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Freight transportation on a high speed double tracked rail network in Norway

Report IRIS - 2008/267

Project number:	7252218
Project title:	Freight transportation on a high speed double tracked rail network in Norway
Client:	Norsk Bane AS
ISBN:	978-82-490-0610-6
Distribution restriction:	Open

Stavanger, 12.12.2008

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Summary

During the past forty years, Norway has experienced a substantial growth in performed transport work of goods (SSB 2008). Sea and road transportation accounted for the largest growth. Rail transportation in comparison had a modest growth during the same period, loosing considerable market share to the other modes of transportation.

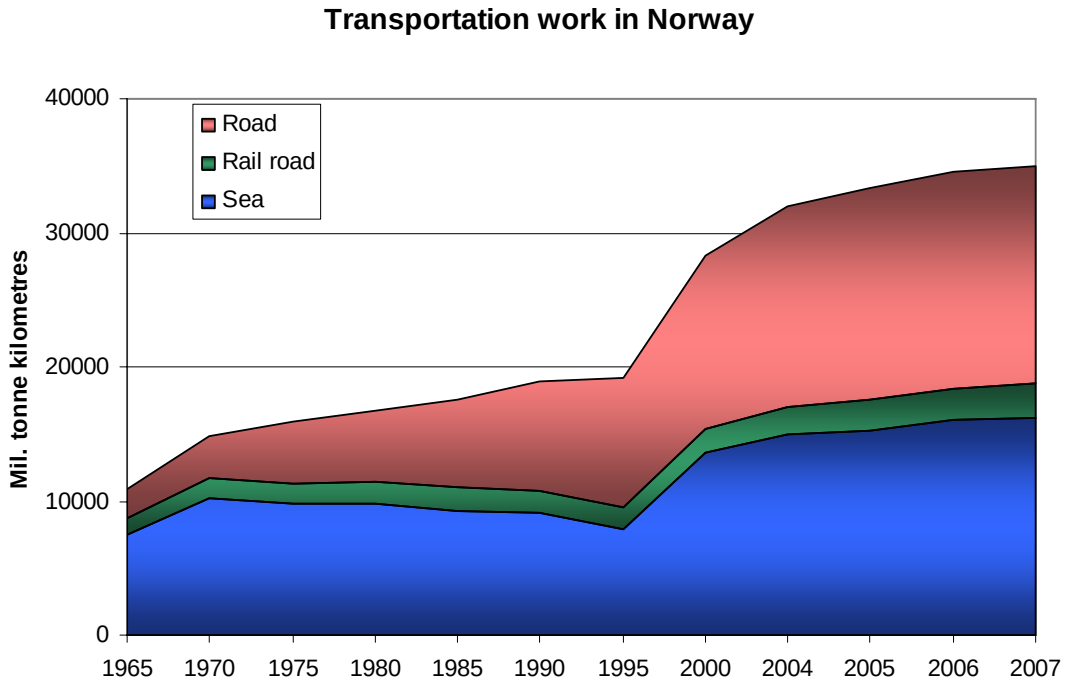

Figure 1 The development of transportation work in Norway. 1965-2007. (SSB 2008)

However, the transportation of containers and other standardised units between the largest cities in Norway has proven highly competitive in the later years. During the last 5 years, the railroad has experienced impressive growth rates in container transport, as shown in the table 1.

Table 1 Average yearly growth of containers transported by rail (Pöyry 2008)

Distance/Year	2003	2004	2005	2006	2007	Average
Oslo-Trondheim	10,16 %	7,63 %	8,71 %	1,77 %	8,81 %	7,42 %
Oslo-Kristiansand-Stavanger	8,70 %	9,33 %	6,50 %	6,87 %	8,21 %	7,92 %
Trondheim-Bodø	8,70 %	10,06 %	7,78 %	4,87 %	4,94 %	7,27 %
Oslo-Bergen	5,22 %	18,01 %	14,78 %	17,59 %	11,93 %	13,51 %

The growth between Oslo and Bergen has been at an average rate of 13,5 percent during the last five years. The other distances have experienced impressive growth rates as well, around 8 percent in average during the last five years.

LTL (Logistikk og Transportindustriens Landsforening) reports that if more capacity had been available, the large co-loaders could send additionally 2 000 TEU's by rail a week on these routes, removing 1000 trucks a week from Norwegian roads. On a yearly basis, this means that around 104 000 TEU's could be sent by rail, rather than on roads already today, if adequate capacity was available. This result coincides with the findings in the report "Gods fra vei til Bane" by Econ Pöyry (Pöyry 2007). Here it is estimated a latent demand for transportation by railroad on the main distances in Norway roughly between 115 000 to 150 000 TEU's. This is the numbers of containers that could have been moved by rail, but currently goes by truck because of lack of capacity in the existing railway network.

Further, the same report estimates possible growth paths listed in table 2 for goods transportation on the Norwegian Rail Network. The basis alternative is based on observations from the last years, while the high alternative assumes an increase in both general land based transport and the main rail distances growth. The low alternative assumes a lower growth pattern in the future, than experienced in the past five years.

Table 2 Assumptions of different growth patterns (Pöyry 2007)

Growth paths	General growth in land based goods transport	Yearly growth in goods transport on main railroad distances
Basis alternative	4 %	7 %
High alternative	5 %	9 %
Low alternative	3 %	5 %

The Norwegian rail administration is planning to double the rail network capacity (both terminal and track capacity) on the main lines in the period 2010-2019. This is equivalent to an average yearly increase of the network capacity by 5,7 percent compared with the service offered in 2008. Since the capacity today is close to full utilisation, this means that the average growth rate cannot exceed 5,7 percent. A growth in latent demand/demand for long distance road transportation seems to be the likely result of this strategy.

If the future development in demand for goods transportation on railroads grows at the same rate as seen since 2002, the demand will exceed the planned development of supply. A high-speed double tracked railway network in Norway will improve the capacity of goods transport on rails beyond the most optimistic growth forecast in demand. This will also give room for more actors in the combined transport segment, abolishing the monopoly of Cargonet. A more competitive combined transport market on rail is highly demanded by LTL. In addition, the transport times will be significantly reduced, increasing the capacity of the rolling stock with as much as 50 percent, compared with a conventional rail network.

1 Introduction

The purpose of Norsk Bane AS (Norwegian Rail Ltd.) is to explore the possibility of constructing a high speed rail network between the four largest cities in Norway; Oslo, Bergen, Stavanger and Trondheim. This network is meant to be a competitive option for air travel on the most important distances in Southern Norway.

In today's situation, however, the freight traffic experiences far higher growth rates than passenger traffic on the national railway system. According to the National Rail Administration, the capacity limit of the existing rail network is soon about to be reached, making further growth in freight traffic on rail impossible. A double tracked high speed network will improve capacity far beyond the limitations of the existing rail network. The freight trains will also be a nice addition of income as well as traffic for the planned high speed rail network.

Further we will analyse the existing market situation of the Norwegian freight market on rail, explore its possibilities and limitations as well as estimate future growth patterns.

2 The transport situation in Norway

During the past forty years, Norway has experienced a substantial growth in performed transport work of goods. From around 10.000 million ton kilometres in 1965, the amount has risen until over 35.000 million tonne kilometres in 2007 (SSB 2008). Sea and road transportation accounted for the largest growth. Rail transportation in comparison had a modest growth during the same period, loosing considerable market share to the other modes of transportation.

