INSTITUTION VERSUS TECHNOLOGY
THE HISTORY OF CAPACITY EXPANSION IN NORWEGIAN FISHERIES

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ABSTRACT

The introduction of modern trawl fishing in Norway after the Second World War was intended to be the very platform for the modernisation of the fishing industry. Right up to the end of the seventies, market orientation and the absence of state regulation of fishing were on the agenda. However, the growth of unprofitable overcapacity, increase of international fishing efforts in the Barents Sea and declining resources contributed to the introduction of licences and quotas as a means of control. From the mid-eighties the authorities have initiated a number of capacity-reducing measures. Even so, one can ascertain today that overcapacity, lack of profitability and allocation conflicts still characterise the trawler fleet. This article deals with the growth of the trawler fleet in Norway and elucidates why there is continuing overcapacity in the fleet. Based on these facts, the authorities have launched new and dramatic measures intended to reduce catch capacity. The question now is whether or not the authorities' new strategy will be the final solution for the problems of overcapacity in the trawler fleet.

Keywords: capacity expansion; technology; sustainable management Introduction

With its major efforts in trawl fishing in the Barents Sea after the Second World War, Norway intended once and for all to realise the market values which lay in the resource base. In the new project, the seasonal coastal fishing was defined as unprofitable. The introduction of trawling was intended to be the new solution for old problems and to ensure the growth of a profitable and modern onshore processing industry. In the broader context, trawl fishing was meant to be the backbone in the revival of North Norway after the War and a component in the modernisation of the fishing industry. The new strategy clearly referred to an increased focus on economic profitability and market orientation.

According to Mikalsen [1] however, official interference in the fishing industry is not of recent date and Hallenstvedt [2] describes the industry as a thoroughly regulated and politicised sector which exists on the borderline between regulation by both the market and officialdom. According to Lindblom [3] this development is referred to as a gradual approach from the use of market mechanisms to the increasingly stronger position of official regulation. Should we consider the fishing industry as an isolated segment of the rest of society, the increasing extent of official regulation will follow as a logical result of the need to control the capacity development in fishing as well as to share the limited fishing resources between all legitimate parties [4]. However, in a broader perspective it is claimed that the use of both market mechanisms and governmental management regulations, is closely linked to certain characteristics of the Norwegian society. In the extensive project "Maktutredningen" which was given the task of "…studying the real power situation in Norway in the seventies", society is described as "a negotiation society" or "mixed economy" by which industrial policy is formed through negotiations and compromises between the Government, industry and organisations [5]. In the negotiating society the Government is described as a corrective mechanism to the market

economy whereby the Government shall in part stimulate competition and cost-free transactions in the market, but also reduce the effects of competition when the market fails.

The extent and type of regulation have, however, changed both in character and content. Until the end of the seventies, trawl fishing was also affected by individual adjustments by which fishing resources were in fact the market for rational economic parties. The official standpoint showed a relative absence of regulation and the industry's main problem was linked to the conditions for technological efficiency and government support for industrialisation of the trade [6]. Today, or about 30 years after trawl fishing's liberal adaptation came to an end, one can, however, summarise the development by stating that overcapacity, lack of profitability and allocation conflicts are high on the agenda today. This development has occurred within the framework of a closed sector with quotas and licences and the steadily increasing extent of structural measures aimed at reducing overcapacity in the fleet.

The main purpose of this article is to illustrate the growth of the trawler fleet fishing cod in Norway and to show how the use of both market mechanisms and governmental regulations are expressed in regard to the political control of the fleet. This problem has become increasingly relevant because the Ministry of Fisheries [7] has recently granted permission to concentrate the quota basis on up to three trawls per vessel. This new measure is a dramatic initiative in terms of Norwegian administrative practice. In principle, this measure may lead to the number of vessels being reduced to 1/3 of today's level and this will have great effect on the structure of future fleets. The aim of the new structural measures, however, is identical to previous capacity reduction methods, i.e. to remove unprofitable overcapacity, strengthen profitability in the fleet as well as allowing for renewal of an ageing trawler fleet. At the same time, this measure indicates that a considerable proportion of the potential resource interest is capitalised in the form of overcapacity in the fleet. This contributes to a reduction in profits so that resource interest is to a lesser extent realised in the trawler fleet.

