do you expect in container haulage from Rotterdam to Duisburg in 2010?

Figure 8: Expectations regarding road rates in 2010, exclusive of inflation (2001 = 100) (n = 26)

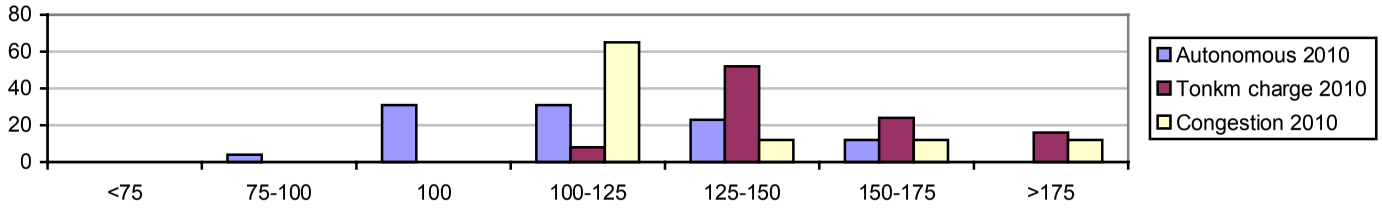


Figure 9: Expectations regarding transit times in 2010 (2001 = 100) (n = 26)

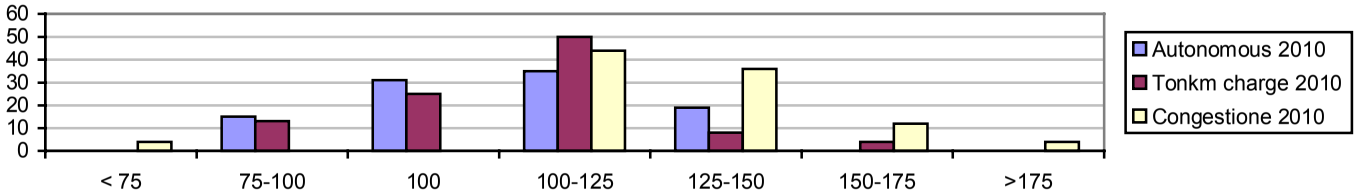
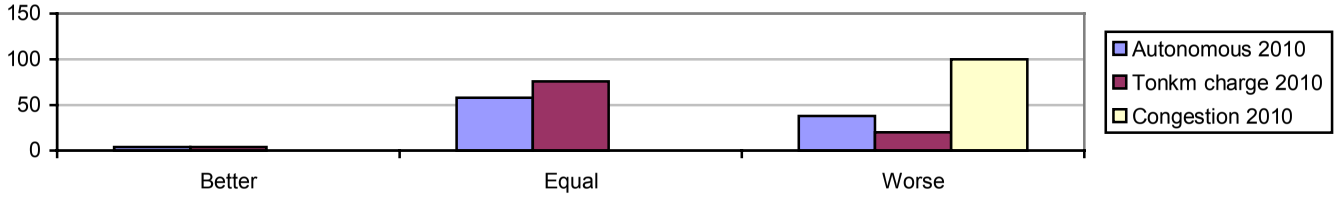


Figure 10: Expectations regarding delivery reliability in 2010 (2001 = 100) (n = 26)



Results part research into inland navigation (n = 19)

Question 1: How likely do you consider the following developments in container shipping from Rotterdam to Mannheim between 2001 and 2010?

Possible developments:	**No scenario** How likely do you consider this development between now and 2010, if neither scenario eventuates?						**Scenario 1** How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						**Scenario 2** How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
(Shaded are questions on which a sufficient degree of consensus existed)	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
1. Carriers will more often base rates on real costs; hence cost increases will be passed on to shippers more frequently	11%	58%	21%			11%	50%	26%	21%			5%		53%	26%			11%
2. Carriers will more often raise rates in response to the increased demand for transport services	11%	32%	32%		11%	16%	11%	21%	50%		5%	16%	11%	21%	42%		11%	16%
3. Sailings will take longer than now due to delays; carriers will not take measures to reduce these delays		11%	63%	5%	11%	11%		11%	68%	5%	11%	5%	11%	53%	11%	11%	11%	5%
4. The use of planning systems will increase	16%	68%	11%			5%	16%	63%	16%			5%	26%	53%	11%			11%
5. Load factors of vessels will improve because carriers will schedule trips more in advance in co-operation with shippers	11%	63%	21%			5%	11%	63%	21%			5%	21%	50%	21%			11%
6. Carriers will more often acquire return cargo	11%	63%	16%			11%	26%	53%	11%			11%	16%	50%	26%			11%
7. Carriers will more often exchange cargo with other carriers, in order to reduce empty shipping and to improve load factors	5%	32%	53%		5%	5%	11%	58%	26%			5%	16%	50%	32%			5%
8. Small or unprofitable cargoes will be outsourced more often	5%	26%	32%	5%	5%	26%	11%	37%	26%			26%	11%	42%	16%	5%		26%
9. Carriers will more often than now postpone departure until a higher load factor or return cargo is obtained	5%	5%	74%	11%		5%		37%	50%	5%	5%	5%		32%	53%	11%		5%

