

**Freight transport as value adding activity:  
A case study of Norwegian fish transports**

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**Abstract**

The Norwegian fish industry has for some time been able to exploit efficient transport solutions and low transport costs. One consequence is an increasing quantity of Norwegian fish processed abroad. For instance, frozen Norwegian fish is transported at sea to China where the products are prepared for the market. These products are often transported back to European consumers. At the same time, we also know that growth in the fish farming industry will affect the volume and structure of future fresh fish transports in Norway.

The central issue in the paper is to investigate how infrastructure investments could add value to Norwegian fish production. This is done by analysing key performance indicators related to the transport activities, such as transport costs and transport time. By measuring these factors and investigating the logistic organisation of the Norwegian fish transports, we try to identify how transport costs and transport time affect the value added by the transport sector. The results indicate which investments (e.g. in road infrastructure or in developing technological solutions for sea transport) that will increase the value creation made by the fish transports.

**1. Introduction**

The demand for freight transport and the structure of global freight transport suppliers is changing rapidly. Increased globalisation leads to increased competition, restructuring and geographical specialisation.

In the fresh fish segment, markets are often characterised by global competition with a number of multinational players. The industry has gone through a number of structural changes during the last five years:

- Economies of scale have led to increased industrialisation, market power, stability of deliveries and reduced geographic risk.
- Vertical integration has resulted in improved logistics and product development.

- Better feeding and feeding technology, better salmon vaccines, routines and processes.

The increased efficiency and the higher production level in the sector leads to an increased use of road transports, and this will demand investments in road infrastructure. In Norway and in many other European countries, the authorities wish to transfer goods from road to sea due to capacity problems, congestion and pollution. Norwegian engineers are therefore trying to find technological solutions which allows faster fresh fish transports at sea.

The paper is based on results from the project “The competition in the Norwegian freight transport market,” financed by the Norwegian Ministry of Transport and Communications. As a case study, supply chains of Norwegian fish transports were examined. In section 2 the theoretical framework is presented. The research methodology is described in section 3. In section 4, 5 and 6 the distribution system of Norwegian fish transports is studied. Key performance indicators like transport rates, aggregated transport costs, transport times etc. are quantified. Some of these variables are compared with corresponding indicators for fish transports in Iceland and Scotland. Section 7 draws together the main conclusions.

## 2. Theoretical Framework

The definition of value creation varies a lot. Porter (1985) introduces *the value chain* as a basic tool when analysing the sources of competitive advantage. “The value chain disaggregates a firm into its strategically relevant activities in order to understand the behavior of costs and the existing and potential sources of differentiation.”

In figure 1 the company structure of a large salmon producer is visualised. This is an example of a typical value chain in the sector.

**Figure 1.** Value chain of a salmon producer.



A question is in which part of the value chain value should be created. Decreased value creation in the transport sector due to lower transport costs, may lead to opportunities for higher market shares and increased value creation in the other value chain activities.

The value of a product bought by a consumer is defined as the sum of the increased values each industry add to the product. Mathematically, the value a industry adds to a product is the value the product achieves after the value-adding activity, minus the use of services/products produced by other industries.

To gain competitive advantage over its rivals, a firm must deliver value to its customers through performing these activities more efficiently than its competitors,

or by performing the activities in a unique way that creates greater differentiation (Christopher, 1998).

More efficient solutions in the transport sector demands better performance in the so-called supply chain. Aitken (1998) define the supply chain as:

*A network of connected and interdependent organizations mutually and co-operatively working together to control manage and improve the flow of materials and information from suppliers to end users.*

In Handfield and Nichols (1999) the supply chain management is defined as: “The management of upstream and downstream relationships with suppliers and consumers to deliver superior customer value at less cost to the supply chain as a whole.”

Three key outcomes of success in the supply chain is better, faster and cheaper. These goals are significant because they combine customer-based measures of performance in terms of total quality with internal measures of resource and asset utilization. These activities are therefore the drivers for performance in logistics and supply chain management (Christopher, 1998).

Value adding time is often thought of as time spent doing something which creates value the customer is prepared to pay for. Both Christopher (1998) and Riggs and Robbins (1998) points at three key drivers for performance in the supply chain:

- Better quality/service
- Lower transport costs
- Faster transport time

Since logistics represents activities in the value chain, we will assume that better performance in the supply chain will also lead to increased value in the value chain. The increased performance in the supply chain might occur through:

**Lower costs:** Cost efficient solutions (as reduced costs through larger volumes, lower use of fuel, lower demand for labour force etc.) and lower external costs.