This time various parties have expressed the view that the new structure will be the "final solution" for all problems in the trawler fleet [8]. At the same time, there is good reason to claim that there has been a series of structure systems since the seventies which should have solved the problems in the fleet. However, the results have been lacking in some cases and in others the aggregate effects of the systems have had substantial side effects [9].

With reference to the fact that this new structure has been developed in the borderline between market and administration and that the parties in the industry have acted within this frameworks, we would like to take a closer look at some of the future effects of the system. Will the parties make use of the new system and what will be the extent of the structural changes in the trawler fleet ? Are there similar prerequisites between the parties in the trawler fleet to make use of the official resolution and will it lead to increased or reduced catch capacity even though the number of vessels is reduced? In short, with experience from previous initiatives, we would like to discuss whether or not the new structural system is the "final solution" for the trawler fleet or whether the results deviate from the aims of the new strategy.

1.0 Background for the growth of the trawler fleet

Ever since the introduction of modern trawling in the fifties and sixties, most of the people who are engaged in fishing matters have expressed strong points of view on trawl fishing in terms of the Norwegian fishing industry. To a certain extent it is emphasised as the very symbol of the most modern and efficient fishing of our times [10]whilst another point of view emphasises the adaptation to capital-intensive and industrial large-scale industry which threatens fish resources and the position of traditional outlying districts [11]. The strong points of view on trawl fishing are also the background for the claim that the fishing industry is particularly susceptible to a series of internal conflicts in distribution. In the first instance, this refers to basic conflict questions such as the division of limited fish resources between coastal-and ocean fishing fleets and between different geographical regions. The question of trawl fishing's place in the Norwegian fishing industry has been a continuous area of conflict, but has nonetheless had differing status as far as the modernisation of the post-war fishing industry is concerned [12]. Even though the introduction of trawl fishing was launched in the thirties with large-scale conflicts between the coastal fishermen and the new industrial participants in fishing, it was not until after the Second World War that this featured on the agenda in the political fishing debate. After the Germans burnt down North Norway in 1945, it was clear that the rebuilding of this part of the country should also be a step in the considerable modernisation process of the fishing industry. A large-scale industrialisation of the fishing trade was put on the agenda through a series of official reports and plans [13]. The conclusion was that they should direct their efforts to building up a vertically-integrated industrial business with land-based production of frozen fillet for an assumed unlimited export market in Europe. During the sixties a series of industrial plants were built along the coast of North Norway intended to ensure the modernisation of the region and contribute to employment for the region which was most dependent upon fishing. However, a basic prerequisite for making inroads into the large market potential for frozen fillet and realising the economies of scale of large-scale operation for industrial fillet production, was the assumption of a stable supply of raw materials throughout the year. Based on this, there arose a demand for the building of a modern trawler fleet which should contribute to stable supplies and realise the industrialisation of a trade which otherwise was characterised by season-based coastal fishing [1].

The strong expansion in trawl fishing continued throughout the seventies with total cod catches of about 1 million tons per annum. However, the growth in catch rates stagnated at the end of the seventies. In spite of the reduction in catch quantities, the catch rate continued and lead to a considerable reduction in the cod stock. The trawler fleet which delivered raw materials to the fishing industry experienced a considerable loss in catch income and the need for governmental subsidy of operations. This negative development also had consequences for fishing policy. Norway established the 200 mile economic zone in 1977, fishing with floating trawl was forbidden the same year and licences, total quotas and vessel quotas were introduced over a short period of time. The Government's long-term plan for the fishing industry expressed for the first time the formulation that catch capacity should be adapted to the resource basis [16]. This meant in practice freezing the number of trawlers as well as a proposal for the reduction of the factory trawler fleet which produced fillets on board.

As a result, twenty years of optimism in the development of the trawler industry, as a result, turned to pessimism. The coastal fleet was again the subject of positive attention in fishing policy. A fishing policy epoch in which the technical/economical rationale had contributed to the fishing policy from the first post-war year, thus came to an end. A resource crisis and understanding of the crisis were needed in order for the coastal fleet to once again come into focus as the basic element in the Norwegian fishing industry. The ecological pre-conditions for the structure in the catch element and choice of technology seemed to be a new problem in fishing policy, moreover a standpoint which the coastal fishermen had argued for since the debate on trawl fishing started after the war.