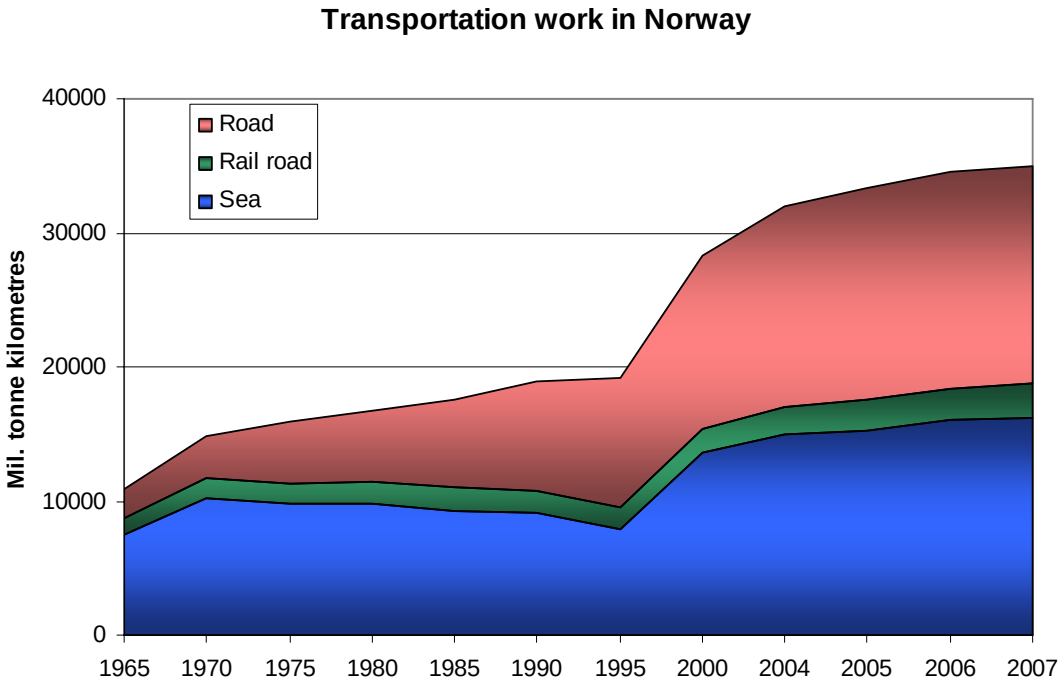

Figure 2.1 The development of transportation work in Norway. 1965-2007. (SSB 2008)

2.1 Goods transport on railroad

The low market share of rail transport in Norway can partly be explained by the characteristic Norwegian geography. Most of the transport intensive industries, such as metallurgy mills, oil refining plants, ship yards, and cement and fertiliser plants, have a long tradition taking advantage of the 25.000 kilometres long Norwegian coastline. Building their logistical needs around sea based transport, very few examples of transport intensive factories not having direct access to sea transport exist. Transport intensive industries, such as the car- and machinery industry, which are considered the main customers of rail transport in rest of Europe, are negligible in Norway. Related to Gross Domestic Product (GDP), Norway transports around 100 ton kilometres less per thousand Euro than the WE17[1] (Ickert, Erhardt et al. 2007). For these reasons, the Norwegian market for rail transport is quite different from the situation experienced in rest of Europe.

1 WE17 is equivalent to EU15 in addition to Norway and Switzerland

2.1.1 The transport services

There are three different freight services on the Norwegian rail network today. The main freight traffic is generated by a regular service of pendulum trains, carrying container and piggy back wagons between the largest cities in Norway. This service is run by Cargonet alone. The container/piggyback traffic accounts for around 85 percent of the total freight transport in Norway, excluding the iron ore traffic on Ofotbanen. The last 15 percent of the freight traffic consist of other system cargo transports, with fully loaded special trains between few destinations, often run at an irregular basis, and the more traditional wagon load traffic[2]. In 2007, around 87 percent of the domestic goods transported by Cargonet (measured in tonnes) came from the pendulum service, while the rest came from transportation of jet fuel, cars, lumber and various wood/paper products.

After 2004 Green Cargo, Hector Rail, Togab and Peterson Rail has entered the Norwegian system rail market. They are mostly running cross-border traffic from Drammen or Fredrikstad to Sweden, but some run domestic rail services, mainly transporting cars, gravel, lumber and various wood/paper products.

The amount of goods transported on the Norwegian rail network, and its distribution between domestic (pendulum/system rail), cross-border and iron ore traffic is displayed in figure 2.2 below.

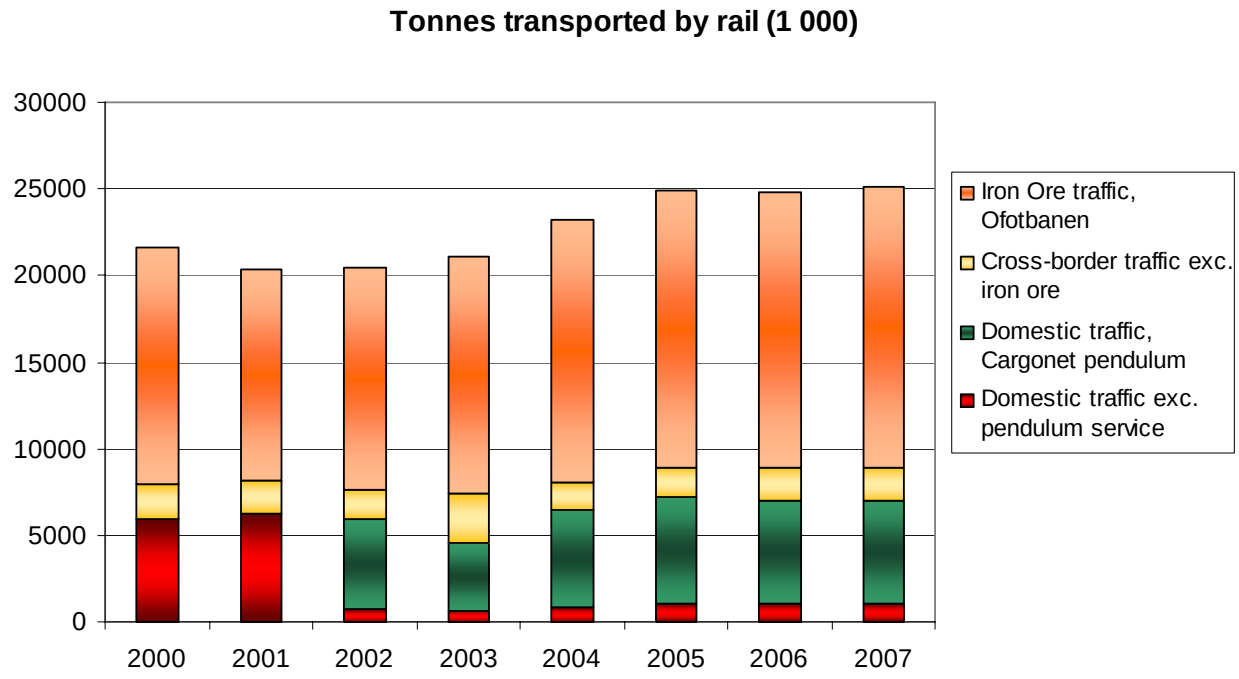

Figure 2.2 Tonnes transported by rail. (Jernbaneverket 2007)

2 Wagon load traffic is wagons less than a train load, which is transported to terminals and connected with other wagons heading for the same direction to form a full train.

2.1.2 The recent history of Norwegian rail transport

The Norwegian rail market for goods transport has undergone some fundamental changes during the six last years. Before, the Norwegian railway system was organised as a state owned monopoly service, with one company handling all the rail traffic on Norwegian tracks. In 2002, the national railway company NSB (Norges StatsBaner) was re-organised and the goods segment were separated into an own company, Cargonet, 55 percent owned by NSB and 45 percent owned by Green Cargo. At the same time, other transport companies were allowed access on the Norwegian rail network. Today, seven different railway companies operate freight trains on the Norwegian railway network; Cargonet, Green Cargo, Malmtrafikk, Ofotbanen AS[3], Hector Rail, Togab, and Peterson Rail. One more company, Cargolink AS, is currently waiting for licence to operate freight trains in Norway.