**Faster transport and higher transport quality:** Higher frequency, door-to-door transport and/or faster transports, flexibility (volum, departure time etc.) and perfect order achievement and ability to deliver.

Faster transports often leads to higher product prices, especially in fish markets. Better service as flexibility with respect to delivery times and the possibility for door-to-door transports will in some situations, when transporting fresh fish for instance, be necessary to deliver products of high quality.

### 3. Methodological framework

Based on the theoretical framework, we made an empirical analysis and studied differences in the key performance indicators in the supply chain. The results indicate the competitive performance of the value chain of Norwegian fish transports. We interviewed about 20 export companies and 10 transport companies about basic logistic organisation, markets and delivery times. Questions were mainly related to transport of fresh fish, but information about sea transport of frozen fish were also included in the survey. We discovered considerably uncertainty in the material. Differences in markets, products and production areas in Norway creates a rather complex picture of the transports. We therefore chose a qualitative evaluation of the results and compared them with other sources when possible.

Another task was to quantify the value created by Norwegian fish transports. In the project it was not realistic to estimate the annual value created by these transports, since such an exercise will include many other industries. However, we made calculations of the aggregated transport costs, and let these work as indicators of the value created by sea, road and air transport from the producing regions.

Finally, the study indicated how the markets would react to changes in the transport costs and the transport time. In chapter 7, recommended investments is based on these results.

#### 4. Distribution of Norwegian fish products

Norwegian seafood products are carried by road, sea or air transport. Because of longer transport time, sea transport is primarily used for frozen, dried or canned seafood. For fresh or chilled seafood, road or air transportation are the main alternatives.

Transport by road is the usual way to distribute fresh fish from Norway to the European continent. Fresh seafood is transported by air to remote destinations such as Asia and North America. Fish carried by plane is often transported via continental airports like Frankfurt and Amsterdam. For fish transported to the European market, railway from Northern Norway to Oslo and ferries from Southern Norway to Denmark and Great Britain is also often used.

Large volumes transported by fully loaded trucks is crucial for achieving low transport costs for fresh fish. The cost also increases when smaller quantities of seafood is transported to larger terminals.

Table 1 shows costs per kilo fish for transports to different markets. The rates are mainly based on door-to-door transports (full loaded trucks), but as table 2 shows (costs of extra services) the real prices may vary a lot.

**Table 1.** Estimates on transport costs and transport times for road transport of fresh fish to Europe.

	Transport costs (NOK per kilo fish)	Transport time (days)
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To	From Bergen	From Trondheim	From Nordland County	From Troms County	From Bergen	From Trondheim	From Nordland County	From Troms County
Oslo	0,45	0,40	0,90	1,30	0,5	0,5	1,0	1,5
Padborg	1,10	1,05	1,55	1,95	1,5	1,5	2,0	2,5
BeNeLux	1,40	1,35	1,85	2,25	2,0	2,0	2,5	3,0
Northern France	1,60	1,55	2,05	2,45	2,5	2,5	3,0	3,5
Madrid	2,30	2,25	2,75	3,15	3,5	3,5	4,0	4,5

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**Table 2.** Costs of different services

Service	Cost	In % of total transport cost	In % of export-price
Two drivers	+ 10 % on transport rate.	10 %	1 %
Transport of fish to terminal	Southern Norway: 0,15 to 0,40 NOK per kilo Northern Norway up to 1,00 NOK.	7-33 %	1-4%
Reloading	1000 - 2000 NOK per cargo.	5%	0,5%
Transport as general cargo	+ 40-70 % on transport rate.	40-70 %	4-7 %

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In addition to the road transport, typical rates for air transport to Japan and other countries in the Far East lies between 16 to 19 NOK per kilo fish. Costs for sea transports of frozen fish to Southern Europe are approximately 1 NOK per kilo fish.

When it comes to the location of the production area, the transport costs are higher for transports from Northern Norway compared to fish transports from Southern Norway. Transport time from Northern Norway is often 24 hours longer. In the negotiations with continental buyers in a market with large supply, this could force the seller to lower his price.

A reason why exporters with long transport distances can achieve high product value, is probably the adaptability of the farmers and the exporters. A way of delivering value to the costumers, is according to theory from chapter 2, to perform activities in a unique way that creates greater differentiation. Because of lower sea temperatures in Northern Norway the fish grows slower. This is sometimes used to differentiate between weight classes of farmed fish. This differentiation of products makes the price less sensitive to transport distances.