2.1. Unit quota system as a structural measure

In a unit quota system one can, under certain conditions, accumulate quotas from several vessels for fishing with one single vessel. A precondition is that the vessel withdraws from fishing to reduce the number of vessels in the fleet. The purpose of the unit quota system is to adjust the catch capacity to the resource basis and thereby achieve a better operating basis for the remaining vessels.

Following the reduction in the resource basis and the following economic deficit in the trawler fleet, the Directorate of Fisheries introduced the unit quota system for the group of fresh fish/freezer trawlers for the first time in 1984. The system was extended to include the entire trawler fleet following a new reduction in the cod stock in 1990. A new system came into effect in 1997 and was renewed again in the year 2000.

However, there have occurred important changes in relation to the unit quota systems which were operative to the end of the nineties. The duration of the system was extended from 13 to 18 years should the selected vessel be condemned. For those who chose to make use of the unit quota system, this would mean that after 13 or 18 years, the quota advantage which was bought at market price would cease and the quota would be divided out equally between all the participants in the relevant group (for example the factory trawler group). Parallel to this, a unification system was established for small trawlers with unlimited duration. The original system had also an upper limit for how many unit quota systems could be concentrated per vessel and per owner. The first system did not allow more than 1.5 unit quotas for a small trawler and 2.0 unit quotas for a large trawler. When the effects of the system were marginal in relation to the aim of reducing catch capacity, the system from 2000 was extended so that it was possible to concentrate up to 3.0 quotas for a large trawler and 2.5 quotas per small trawler. Steps were taken to avoid undesirable fishing political effects of the unit quota system whereby, for example, vessels within the category factory trawlers strengthened their quota basis at the expense of the quota basis of the small trawler category. The unit quota system from 2000 was divided into three separate “markets”, small trawlers, fresh fish/ freezing trawlers and factory trawlers. In addition it was decided that one single participant should not be able to own more than a maximum of 9 quotas. [21].

Should we consider in isolation the development in the number of vessels, then it is possible to claim that the authorities' structural measures to reduce the catch capacity has had a positive effect, in particular on the group of small trawlers. However, this is not the case for the trawler fleet as a whole. The use of the structural system is as good as non-existent for freezer trawlers and factory trawlers and, if anything, the catch capacity has increased even though the number of vessels has been reduced. The considerable increase in catch capacity is attributable in the first instance to the considerable technical upgrading of older vessels as well as a substantial renewal of a number of combined cod and shrimp trawlers. In this process, new vessels are constructed with far greater technical catch capacity than the previous generation of vessels. The most noticeable change is that double and triple trawls are taken into use for shrimp fishing and that this technology is also adopted for cod trawling [22][1]. This development clearly illustrates the dynamics in technological terms in that catch capacity per metre length today is much greater than for vessels built in the seventies and eighties. Based on this, one can conclude that the increase in catch capacity by means of the new technology through renewal of the fleet and technical upgrading of older vessels, has far overshadowed the effect of the reduction in the number of vessels through the unit quota system.

In order to illustrate overcapacity, we can find examples of vessels which fish double quotas in nearly 170 catch days [23]. For trawlers which only have 1.0 trawl quota, the number of catch days is reduced even more. However, in this part of the fleet, there is deliberate inefficient fishing in order that the crews can obtain sufficient catch days in order to meet the conditions to qualify for Page B in the register of fishermen (year-round fishermen). Again this forms the basis for reducing the gross catch income by NOK 80,000 which gives a tax benefit for fishermen and hunters in Norway [24]. The situation in the trawler fleet with a quota basis which barely forms the foundation for a half-yearly use of vessels, is also a good indicator that income has been far too poor and has not given the basis for sufficient renewal of the fleet. For example, statistics from the annual analysis of the operation of the fishing fleet shows that the average age of fresh fish and freezer trawlers is 20.47 years, 38.55 years for vessels in the small trawler group whilst it is 14.44 years for factory trawlers [25].