Possible developments: *(Shaded are questions on which a sufficient degree of consensus existed)*	**No scenario** How likely do you consider this development between now and 2010, if neither scenario eventuates?						**Scenario 1** How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						**Scenario 2** How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
10. Carriers will use larger vessels	21%	42%	21%			16%	16%	53%	16%			16%	16%	42%	26%			16%
11. Maintenance and (replacement) investments will be postponed more often		26%	53%	5%		16%	11%	37%	26%	5%		21%	5%	26%	50%		5%	16%
12. Carriers will reduce fuel use (e.g., by more economical engines or sailing)		58%	32%	5%		5%	32%	32%	21%	11%		5%		32%	42%	16%		11%
13. Carriers will change departure times in order to reduce transit times		37%	37%		5%	21%		11%	53%		5%	32%	21%	32%	32%			16%
14. Carriers will change departure times in order to guarantee delivery reliability		42%	42%		5%	11%		21%	53%	5%	5%	16%	21%	26%	37%			16%
15. Carriers will more often change route choice		21%	53%	5%	11%	11%		32%	37%	5%	11%	16%	21%	16%	42%	5%	5%	11%
16. Carriers from low-cost countries will obtain a larger market share (assumed that their liberties remain unchanged)	5%	50%	21%	16%		11%	16%	11%	50%	16%		11%	5%	21%	37%	16%	5%	16%
17. Carriers will more often co-operate with firms that are specialized in cargo acquisition and consolidation	5%	37%	26%	11%	11%	11%	11%	26%	26%	11%	16%	11%	11%	32%	21%	11%	5%	21%
18. Carriers will visit more ports during a voyage in order to improve load factors	5%	21%	42%			32%	11%	32%	32%			26%	11%	16%	32%	5%	5%	32%
19. The number of large transport firms will increase (due to e.g., mergers)	5%	42%	32%			21%	11%	37%	21%			26%	16%	32%	32%			21%

Due to rounding off, totals may sometimes be more or less than 100%

Results part research into inland navigation (continued)

Question 2: Which rates, transit times, and delivery reliability do you expect in container shipping from Rotterdam to Mannheim in 2010?

Figure 11: Expectations regarding inland navigation rates in 2010, exclusive of inflation (2001 = 100) (n = 19)

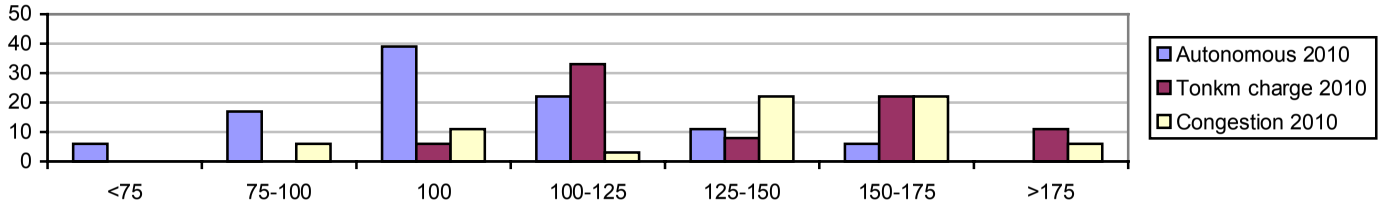


Figure 12: Expectations regarding transit times in 2010 (2001 = 100) (n = 19)