The results of Cargonet's decision to put their effort into transporting unitised goods can be read out of the statistics; the figure below displays the growth in the number of containers transported on the Norwegian rail network between 1992 and 2006. Note that the growth rate between 2000 and 2006 has been at 14 percent on average.

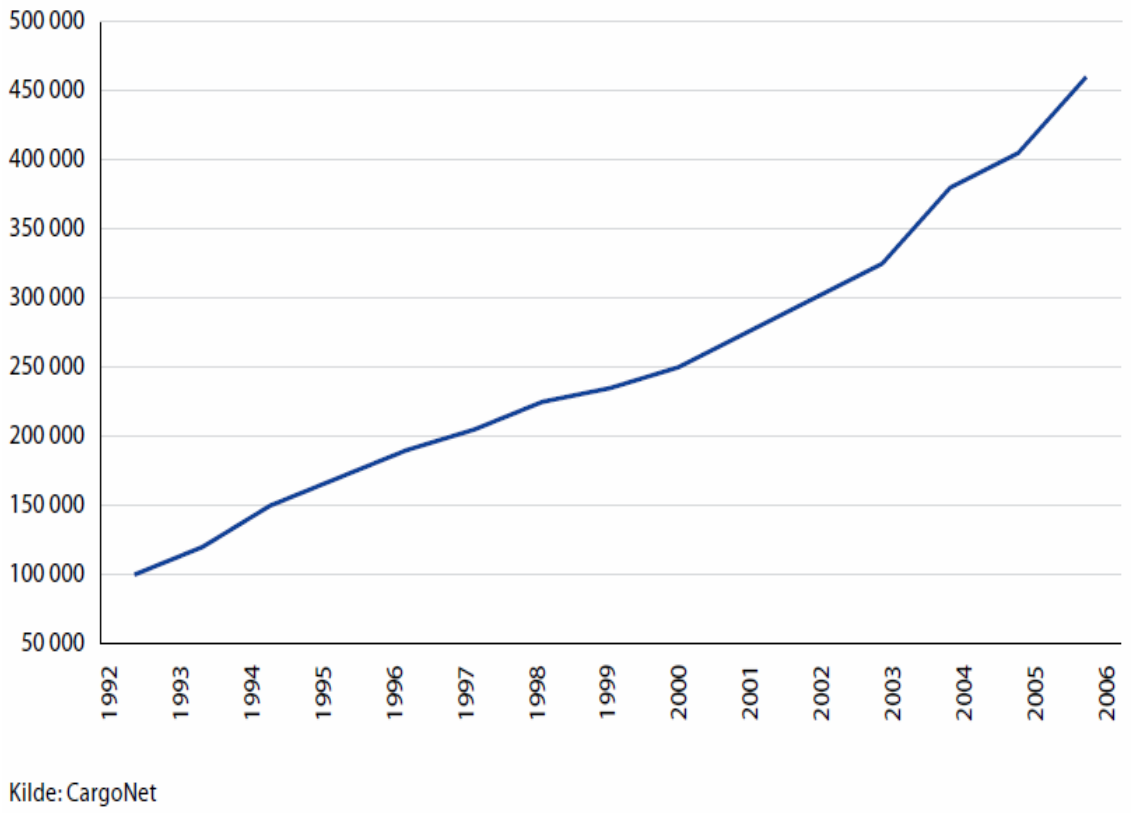

Figure 2.3 Number of containers transported, 1992-2006. (Nilsen 2008).

Transportation of containers between the largest cities in Norway has proven highly competitive in the later years. During the last 5 years, the railroad has experienced impressive growth rates in container transport, shown in table 2.1.

3 Ofotbanen AS has currently lost its licence to run trains on the Norwegian rail network. (Transport Inside 19/08)

Table 2.1 Average yearly growth of containers transported by rail (Pöyry 2008)

Distance/Year	2003	2004	2005	2006	2007	Average
Oslo-Trondheim	10,16 %	7,63 %	8,71 %	1,77 %	8,81 %	7,42 %
Oslo-Kristiansand-Stavanger	8,70 %	9,33 %	6,50 %	6,87 %	8,21 %	7,92 %
Trondheim-Bodø	8,70 %	10,06 %	7,78 %	4,87 %	4,94 %	7,27 %
Oslo-Bergen	5,22 %	18,01 %	14,78 %	17,59 %	11,93 %	13,51 %

The growth between Oslo and Bergen has been at an average rate of 13,5 percent during the last five years. The other distances have experienced impressive growth rates as well, around 8 percent in average during the last five years. In figure 2.4 the growth rates of goods traffic on rail are compared with road transport. For all the distances where rail transport is an alternative to road transport, rail has experienced higher growth rates. The market share of rail transport has increased from around 25 percent to 40 percent for combined transport between Oslo and Bergen, Stavanger and Trondheim in this period (Pöyry 2007). The figure also shows that road transportation has grown more on distances where no realistic alternative modes of transportation is available, mainly between Oslo-Haugesund and Stavanger-Bergen.

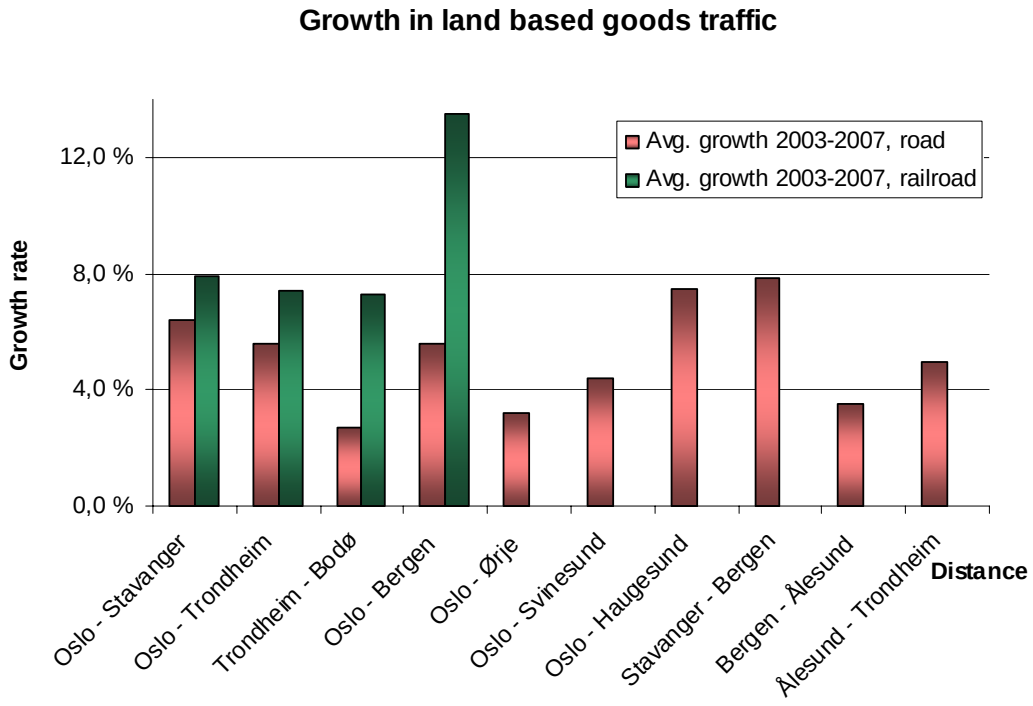

Figure 2.4 Average growth in land based goods traffic in the period 2003-2007 (Pöyry 2008) and (Vegvesen 2008).

It seems that a positive spiral effect has taken place for the combined transport on railroad in this period. The more goods the co-loaders sent by rail, the more trains Cargonet had to put up on the same distance. This again led to a more frequent service, and less average transportation time for each container. As a result transportation by rail became even more competitive to road transport, and market shares could be gained.