The annual total transport cost in the fish export sector in Norway is in the project estimated to approximately 500 million Euro. Sea transport is assumed to represent half of the aggregated transport costs, while most of the other costs are related to road/ferry or air transports. The large share of sea transports is explained by the fact that 71 per cent of the fish products is carried at sea. However, there are problems by calculating these costs, because the estimates are primarily based on border-crossing transports. When intermodal transports are used, considerable costs might occur when transporting the fish by road transport to ports.

## **5. Norwegian fish transports and the European market**

To measure the performance of transport companies carrying Norwegian fresh fish products, we compared the results from the study with indicators from similar transports from Scotland and Iceland.

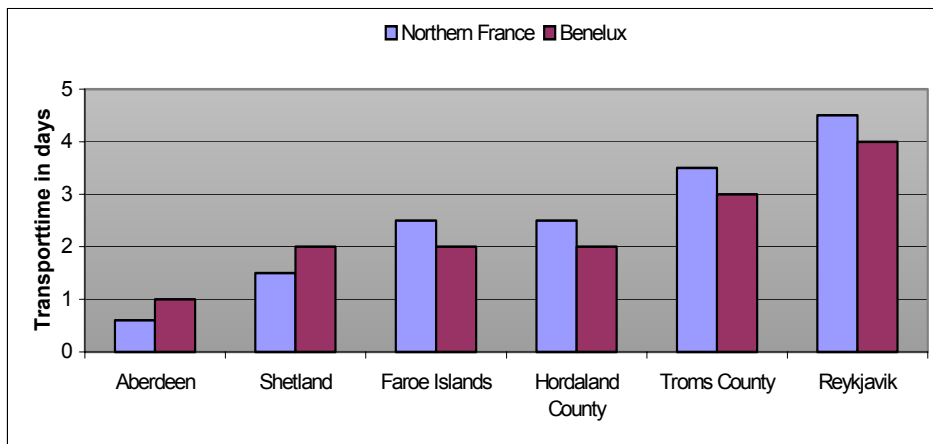
The logistics from the three exporting countries is rather different for the fresh fish transports. For Norway France, Japan and Denmark are important markets. From Norway the sea transports are largest in quantity, but considerable volumes of fish is transported by road. For fresh fish products, we find a large degree of preparation abroad, especially in Denmark.

For Iceland, Great Britain, USA and Germany are important markets. Sea and air transport is used for fresh fish transports to the European continent. As from Norway, there exist sea transports of frozen pelagic fish to Eastern Europe.

For Scotland, France is the most important market for fish products exported from the United Kingdom. Germany and Russia also represent important markets. Fresh fish from Scotland and England is often transported through the Eurochannel, which ensures fast deliveries, typically 10-15 hours to Boulogne. Great Britain is also a large consumer of fish products, and this reduces the export volume.

The geographical location of the production areas causes some of the differences between the three fish exporting countries. In figure 2, examples of transport times to Northern France and Benelux is visualised. We have assumed a combination of sea and road transport for fish products from Iceland and Faroe Islands.

**Figure 2.** Transport times for fresh fish from different production areas to Northern France and Benelux



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Fish from Scotland has a natural competitive advantage when it comes to transport times to important markets as Northern France and Benelux. However, some of the important areas for fish farming in Scotland lie on Shetland and the Hebrides. This causes a considerable longer transport time to the French market.

Our research shows only small differences in transport rates between Norway, Iceland and Scotland. However, a comparison of examples of rates could lead to wrong conclusions. For Reykjavik the rates includes sea transport, which implies lower transport rates. On the other hand, Scottish fish exporters focuses heavily on time expensive and time efficient deliveries to France, often directly to supermarkets.

Still, examples of transport costs show that Norwegian fresh fish transports to the European continent is cost efficient. Variations in transport costs could be of domestic reasons or caused by different logistics and product quality, rather than general differences in transport rates.

## 6. Time and cost sensitivity

According to the supply chain theory in chapter 2, improved performance through higher service quality, lower transport time and/or lower transport costs will improve the efficiency in the supply chain, and also increase the value creation in the value chain. As mentioned, frozen fish products are often shipped by sea transport, and the transport costs are therefore low. The low transport costs create opportunities for the companies to gain profit by transporting the fish to China, where the industry prepares the product for the market. This means that the fish often is transported from Norway to China and back to Europe. The time costs and

the need for flexibility is low for this type of transports. This means the potential for increased value creation in the value chain probably lies in the fresh fish transports. This is also the reason why considerable resources are used to develop faster transports at sea and to achieve reduced road transports.