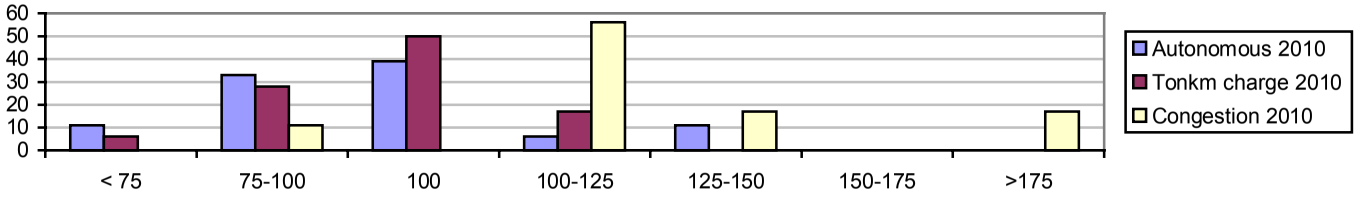
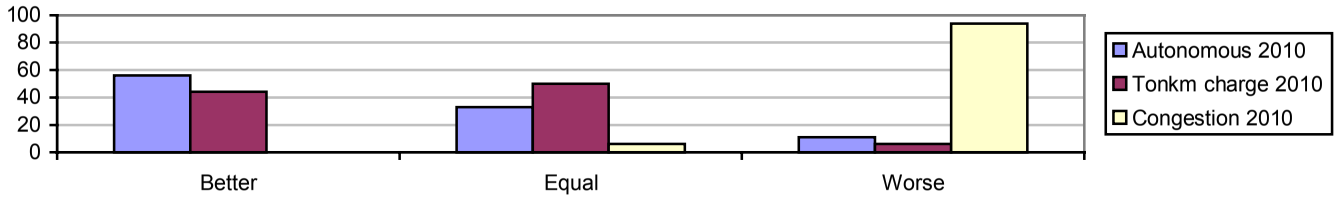


Figure 13: Expectations regarding delivery reliability in 2010 (2001 = 100) (n = 19)



Results part research into rail transport (n = 19)

Question 1: How likely do you consider the following developments in container transport by rail from Rotterdam to Milan between 2001 and 2010?

Possible developments:	No scenario: How likely do you consider this development between now and 2010, if neither scenario eventuates?						Scenario 1: How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?					
(Shaded are questions on which a sufficient degree of consensus existed)	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
1. Carriers will base their rates more often on real costs; hence, cost increases will be passed on to shippers more frequently	11%	58%	16%	5%	11%		42%	53%		5%		
2. Carriers will raise rates in response to the increased demand for transport services	5%	42%	32%	11%	11%		11%	42%	37%	5%	5%	
3. The use of planning systems will increase	26%	50%	16%	11%			32%	42%	16%	11%		
4. Load factors of trains will improve because carriers will schedule trips more in advance in co-operation with shippers	21%	42%	16%	11%	5%	5%	37%	32%	16%	11%		5%
5. Carriers will acquire more return cargo	21%	42%	26%		11%		42%	32%	26%			
6. Carriers will more often exchange cargo with other carriers, in order to improve load factors		58%	26%	5%		11%	42%	32%	21%			5%
7. Small or unprofitable cargoes will be outsourced more often		32%	32%	5%	11%	21%	11%	37%	21%		11%	21%
8. Carriers will more often postpone departure until a higher load factor or return cargo is obtained		11%	68%	21%			11%	21%	42%	26%		
9. Carriers will use larger trains	16%	42%	37%			5%	37%	32%	21%			11%
10. Maintenance and (replacement) investments will be postponed more often		11%	68%	5%		16%		21%	58%	5%		16%

Possible developments:	No scenario How likely do you consider this development between now and 2010, if neither scenario eventuates?						Scenario 1 How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?					
(Shaded are questions on which a sufficient degree of consensus existed)	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
11. Fuel use will be reduced (e.g., due to more economical engines)	11%	53%	26%	5%		5%	37%	37%	21%			5%
12. En route, carriers will visit more terminals in order to improve load factors	5%	16%	58%	11%		11%	5%	21%	50%	11%		16%
13. The number of large transport firms will increase (e.g., due to mergers)	16%	68%	5%			11%	32%	50%	5%			16%
14. Competition in rail transport will increase by the entry of other European carriers	21%	79%					26%	68%	5%			

Due to rounding off, totals may sometimes be more or less than 100%

Results part research into rail transport (continued)

Question 2: Which rates, transit times, and delivery reliability do you expect in container transport by rail from Rotterdam to Milan in 2010?

Figure 14: Expectations regarding rail rates in 2010, exclusive of inflation (2001 = 100) (n = 19)

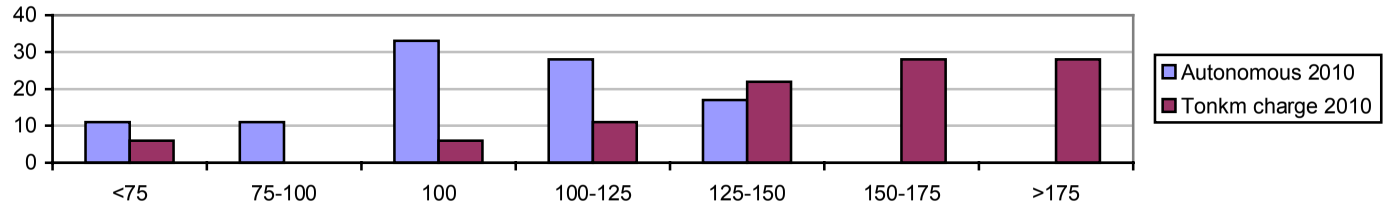


Figure 15: Expectations regarding transit times in 2010 (2001 = 100) (n = 19)