3 The development of the general goods transportation market

Since Malcolm Mclean started the first container service between New York and Houston by ship in 1956, more and more goods has been containerised before transportation (Levinson 2006). The reason for the success of the container is its cheaper handling cost, due to reduction in loading/unloading time as well as standardisation of the handling equipment and the complete transportation system. Also storage cost is reduced by using containers, as warehousing is no longer needed. This made multimodal transport more practical, as the goods were loaded and unloaded separately only once, at the origin and at the destination, and not every time the goods changed mode or was stored. All this has reduced the transportation cost of a 40 feet box significantly compared to other alternatives of transportation.

3.1 Implications for rail transport

Reduction of handling time and cost by containerisation has been greatly beneficial for the railroad when it comes to transportation of general cargo over longer distances. As a rule of thumb, railroads are competitive to road transportation transporting general cargo when large amounts of unitised cargo is transported at distances over 300-500 kilometres. For ordinary break bulk this distance will be higher, as the higher handling costs make the switch is more expensive. The disadvantage of using railroad is that it has to be fed and unfed goods by ship or trucks, leading to loading and unloading costs that would not have occurred if the whole leg had been carried out by trucks. For that reason, railroads are mainly used on intermediate transport legs[4], most commonly between large co-loading terminals, and other distances where the amount of goods is large enough to fill up a train are transported between the same places. Since transportation by railroad has less average costs per ton kilometre, rail transport will be competitive to road transport on intermediate transport legs where the distance is over 300-500 kilometres and where the amount of traffic is large enough to run a fully loaded freight train in at least one direction. The more goods going by rail between two cities, the more trains are needed, increasing the frequency and improving the transport service as a result.

As the container transport system developed and turned into a multimodal door to door transportation system, the actors adapted to fully utilise the benefits given by this revolution in the transport sector. Economics of scale and lower transportation cost per ton-kilometre made it possible to cut costs by centralising the logistical centres and engross stores and servicing the customers with just-in time deliveries. This made each transport assignment smaller, but the total demand for transportation much higher. Large co-loading companies got a higher share of the market, as they where better able to fully utilise the container by packing goods bound for the same direction together into fully loaded containers.

4 Intermediate transport is defined as distribution from factory to storage, or from storage to customers through a hub. On these stages, the goods transported by trucks will go through an extra handling operation as well, because the cargo has to be redistributed at the terminals before reaching its final destination.

3.2 The Norwegian case

In Norway one result of the containerisation has been a centralisation of the logistical centres to the more densely populated south-eastern part, with a large increase of just-in-time intermediate transport to the rest of the regions of the country. This has been favourable for the large co-loader companies, which have conquered larger market shares of the transport market of general cargo and break bulk in the later years.

Taking a look at the geography of Norway, there are distances of around 500-700 kilometres between the largest urban areas, and the Norwegian rail network is constructed with rails spreading out from Oslo, functioning as the only hub. Taking into account the relatively poor road quality, adding extra costs per kilometre for the road transport, Norway is an ideal area for goods transport on railroad.

For Cargonet to take advantage of these favourable trends and market edges, they had to offer a transport service which was able to compete with road transport on the main transport corridors in Norway where railways exist. This meant that they had to offer a service which where frequent enough to satisfy the needs of their customers, and cheap enough to compete with road transportation. To do this, they made a strategically choice in 2002, where they stopped offering wagon load services, and started a high frequent pendulum service transporting unitised goods between the largest cities in Norway and between Oslo and cities in Sweden instead. Customers with goods flows large enough to fill up a full train were still served with whole trains, while those with less than a train load need of transportation had to find alternative modes of transportation. Often these customers continued to send cargo by train, but now unitised with the pendulum service.

Especially the large co-loaders operating in the Norwegian market, Bring Logistics (former Posten/Nor Cargo), Schencker/Linjegods, Tolpost Globe and DHL took advantage of the new transport service by Cargonet. Being able to send fully loaded containers with co-loaded goods between their largest goods terminals in Norway, transportation by rail become a more competitive option than road transport on the main transport corridors between Oslo and Bergen, Trondheim and Stavanger.

Still trucks have a large market share of the transport market on the routes also served by Cargonet. The main reason is the fact that a full container load moves more cheaply between two destinations in southern Norway with trucks even at longer distances because it can be transported directly from door to door, eliminating the extra handling costs that incur if the full container should be brought to and picked up from the railway terminals. In later years also capacity problems on the railway network and in the terminals have turned goods over to roads.

4 The development of the goods transport market on rail

4.1 Combined transport

In today's situation, Cargonet accounts for nearly all of the container and piggyback transportation in Norway, making it possible to calculate the total capacity of multimodal cargo in the Norwegian rail network. Depending on the rail infrastructure, the freight trains operated by Cargonet have a capacity between 40 and 50 TEU on each trip. The rail infrastructure between Bergen-Oslo and Stavanger-Kristiansand-Oslo only allows for typical train lengths around 400 metres, due to short tracks where two trains can meet[5]. This limits the typical capacity for each train to around 40-42 TEU per trip. The other railroad distances allows for longer trains and increased capacity for each train. In the table bellow, theoretical capacity on each distance is calculated based on today's freight train service for 2007.

Table 4.1. The combined transport rail service in Norway in 2007, based on the time schedule from Cargonet.

From	Via	To	Avg. train capacity, TEU	Number of weekly trips	Yearly capacity TEU	Number of weekly return trips	Yearly capacity TEU
Oslo		Bergen	40	26	54080	26	54080
Drammen		Bergen	40	5	10400	5	10400
Oslo	Kristiansand	Stavanger	42	16	34944	16	34944
Drammen	Kristiansand	Stavanger	42	5	10920	5	10920
Oslo		Stavanger	42	1	2184	1	2184
Oslo		Åndalsnes	38	10	19760	10	19760
Oslo		Trondheim	44	16	36608	16	36608
Oslo	Trondheim	Mo i Rana	44	5	11440	5	11440
Oslo	Trondheim	Bodø/Fauske	44	5	11440	10	22880
Oslo	All services	Trondheim	44	26	59488	31	70928
Oslo		Bodø/Fauske	44	11	25168	6	13728
Oslo		Narvik	44	11	25168	11	25168
Oslo		Stockholm	48	1	2496	1	2496
Oslo		Jönköping	48	5	12480	5	12480
Oslo		Älmhult	48	6	14976	6	14976
Oslo		Malmö/Trelleborg	48	6	14976	6	14976
Oslo		Taulov	48	1	2496	1	2496
Oslo		Göteborg	48	5	12480	5	12480
Oslo	All services	Sweden/Denmark	48	24	59904	24	59904
Total			45	135	314053	135	314053
Theoretical capacity of Cargonet							628105

5 The limitation due to the length of meeting points on a single tracked railroad only apply when two trains longer than these tracks are passing each other. Other limitations to train capacity on a specific line are track gradients and the track lengths at the terminals.

During 2008, Cargonet set up three new railroad services, which has increased the capacity on Bergensbanen and Sørlandsbanen with one daily departure in each direction as well as introducing one more weekly departure between Oslo and Taulov in Denmark. The result is shown in Table 4.2.

Table 4.2. The combined transport rail service in Norway from October 2008, based on the time schedule from Cargonet.

From	Via	To	Train capacity (TEU)	Number of weekly trips	Yearly capacity TEU	Number of weekly return trips	Yearly capacity TEU
Oslo		Bergen	40	31	64480	31	64480
Drammen		Bergen	40	5	10400	5	10400
Oslo	Kristiansand	Stavanger	42	20	43680	20	43680
Drammen	Kristiansand	Stavanger	42	5	10920	5	10920
Oslo		Stavanger	42	1	2184	1	2184
Oslo		Åndalsnes	38	10	19760	10	19760
Oslo		Trondheim	44	16	36608	16	36608
Oslo	Trondheim	Mo i Rana	44	5	11440	5	11440
Oslo	Trondheim	Bodø/Fauske	44	5	11440	10	22880
Oslo	All services	Trondheim	44	26	59488	31	70928
Oslo		Bodø/Fauske	44	11	25168	6	13728
Oslo		Narvik	44	11	25168	11	25168
Oslo		Stockholm	48	1	2496	1	2496
Oslo		Jönköping	48	5	12480	5	12480
Oslo		Älmhult	48	6	14976	6	14976
Oslo		Malmö/Trelleborg	48	6	14976	6	14976
Oslo		Taulov	48	2	4992	2	4992
Oslo		Göteborg	48	5	12480	5	12480
Oslo	All services	Sweden/Denmark	48	25	62400	25	62400
Totalt			45	145	337316	145	337316
Theoretical capacity of Cargonet							674632

By introducing the new freight services during 2008, the theoretical capacity of Cargonet increased with 7.4 percent between 2007 and 2008.