A conclusion from the project is that Norwegian fresh fish transports is efficiently organised when it comes to costs and transport time. However, the analysis indicates that a higher level of value creation could be reached through faster transports of fresh fish.

If we assume the export price to represent 40% of the price to the consumer, the transport cost is a total of 5% of the final price. An increase of 20 % in the transport cost, will represent a 1 % increase in the consumer price. Table 3 shows scenarios resulting in similar conclusions.

**Table 3.** Increase in road transport costs compared to consumer price

Market	Increase in transport costs		Increase in transport costs in per cent of consumer price	
	in %	in NOK	in %	in %
<b>Northern France</b>	5 %	NOK 0,08	0,1 %	0,2 %
Transport cost:	20 %	NOK 0,32	0,3 %	0,6 %
Approx. 1,60 NOK per kg fish				
	50 %	NOK 0,80	0,8 %	1,6 %
<b>Madrid</b>	5 %	NOK 0,12	0,1 %	0,2 %
Transport cost:	20 %	NOK 0,46	0,5 %	0,9 %
Approx. 2,30 NOK per kg fish				
	50 %	NOK 1,15	1,2 %	2,3 %

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The significance of the variations in the transport costs seems low compared to value of time. It is difficult to estimate the time costs for fresh fish, but we know the price offered to the exporter often is reduced by 20-25 per cent after 2 days. The value could be reduced to zero after 4 days. This means that when the transport time exceeds certain limits, the value of the product could be reduced by 10 per cent or more measured against the price to consumer. This indicates that higher transport costs for these fish products will not reduce the volume of road transports significantly.

## 7. Conclusions and further work

- With the existing market structure for Norwegian fish, the results from the theory in chapter 2 combined with estimation of the key performance indicators transport time and transport costs, indicate that the potential for value creation

lies in faster transports. The results from the study also show that the road transports of fish from Norway already have an efficient logistic organisation. There are only small differences in transport costs between Scotland (road), Norway (road), and Iceland (sea/road) for fish products exported to Northern France.

- The calculations in the study show that an increase in the road transport costs must be large to transfer fish products from road to sea transport. An increase in the costs will first of all affect the export to distant markets as Southern Europe. However, closer markets as Denmark and France are today the most important markets for Norwegian fresh fish. At the same time, road transport has many advantages when it comes to flexibility. For instance, weather conditions will more often delay sea and railway transports than road transports. The flexibility is also useful when coordinating primary processing and time of delivery.
- The high time-sensitivity for the fresh products shows the importance of success in all activities of the value chain. A more efficient transport solution may improve the total output from all industries in the value chain. Since the road transports seem to be competitive and efficiently organised, faster transports may demand new technology such as specially constructed express boats. Therefore this transport solution represents a future potential for value creation in the Norwegian transport sector.
  - However, until this new technology is developed it will be important to maintain efficient road transports. Investing in road infrastructure from production areas to main ports could accelerate the process of transferring sea transports of fresh fish into economic profitable solutions.
  - The potential of added value by developing express routes at sea also points out directions for further work: A more detailed research, which draws the line between the production areas who benefit from such new technology-based transports and the areas where the producers will prefer road transport anyway, would be useful. The same type of research has to be done with a focus on the other end of the supply chain. Which markets are willingly to pay for these services ?

## REFERENCES:

Aitken, J. (1998):  
*Supply Chain Integration within the Context of a Supplier Association*  
Cranfield University, Ph. D. Thesis

Christopher, M. (1998):  
*Logistics and Supply Chain Management*  
London, Financial Times, Prentice Hall

Handfield, R. B. and Nichols E. L. Jr. (1999):  
*Introduction to Supply Chain Management*  
New Jersey, Prentice-Hall, Inc.

Larsen, I. K. (2003):  
*Fish transport as value adding activity*  
Oslo, Institute of Transport Economics, Report 651/2003  
(In Norwegian with English summary)

Porter, M. E. (1985):  
*Competitive advantage*  
New York, The Free Press

Riggs, D. A. and Robbins S.L. (1998):  
*The Executive's Guide to Supply Management Strategies*  
New York, AMACOM