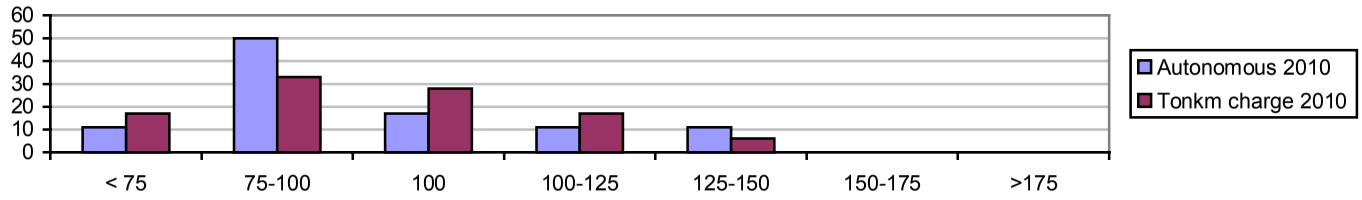
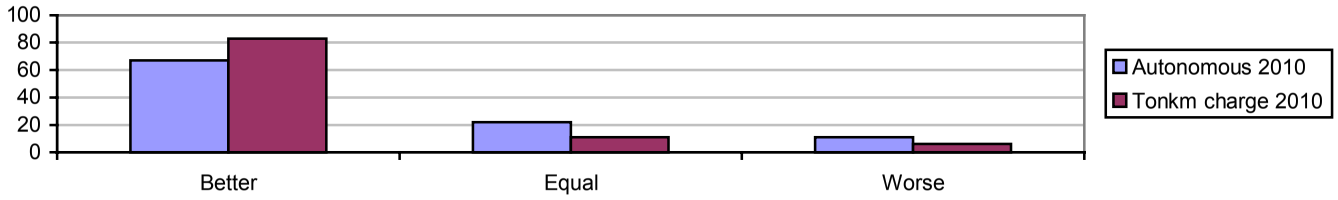


Figure 16: Expectations regarding delivery reliability in 2010 (2001 = 100) (n = 19)



Results part research into airfreight (n = 7)

Question 1: How likely do you consider the following developments in airfreight from Schiphol to Tokyo between 2001 and 2010?

Possible developments:	No scenario How likely do you consider this development between now and 2010, if neither scenario eventuates?						Scenario 1 How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						Scenario 2 How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
(Shaded are questions on which a sufficient degree of consensus existed)	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
1. Airlines will pass cost increases immediately on to shippers	29%	43%	14%			14%	43%	43%			14%		29%	43%				29%
2. Airlines will more often raise rates in response to the increased demand for transport services	57%	29%	14%			14%	71%	14%				14%	71%	14%				14%
3. Load factors will improve, because airlines will more often plan their flights in advance in co-operation with shippers		14%	29%	14%	43%			43%	14%	43%				57%	14%		14%	14%
4. Airlines will acquire more return cargo	14%	14%	43%		14%	14%		43%	43%	14%				43%	29%	14%		14%
5. Airlines will more often exchange cargo with other airlines, in order to improve load factors		29%	57%	14%				57%	14%	14%		14%		14%	29%	43%		14%
6. Airlines will more often refuse unprofitable cargoes	43%	14%	43%				29%	43%	14%			14%	43%	29%	14%			14%
7. Airlines will use larger airplanes		29%	29%	14%	29%			14%	71%			14%	29%	29%	14%		14%	14%
8. Airlines will more often use full freighters instead of passenger airplanes carrying freight		71%	14%		14%			43%	43%		14%		14%	57%			14%	14%
9. Maintenance and (replacement) investments will be postponed more frequently			29%	57%		14%			29%	57%		14%			29%	57%		14%

Possible developments:	No scenario How likely do you consider this development between now and 2010, if neither scenario eventuates?						Scenario 1 How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						Scenario 2 How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
(Shaded are questions on which a sufficient degree of consensus existed)	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
10. Airlines will reduce fuel use (e.g., due to more economical engines)	14%	57%	14%			14%	43%	29%	14%			14%	43%	43%	14%			29%
11. Airlines will more often fly to other Japanese airports and have their cargo transported by road to Tokyo		29%	71%					14%	71%			14%		86%				14%
12. Airlines will make more stops en route in order to improve load factors			57%		29%	14%			43%	14%	29%	14%			29%	29%	29%	14%
13. Airlines will add hubs to their networks in order to improve load factors		57%	29%		14%		14%	29%	14%		29%	14%		43%	29%	14%	14%	
14. Airlines will more often co-operate with firms that are specialized in cargo acquisition and consolidation		43%	14%		14%	29%	14%	14%	14%	29%	14%	14%		14%	29%	29%	14%	14%
15. The number of large airlines will increase (e.g., due to mergers)		57%	43%					14%	71%			14%		29%	57%			14%

Due to rounding off, totals may sometimes be more or less than 100%

Results part research into airfreight (continued)

Question 2: Which rates, transit times, and delivery reliability do you expect in airfreight from Schiphol to Tokyo in 2010?