From the time table, the theoretical capacity of the rail service offered by Cargonet between their terminals can be estimated. This is done in table 4.3.

Table 4.3. The theoretical amount of TEU Cargonet could transport between each terminal in 2007 (Cargonet 2008).

Terminal	Oslo	Drammen	Bergen	Kristiansand	Stavanger	Narvik	Åndalsnes	Trondheim	Mo i Rana	Bodø/ Fauske	Sweden/ Denmark
Oslo	561392		54080	7932	29196	25168	19760	50911	3244	30501	59904
Drammen		42640	10400	2479	8441						
Bergen	54080	10400	128960								
Kristiansand	7932	2479		20822							
Stavanger	29196	8441			75274						
Narvik	25168					50336					
Åndalsnes	19760						39520				
Trondheim	53134							142936	8196	6107	
Mo i Rana	3244							8196	22880		
Bodø/ Fauske	28278							16392		81278	
Sweden/ Denmark	59904										119808

From table 4.3, the total theoretical capacity of the total combined transport service of Cargonet can be calculated to around 630 000 TEU a year in 2007.

The following table lists how many TEU's each railway terminal in Norway handled in 2007.

Table 4.4. Railroad terminals in Norway. Number of TEU handled in 2007 (Nilsen 2008) and (Grønland and Berg 2006).

Railroad terminal	Number of TEU
Oslo	500 000
Drammen	43 000
Bergen	112 000
Kristiansand	25 000
Stavanger	85 000
Åndalsnes	25 000
Trondheim	100 000
Mo i Rana	13 000
Fauske	16 000
Bodø	38 000
Narvik	45 000
Sweden/Denmark	113 200

Figure 4.1 shows the existing Norwegian railway network, the distances where Cargonet operates, as well as the amount of Containers handled at each railway terminal in 2007.

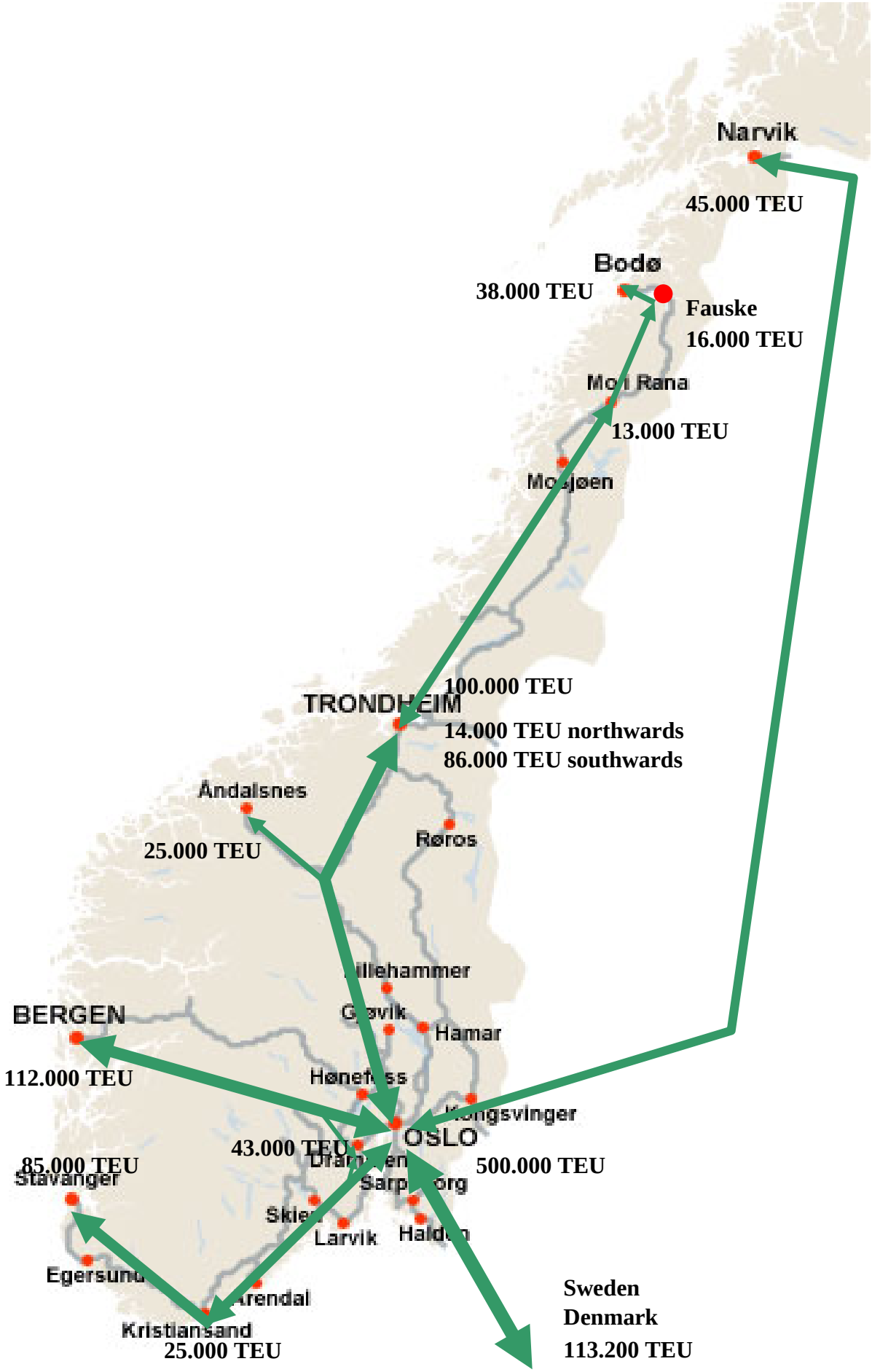

Figure 4.1 The Norwegian rail network (the freight service is indicated with green arrows) and the amount of containers handled at each terminal in 2007. (Cargonet 2008), (Nilsen 2008) and (Grønland and Berg 2006).

The Norwegian rail network is organised as a Hub and spoke system, where Oslo is the hub, and the other large Norwegian cities are located at the end of each spoke. For this reason, most of the combined transport is to and from the Alnabru terminal in Oslo. The exception is a daily rail service between Bergen and Drammen, Stavanger/Kristiansand and Drammen, and goods going from Trondheim and northwards.

There are large inequalities in the direction balance to and from Oslo, often as high as 75/25, which means 75 percent of the goods are transported out from Oslo, while 25 percent are transported towards Oslo on a given distance. Although the goods balance of direction is uneven, the same amount of rail cars has to be transported back to the origin[6]. This capacity is often used to carry empty containers back to Oslo. For this reason, it is roughly true that the direction balance of handled containers is 50 percent in each direction. Assuming this, the amount of containers which was transported between each terminal in 2007 can be read out of the table below.

Table 4.5. Number of TEU handled and transported between each terminal in 2007[7] (Cargonet 2008), (Nilsen 2008) and (Grønland and Berg 2006).