Figure 17: Expectations regarding airfreight rates in 2010, exclusive of inflation (2001 = 100) (n = 7)

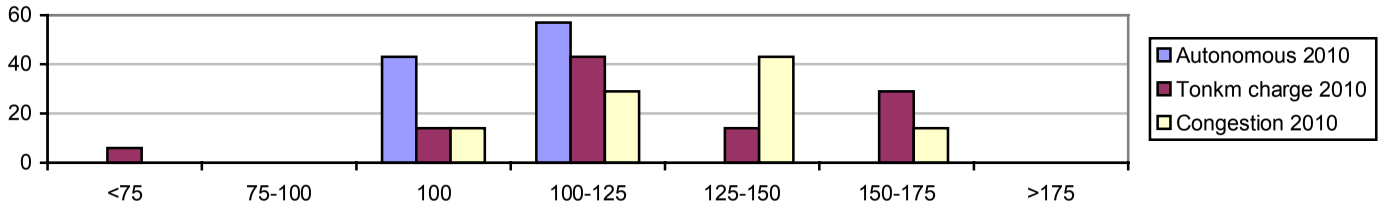


Figure 18: Expectations regarding transit times in 2010 (2001 = 100) (n = 7)

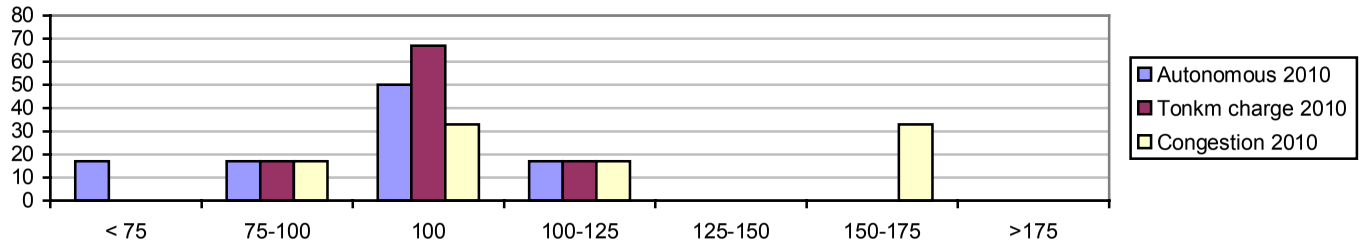
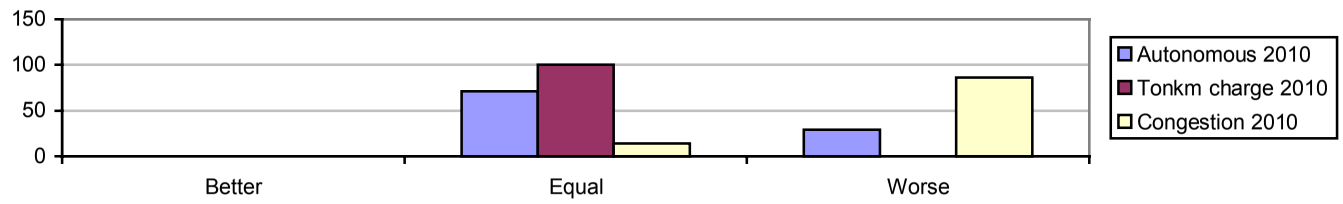


Figure 19: Expectations regarding delivery reliability in 2010 (2001 = 100) (n = 7)



Results part research into deep sea shipping (n = 5)

Question 1: How likely do you consider the following developments in container shipping from Rotterdam to Singapore between 2001 and 2010?

	No scenario How likely do you consider this development between now and 2010, if neither scenario eventuates?						**Scenario 1** How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						**Scenario 2** How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
Possible developments: *(Shaded are questions on which a sufficient degree of consensus existed)*	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
1. Shipowners will pass cost increases directly on to shippers	20%	20%	40%	20%			60%	20%	20%				20%		80%			
2. Shipowners will raise rates in response to increased demand for transport services	40%	40%	20%				60%	40%					60%	20%	20%			
3. Voyages will take longer due to delays; shipowners do not take counteractive measures to reduce these delays			60%	20%		20%			80%	20%					40%	40%	20%	
4. The use of planning systems will increase	20%	60%				20%	40%	40%				20%	40%	40%				20%
5. Load factors of vessels will increase, because shipowners will plan their voyages ahead on the long-term with shippers	20%	20%	20%		40%		20%	40%	20%		20%		40%		20%		40%	
6. Shipowners will acquire more return cargo	20%	40%			40%			80%			20%			40%	20%		40%	
7. Shipowners will exchange more cargo with other shipowners, so that vessels' load factors increase	20%	60%				20%	20%	60%				20%	20%	40%	20%			20%
8. Shipowners will outsource more small or unprofitable shipments	20%	20%	20%		40%			80%		20%				40%	60%			
9. Shipowners will more frequently postpone departures until a higher load factor or more return cargo is acquired	20%	40%		40%				60%		40%				20%	20%	40%	20%	

Possible developments:	No scenario How likely do you consider this development between now and 2010, if neither scenario eventuates?						Scenario 1 How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						Scenario 2 How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
(Shaded are questions on which a sufficient degree of consensus existed)	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
10. Shipowners will more frequently use vessels of a higher capacity	60%	40%					40%	60%					40%	40%	20%			
11. Shipowners will increasingly postpone maintenance or (replacement) investments	20%		60%	20%				20%	40%		20%	20%			40%	20%	20%	20%
12. Shipowners will reduce fuel use (e.g., by using more efficient engines or by more economic shipping behavior)	20%	60%	20%				40%	40%			20%			40%	20%	20%	20%	
13. Shipowners will change departure times in order to reduce transit times	20%	20%	40%			20%	20%	20%	40%			20%	20%	20%	20%		20%	20%
14. Shipowners will change departure times in order to guarantee reliability of arrival	20%	80%					20%	80%					60%	20%	20%			
15. Shipowners will choose other ports of call in order to avoid delays in congested ports	40%	40%	20%					40%	40%		20%		80%		20%			
16. Shipowners will visit more ports during a voyage in order to improve load factors		40%	60%					60%	40%						60%	40%		
17. Shipowners will increasingly co-operate with firms that are specialised in cargo acquisition and consolidation	40%		40%		20%		20%	20%	40%		20%		20%		60%		20%	
18. Average firm size of shipowners will increase (due to take-overs etc.)	60%	20%	20%				60%	40%					40%	40%	20%			

Results part research into deep sea shipping (continued)

Question 2: Which rates, transit times, and delivery reliability do you expect in container shipping from Rotterdam to Singapore in 2010?

Figure 20: Expectations regarding deep sea shipping rates in 2010, exclusive of inflation (2001 = 100) (n = 5)

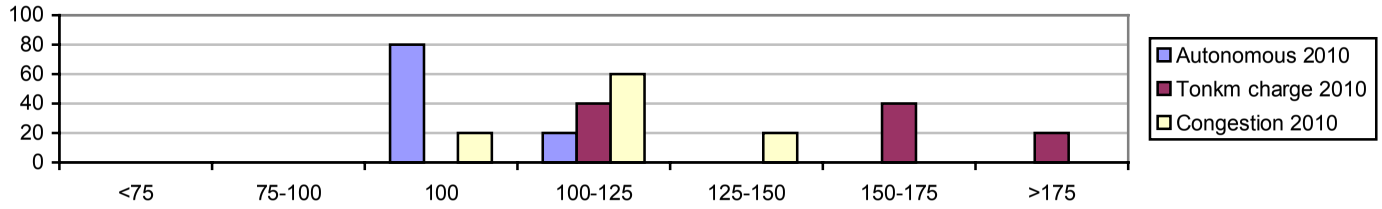


Figure 21: Expectations regarding transit times in 2010 (2001 = 10) (n = 5)

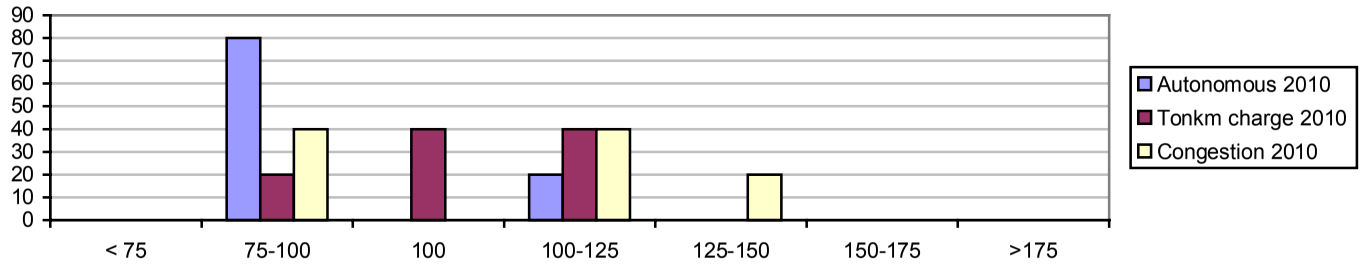
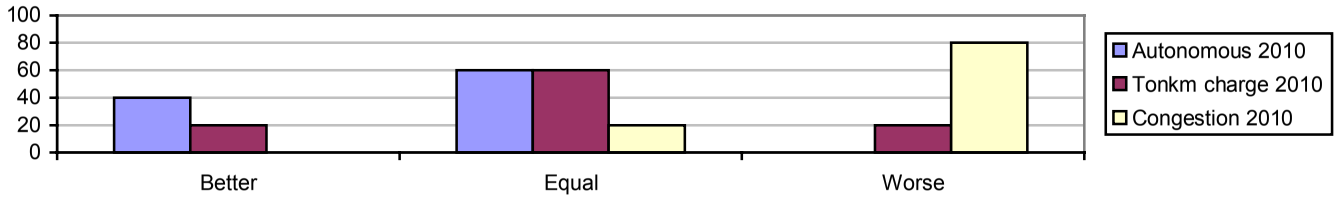