Terminal	Oslo	Drammen	Bergen	Kristiansand	Stavanger	Narvik	Åndalsnes	Trondheim	Mo i Rana	Bodø/ Fauske	Sweden/ Denmark*
Oslo	500000		45250	10060	34190	22500	12500	42700	3250	22950	56600
Drammen		43000	10750	2440	8310						
Bergen	45250	10750	112000								
Kristiansand	10060	2440		25000							
Stavanger	34190	8310			85000						
Narvik	22500					45000					
Åndalsnes	12500						25000				
Trondheim	42700							100000	3250	4050	
Mo i Rana	3250							3250	13000		
Bodø/ Fauske	22950							4050		54000	
Sweden/ Denmark*	56600										113200

** The amount of cross-border traffic is calculated by subtracting the amount of TEU's Oslo handles by the amount each other terminal in Norway handles of TEU's from Oslo.*

From Table 3.5, it is possible to calculate that Cargonet handled (loaded and unloaded) around 560 000 TEU in 2007. In 2008, Cargonet expects to handle around 600 000 TEU, an increase of 7 percent. Table 4.3, divided by table 4.5 tells how close each line is to reach its maximum capacity. A number close to 1 indicate that the capacity is reached, and no further growth of transportation is possible for that line, unless the service is expanded.

6 Else the rail cars would pile up at the terminals which are sending out less cargo than it receives.

7 The amount of goods transported between the terminals can be computed in tonnes by multiplying each TEU with 13,4, which is the average weight of goods in each TEU transported by Cargonet domestically. For cross-border traffic the average weight is 11,9. The average weight is found by dividing the total amount of tonnes transported from table 2.2 with the total amount of TEU's handled.

Table 4.6. The relationship of theoretical capacity compared with actual amount transported between each terminal in 2007 (Cargonet 2008), (Nilsen 2008) and (Grønland and Berg 2006).

Terminal	Oslo	Drammen	Bergen	Kristiansand	Stavanger	Narvik	Åndalsnes	Trondheim	Mo i Rana	Bodø/ Fauske	Sweden/ Denmark
Oslo			0,84	1,27	1,17	0,89	0,63	0,84	1,00	0,75	0,94
Drammen			1,03	0,98	0,98						
Bergen	0,84	1,03									
Kristiansand	1,27	0,98									
Stavanger	1,17	0,98									
Narvik	0,89										
Åndalsnes	0,63										
Trondheim	0,80								0,40	0,66	
Mo i Rana	1,00							0,40			
Bodø/ Fauske	0,81							0,25			
Sweden/Denmark	0,94										

Table 4.6 shows that the railway service runs close to its full capacity for most of the lines to and from Oslo. Note that lack of capacity is also reported on distances where as less as 84 percent of the theoretical capacity is utilised. Reasons for why it is not possible to fully utilise the capacity can be the fact that not all the empty containers are transported back to Oslo by train, but shipped out with other modes instead, making the balance of handled containers uneven. Another reason is that some departures are not fully utilised, while there is no capacity left on the evening departures. This can be true for the distances Oslo-Bergen, Oslo-Trondheim and Oslo-Bodø. For 2007, the average utilisation of the combined transport service of Cargonet was 88 percent.

That Sørlandsbanen has a number above 1 suggests that trains with better capacity are used, and/or some of the containers are transported between Stavanger and Kristiansand.

4.2 Wagonload and system cargo

Wagonload and system cargo constitute a small part of transport on the railway, in the region of 5% - 8%, depending on whether the transport is measured in tonnes or ton km and whether it is compared with local Norwegian transport or by the sum of all transport, including interoperation with foreign countries.

Wagonload traffic today is very different from the previous traditional wagonload product. Today, fixed unit trains with wagonload run from terminal to terminal. No servicing of individual customers on branch lines is offered. Wagonload transport has increased considerably in recent years. However, it is difficult to get reliable statistics.

Green Cargo is the major operator of wagonload transport. At present, wagonload services runs between Sweden and Norway, to terminals in Drammen, Rolvsøy and Trondheim. Any further developments in the wagonload segment are most likely to spring out of these three areas. Other areas suitable for wagonload services could be the Grenland/Vestfold area, industry clusters along the Norlandsbanen, and industrial inland cities such as Hønefoss, Kongsberg or Hamar/Lillehammer.

System cargo, apart from timber, comprises of car and paper transport. A small part of the system cargo is made up of closed transports for one or more industrial customers. The transports are operated as whole trains and the cargo comprises of aircraft fuel, chemicals, calcium, ore, heavy electrical equipments and dangerous goods. At present the system cargo segment is still dominated by Cargonet, but other companies has also introduced services, making this segment the only well functioning market on the Norwegian rail network. In 2006 Cargonet transported around 893 million tonnes by its system cargo service domestically, while other companies accounted for around 160 million tonnes. The majority of the domestic system cargo is transported on the axis between Trondheim and Oslo.

The other companies transported around 500 million tonnes across the border in 2006, while Cargonet transported around 1348 million tonnes, including combined transport. How much which comes from system cargo is unknown, but since Cargonet has left most of this traffic to Green Cargo, this is considered insignificant.

4.3 The present situation – Lack of capacity

As table 4.6 indicates, the amount of goods traffic today is about to reach its theoretical capacity in the Norwegian railway network on most of the distances. Interviews with some of the main co-loaders, as well as Cargonet, also confirm this situation. The co-loaders would like to send more goods with the railroad, but are unable to do so because of lack of capacity. Cargonet would like to improve their services, by adding more trains, but the capacity on the rail network as well as at the terminals makes this impossible.

LTL (Logistikk og Transportindustriens Landsforening) reports that they are sending around 3 000 TEU's on a weekly basis with Cargonet's railroad service between the terminals in the major Norwegian cities, Oslo-Bergen, Oslo-Kristiansand/Stavanger, Oslo-Trondheim, Oslo-Bodø and Oslo-Narvik. This is roughly 80 percent of the theoretical capacity Cargonet has on these routes. If more capacity had been available, LTL estimates that the large co-loaders could send additionally 2 000 TEU's by rail a week on these routes, removing 1000 trucks a week from Norwegian roads. On a yearly basis, this means that around 104 000 TEU's could be sent by rail, rather than on the roads already today, if adequate capacity was available. This result coincides with the findings in the report "Gods fra veg til Bane" by Econ Pöyry (Pöyry 2007). Here it is estimated a latent demand for transportation by railroad on the main distances in Norway roughly between 115 000 to 150 000 TEU's. This is the numbers of containers that could have been moved by rail, but currently goes by truck because of lack of capacity in the existing railway network.

What is not mentioned is that the majority of this latent demand is containers moving out from Oslo during the night. The evening departures are the peak time for rail transport demand because then the containers can be transported during the night, and is ready to be unloaded and distributed the next morning. For the Norwegian rail administration and Cargonet, this is problematic because the terminal capacity is fully utilised only during the morning and afternoon periods, and the capacity of the rail network out from Oslo is exceeded in the busy evening period. Since a fully loaded night train out from Oslo becomes an empty day train on the return trip, it is not obvious it will be profitable for Cargonet to add more capacity in the evening either.

In a report requested by the Norwegian Department of Transportation (Samferdselsdepartementet) as input to their next transport plan (NTP 2010-2019), LTL (Logistikk og Transportindustriens Landsforening) listed the following issues as the most important, in order to improve the situation for goods transportation in the Norwegian rail network:

1. Quality in the transportation service. The rail network should allow for higher speed and better reliability for the freight trains, in order to improve the competitiveness of goods transportation on railroad.
2. Allocation of slot times. The primary need for slot times for freight trains is in the evenings since at least two thirds of the transport demand occurs in this time period. LTL suggests that goods traffic will be prioritised over passenger traffic in this time period.
3. Terminals – competition (capacity, ownership). Improved capacity at the terminals will allow for better utilisation of the capacity on the tracks. It is also seen problematic that Cargonet, as the only operator of combined transport by rail, owns most of the important terminals. This effectively excludes other actors from competing in this transport segment.
4. Priority of investments. Improvements allowing for higher speed, more reliability and improved capacity on the network on the main distances should be prioritised.

5 Future trends

The Norwegian rail administration lists the following trends in the transport market, which most likely will imply continuous growth and increased market shares for goods transportation on railroad:

- Considerable growth in transport volumes
- Increasing degree of containerisation of goods transport
- Increasing degree of centralisation towards larger hubs and main transport corridors
- Growing challenges for road transport (resting /driving time regulations, lack of drivers)
- Focusing on safe, sustainable transport

All these trends advocates for further growth of demand for goods transport by rail in the future. An important trend surprisingly left out of this list is the increasing use of just-in-time deliveries. Just-in-time deliveries have become popular because it allows for smaller inventories, reducing the amount of capital tied up in stored goods. This makes each delivery smaller, but more frequent. Just-in-time deliveries are often less than a container load, and moves more cheaply co-loaded with other goods bound for the same direction. Co-loaded goods have to move through a terminal where it will be unloaded and sent together with other goods by trucks to the final destination. Since large amounts of containers are bound for the same place, trains are competitive, as they move larger amounts of goods over longer distances more cheaply than trucks.

5.1 The future development in demand for goods transportation on railroads

In the report “Gods fra vei til bane” by Econ Pöyry following different growth paths are suggested for Norwegian land based goods transport for the near future. The basis alternative is based on observations from the last years, while the high alternative assumes an increase in both general land based transport and the main rail distances growth. The low alternative assumes a lower growth pattern in the future, than experienced in the past five years.

Table 5.1 Assumptions of different growth patterns (Pöyry 2007)

Growth paths	General growth in land based goods transport	Yearly growth in goods transport on main railroad distances
Basis alternative	4 %	7 %
High alternative	5 %	9 %
Low alternative	3 %	5 %

Assuming that the yearly average growth pattern for combined transport on rail seen the past five years will not change towards 2019, Econ Pöyry estimates a 7 percent average growth rate on the main rail distances in Norway.

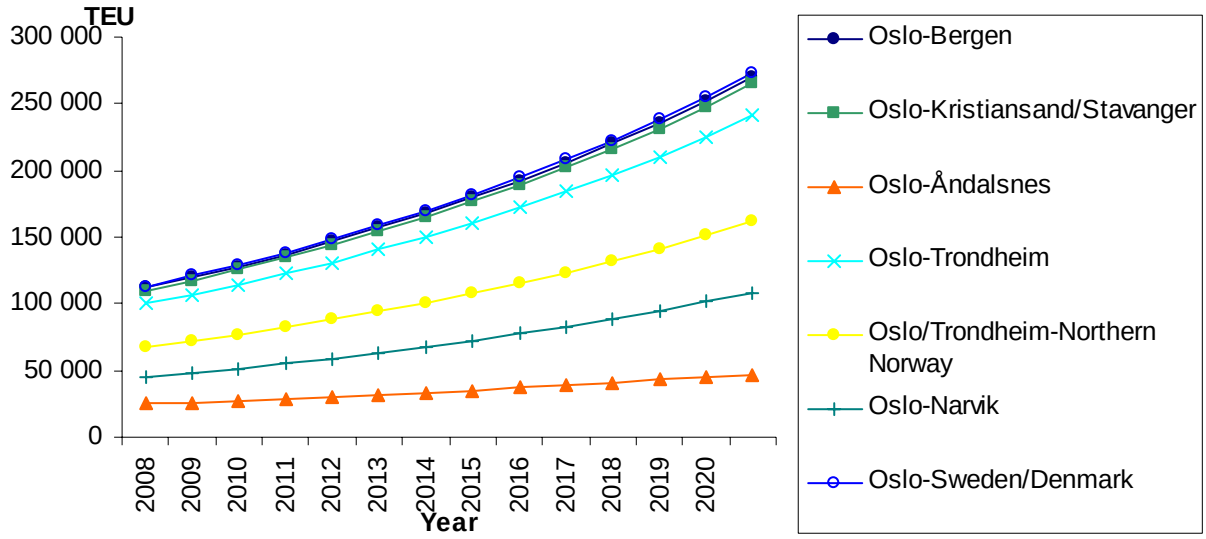

Figure 5.1. The basis alternative. Estimated growth rates of containers transported on the main distances in Norway. 2008-2020.

The amount of containers transported on the main distances in Norway has then a potential to develop as displayed in figure 5.1.

The most optimistic forecast, done by Econ Pöyry, estimates a 5 percent yearly increase in the general goods transport market, and a 9 percent yearly growth rate on goods transported with railways in the period 2008 to 2019. This means that the possible demand for rail transport in 2019 can be three times as high as what is transported today, if the capacity of the rail network is increased to handle such amounts.

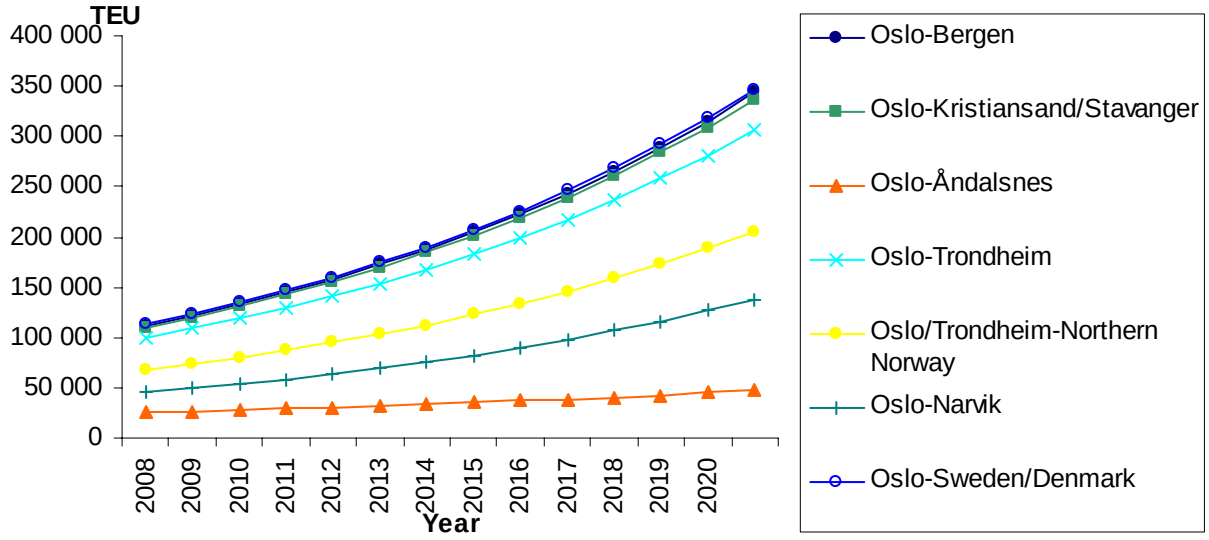

Figure 5.2. The high alternative. Estimated growth rates of containers transported on the main distances in Norway. 2008-2019. Source: Econ Pöyry

Table 5.1 displays the potential container traffic on the Norwegian railroad network in 2020, for the high, low and basis alternative, assuming no capacity restraints. Whether this railroad network is high speed or conventional makes no difference.

Table 5.1. Estimated container traffic on the Norwegian rail network in 2020.

Distance	Number of containers (in TEU) handled on each distance in 2020		
	Low alternative, 5 %	Basis alternative, 7 %	High alternative, 9 %
Oslo-Bergen	211 193	269 903	343 370
Oslo-Kristiansand/Stavanger	207 421	265 083	337 239
Oslo-Åndalsnes	47 141	60 246	76 645
Oslo-Trondheim	188 565	240 985	306 580
Oslo/Trondheim-Northern Norway	126 338	161 460	205 409
Oslo-Narvik	84 854	108 443	137 961
Oslo-Sweden/Denmark	213 455	272 794	347 049
Total	1 078 968	1 378 913	1 754 253

Note that the future situation could change in ways that will affect this forecast. For instance is it possible that Oslo looses its position as a hub for the Norwegian goods transport system (Pöyry 2002). Already today it is shortage in available capacity of both truck and railroad transportation, which will most likely lead to a significantly rise of transport costs in the near future. If the large logistical actors decide to cut costs by centralising and serve Norway by ship from ports in Holland or northern Germany, the demand for rail transportation will be reduced. This scenario is the main threat for further growth of combined transport on railroad. Any market shares trucks gains from the railroad because of lack of capacity could easily be re-taken when capacity is increased.