Figure 22: Expectations regarding delivery reliability in 2010 (2001 = 100) (n = 5)



Results part research into short sea shipping (n = 11)

Question 1: How likely do you consider the following developments in short sea shipping from Sweden to the Netherlands between 2001 and 2010?

	No scenario How likely do you consider this development between now and 2010, if neither scenario eventuates?						**Scenario 1** How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						**Scenario 2** How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
Possible developments: *(Shaded are questions on which a sufficient degree of consensus existed)*	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
1. Shipowners pass cost increases directly on to shippers	45%	27%	18%		9%		73%	9%	9%		9%		64%	18%	9%		9%	
2. Shipowners raise rates in response to increased demand for goods transport services	45%	36%			18%		55%	27%	18%				45%	36%	9%		9%	
3. Voyages take longer due to port delays; shipowners do not take counteractive measures	9%		73%	18%			9%		64%	27%			9%		45%	45%		
4. The use of planning systems increases	18%	64%	9%	9%			18%	55%	27%				27%	73%				
5. Payload factors of vessels increase, because shipowners will plan ahead on the long-term in regard to their shipments with shippers	18%	45%	27%		9%		27%	9%	64%				36%	45%	9%			9%
6. Shipowners acquire more return cargo	9%	91%					18%	73%	9%				18%	64%		9%		9%
7. Shipowners exchange more cargo with other shipowners, so that vessels' payload factors increase		45%	18%		36%			64%	18%		18%		18%	55%	18%		9%	
8. Shipowners outsource more small or unprofitable shipments to other shipowners or other transport firms	9%	36%	27%		27%		18%	36%	36%		9%		36%	27%	18%		18%	
9. Shipowners will more frequently postpone departure until a higher payload factor or more return cargo is acquired	18%		55%	27%			9%	36%	45%	9%			18%	18%	55%	9%		

Possible developments:	No scenario How likely do you consider this development between now and 2010, if neither scenario eventuates?						Scenario 1 How likely do you consider this development between now and 2010 should scenario 1 eventuate (tonne-kilometre charges)?						Scenario 2 How likely do you consider this development between now and 2010 if scenario 2 eventuates (increased congestion)?					
(Shaded are questions on which a sufficient degree of consensus existed)	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know	Very likely	Likely	Unlikely	Very unlikely	Differs between firms	Do not know
10. Shipowners will more frequently use vessels with a higher capacity		64%	18%		18%		9%	55%	18%	9%	9%		27%	45%		18%	9%	
11. Shipowners will increasingly postpone maintenance or (replacement) investments			91%		9%			18%	64%		18%			9%	73%		18%	
12. Shipowners will reduce fuel usage (e.g., by using more efficient engines or by more economic shipping behaviour)		73%	18%	9%			18%	82%					9%	73%	18%			
13. Ship owners will change schedules in order to reduce transit times		45%	27%		18%	9%		36%	36%		18%	9%	9%	55%	18%		9%	9%
14. Shipowners will more often change departure times in order to guarantee reliability of arrival		73%	18%			9%		73%	18%			9%	27%	45%	18%			9%
15. Shipowners will more often choose other ports of call in order to avoid delays in congested ports		36%	55%		9%		9%	45%	36%		9%		27%	64%			9%1	
16. Shipowners will visit more ports during a voyage in order to improve payload factors		45%	55%				9%	45%	45%					45%	45%	9%		
17. Shipowners will co-operate more with firms that are specialised in cargo acquisition		55%	18%	9%	18%		9%	45%	18%	9%	18%		9%	45%	18%	9%	18%	
18. Firm size of shipowners will increase (due to take-overs etc.)	27%	45%	9%	9%	9%		27%	64%		9%			36%	36%	9%	9%	9%	

Due to rounding off, totals may sometimes be more or less than 100%

Results part research into short sea shipping (continued)

Question 2: Which rates, transit times, and delivery reliability do you expect in short sea shipping from Sweden to the Netherlands in 2010?