5.2 The future development in supply for goods transportation on railroads - The future strategy of the Norwegian rail administration

In their main strategy for goods transportation (Nilsen 2008), the Norwegian rail administration suggests to double the rail network capacity on the main lines in the period 2010-2019. This will mainly be achieved by increasing terminal capacity, constructing more and longer tracks where two trains can pass and building double tracks on the most heavily trafficked lines around the larger cities. The investments planned are estimated to cost between 2.185 and 4.725 million NOK. Within 2040, the strategy of the Norwegian rail administration is to triple the capacity. The improvement of the situation is shown in table 5.2.

Table 5.2. The strategy of future development of the combined train service, on various railway lines (Nilsen 2008)

Railway line	2006		Target 2019		Target 2040	
	Number of freight train each direction	Typical train length	Number of freight train each direction	Typical train length	Number of freight train each direction	Typical train length
Bergensbanen	7	390 m	10	600 m	14	600 m
Sørlandsbanen	5	376 m	7	600 m	10	600 m
Dovrebanen	10	425 m	15	600 m	20	600 m
Nordlandsbanen	4	425 m	6	600 m	8	600 m
Østfoldbanen	9	540 m	12	600 m	18	600 m

Based on today's combined transport service on rail in Norway, the capacity of various lines is estimated for 2019 in table 5.3.

Table 5.3. Estimated rail service in Norway in 2019, based on the time schedule from Cargonet and Table 5.2.

From	Via	To	Avg. train capacity (TEU)	Number of weekly trips	Theoretical yearly capacity TEU	Number of weekly return trips	Theoretical yearly capacity TEU
Oslo		Bergen	50	41	106 600	41	106 600
Drammen		Bergen	50	10	26 000	10	26 000
Oslo	Kristiansand	Stavanger	50	30	78 000	30	78 000
Drammen	Kristiansand	Stavanger	50	5	13 000	5	13 000
Oslo		Stavanger	50	1	2 600	1	2 600
Oslo		Åndalsnes	40	10	26 000	10	26 000
Oslo	All services	Trondheim	50	51	132 600	51	132 600
Oslo		Trondheim	50	31	80 600	31	80 600
Oslo	Trondheim	Mo i Rana	50	10	26 000	10	26 000
Oslo	Trondheim	Bodø/Fauske	50	10	26 000	10	26 000
Oslo		Bodø/Fauske	50	11	28 600	11	28 600
Oslo		Narvik	50	11	28 600	11	28 600
Oslo		Sweden/Denmark	50	43	111 800	43	111 800
Totalt			50	213	548 600	213	548 600
Theoretical capacity of the network in 2019:							1 097 200

Assumption: One more daily trip on a line equals five more trips a week in each direction.

Table 5.3 shows that the theoretical capacity of combined transport on the Norwegian rail network will increase by 63 percent in 2019 compared with the service offered in 2008, an average yearly growth of 5,7 percent, if the strategy of the Norwegian rail administration is carried out. This means that the planned network in 2019 is adequate to handle an average yearly growth in combined transport of 5,7 percent in the period from 2008 to 2020, which is roughly equivalent to the low growth alternative assumed by Econ.

5.3 A high-speed double tracked railroad.

A high-speed double tracked railway network in Norway will improve the capacity of goods transport on rails beyond the most optimistic growth forecast in demand. This will also give room for more actors in the combined transport segment, abolishing the monopoly of Cargonet. A more competitive combined transport market on rail is highly demanded by LTL. In addition, the transport times will also be significantly reduced. Besides the increased value for the customers, and the comparative advantage this makes for railroad transportation, this is also beneficial for the train operators. Today, Cargonet is operating with train loops of 24 hours intervals on most of the distances, which means that the loading operation, the transport leg and the unloading operation takes all together around 12 hours. This means that a freight train can only make one trip in each direction a day. If the loading, transport and unloading time are reduced from 12 to 8 hours, which could be possible with a high-speed rail network, a single freight train could make three trips every day. Other factors held constant, a high-speed rail network will increase the capacity of the rolling stock with as much as 50 percent, compared with a conventional rail network.

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Appendix 1

Tabell A1 Tonnes transported by rail. In 1 000 tonnes. (Jernbaneverket 2007)

Segment/Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Domestic traffic exc. pendulum service	5890	6300	766	597	848	1062	1053	1072
Cargonet	5890	6300	5894	4589	6433	7050	6871	6859
Domestic traffic, Cargonet pendulum			5128	3992	5597	6134	5978	5967
Cargonet System rail			766	597	836	917	893	892
Others*	0	0	0	0	12	145	160	180
Cross-border traffic	15745	14081	14534	16556	16738	17665	17771	18097
Cross-border traffic exc. iron ore	2069	1891	1760	2826	1559	1716	1846	1856
Cargonet	2069	1891	1760	2826	1048	1156	1348	1346
Iron Ore traffic, Ofotbanen	13676	12190	12774	13730	15179	15949	15925	16241
Others*					511	560	498	510
Total	21635	20381	15300	17152	17586	18726	18824	19168
*Information from Green Cargo and Hector Rail is not available for 2007								

Tabell A2 The development of transportation work in Norway. 1965-2007 (SSB 2008)

Transportmåte	**1965**	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2004**	**2005**	**2006**	**2007**
I alt	11 107	14 984	16 014	17 109	20 328	26 589	33 039	49 061	62 988	64 860	66 143	64 938
Fastlands-transport i alt	11 107	14 984	16 014	16 761	17 610	18 986	19 196	28 350	32 005	33 393	34 565	35 051
Sjøtransport	7 550	10 253	9 836	9 794	9 300	9 104	7 874	13 539	15 005	15 296	16 058	16 251
Bilferjeruter	57	105	166	223	244	273	223	353	361	368	365	376
Annen rutefart	902	970	912	932	794	107	135	.	.	.	.	.
Leietransport/ egentransport	6 591	9 178	8 758	8 639	8 262	8 724	7 516	13 186	14 644	14 928	15 693	15 875
Tømmerfløting	212	84	92	44	35	0	0	0	0	0	0	0
Jernbane-transport	1 160	1 448	1 508	1 657	1 771	1 632	1 647	1 775	2 017	2 208	2 374	2 467
CargoNet AS	1 147	1 441	1 505	1 654	1 768	1 630	1 647	1 775	2 013	2 203	2 356	2 444
Andre jernbaner	13	7	3	3	3	2	0	0	4	5	18	23
Veitransport	2 183	3 194	4 569	5 252	6 485	8 231	9 654	13 017	14 966	15 871	16 114	16 313
Rutebiler	151	232	344	645	669	..	..	..	..	..	..	..
Godsbiler	2 032	2 962	4 225	4 607	5 816	..	..	..	..	..	..	..
Lufttransport	2	5	9	14	19	19	21	19	17	18	18	19
Kontinental-sokkel	0	0	0	348	2 718	7 603	13 843	20 710	30 983	r31468	r31578	29 888
Oljetransport med skip	-	-	-	348	2 555	4 313	4 999	13 042	10 992	8 595	8 284	7 439
Oljetransport i rør	-	-	-	-	-	2 055	5 261	3 485	4 721	r4590	r4529	4 261
Gasstransport i rør	-	-	-	-	163	1 235	3 583	4 182	15 270	r18283	r18765	18 188