Figure 23: Expectations regarding short sea shipping rates in 2010, exclusive of inflation (2001 = 100) (n = 11)

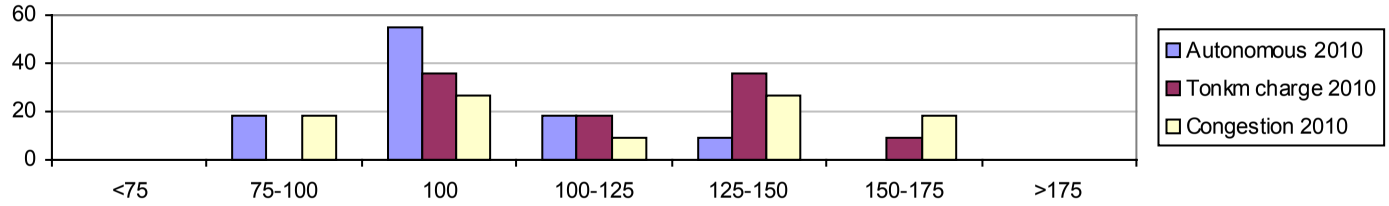


Figure 24: Expectations regarding transit times in 2010 (2001 = 100) (n = 11)

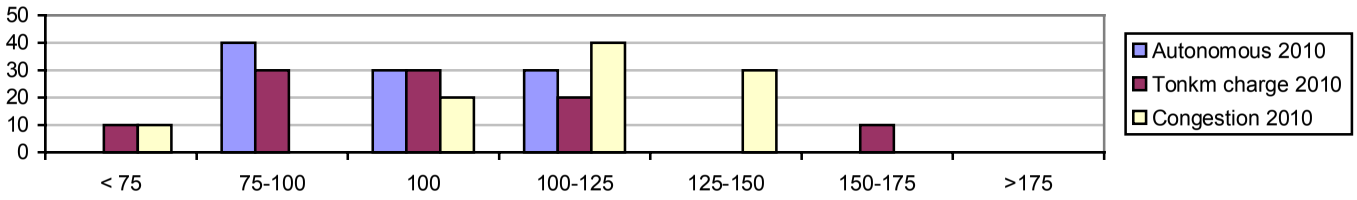
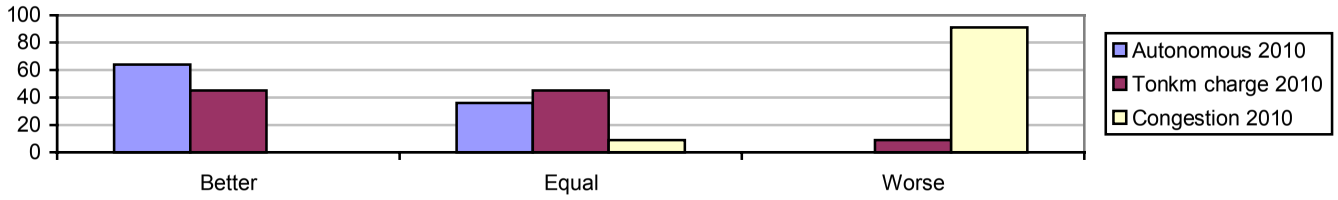


Figure 25: Expectations regarding delivery reliability in 2010 (2001 = 100) (n = 11)



Annex C: Consensus rates

	Road haulage	**Inland navigation**	**Rail transport**	**Airfreight**	**Deep sea shipping**	**Short sea shipping**	**Average**
Reaction round 1:							
- *Degree of consensus question 1*	71.9%	33.3%	75.0%	73.3%	70.4%	74.0%	66.3%
- *Degree of consensus question 2*	55.6%	44.4%	33.3%	66.7%	66.7%	22.2%	48.2%
Reaction round 2:							
- *Degree of consensus question 1*	78.9%	40.4%	82.1%	71.1%	66.7%	74.0%	68.6%
- *Degree of consensus question 2*	66.7%	55.5%	50.0%	66.7%	66.7%	33.3%	56.5%

The table shows on how many items per question, expressed in percentages, the experts had reached a 'sufficient degree of consensus'. With respect to question 1, consensus was defined as the situation in which at least 60% of the respondents had chosen the same answer. This was also the case if the summed scores on for instance 'very likely' and 'likely' mounted to 60% or more. Additionally, the scores on '(very) likely' and '(very) unlikely' should not be spread more or less equally. Regarding question 2, consensus was achieved if at least 50 percent of the respondents had chosen a particular predefined interval.