4.1 What will be the effects of the new structural system?

There is great interest on the part of both the industry and the authorities as to the effects of the new structural measures. To be more precise, it will be a question of how many vessels are taken out of fishing and to what extent the quotas will be concentrated on fewer vessels. To be more precise an important issue will be to study the extent of old vessels being taken out of fishing and replaced with new vessels which have far greater catch capacity.

To indicate something about the future effects of the new structural measures, it might be of interest to deal more closely with some aspects of the division of ownership in the trawler fleet as well as the status of the vessels which it is most relevant to take out of fishing. Thus we can

[1] Analyses of the technical capacity development of combined cod- and shrimp trawlers, indicate that trawlers over 50 metres have increased their catch capacity by 50% in the period 1988-2003 [26].

give an indication of which type of participant can be thought to make best use of the new structural system.

From the nineties to date, there have been considerable changes as far as ownership of the Norwegian trawler fleet is concerned. A considerable number of vessels and licenses is concentrated on steadily fewer participants. The Aker Seafoods company has a special position in this development as they control about 30 trawling licenses. In addition Ytre Rolløya group controls 7 vessels whilst about 7 other companies own 2-5 vessels each. The remaining vessels are divided between ship owners who have one vessel each[2]. With reference to the division of ownership in the Norwegian trawler fleet, we can characterise the trawler fleet as having one large company, 7-8 medium-sized companies while the rest consists of typical small companies in the form of one vessel per ship owner. To a great extent Aker Seafood has at its disposal a number of smaller trawlers which were built in the seventies.

The next approach can be to set up a summary of the vessels' average length divided by the age of the trawler fleet as well calculating the average capacity factor for the trawler fleet.[3] We can assume that the smallest and oldest vessels will be the most likely for scrapping to the advantage of new vessels. In this way, the age and the size of the vessels will indicate something of the extent of the vessels withdrawn from fishing and thus future structural changes in the fleet.

Table 1

Number of cod trawlers distributed by building year, average length (m) and average capacity factor for vessels above 40 metres, per 2004.

Year:	**1965-69**	**70-74**	**75-79**	**80-84**	**85-89**	**90-94**	**95-99**	**00-04**	**1965-2004**
Number:	4	15	9	1	19	2	8	12	71
Average length (m):	54	46	49	51	57	50	50	56	52
Average cap.factor pr. vessel:	1.6	1.4	1.5	2.0	3.1	2.7	2.8	3.9	2.5

Source: [30].

[2] Information on ownership is based on the companies' own home pages on the Internet, the Norwegian Illustrated Vessel Directory [29] (2004) plus the Directorate of Fisheries register of fishing vessels and licenses [30].

[3] Calculation of the technical catch capacity at the vessel level:

$$\text{Capacity factor (C)} = \frac{\text{length} \times \text{width} \times 0.30 \times \text{BRT} \times 0.3 + \text{HP} \times 0.3 \times \text{tool factor}}{500}$$

The 0.3 factors are an internal division of the different parameters and 500 is used to obtain manageable figure values in table form. The tool factor refers to the size of the trawl opening's catch area.

Statistics show that new cod trawlers have been built in Norway in the periods 1970-79, 1985-89 and 1995-2004[4]. As much as 34% of the trawler fleet measuring over 40 metres consists of more than 30 year-old vessels built in the period 1970-79. The vessels have an average capacity factor of 1.4-1.5 and the group is dominated by vessels of about 46 metres in length. The factory ship fleet was renewed in the period 1985-89. The average length of the vessels increased to 57 metres, whilst the average capacity factor at the vessel level increased to 3.1. The fleet renewal after 1995 shows very little change in the length of the vessels compared to the period 1985-89. Nevertheless, we can see that the capacity factors at the vessel level increased from 3.1 to 3.9. This development refers to the fact that an increasing number of vessels use double trawl for fishing and that this is made possible as a result of greater breadth in relation to the length of the vessels, increased gross tonnage (BRT) for larger storage and more powerful engines for fishing with increasingly large trawl use.

As an input to the dimensioning of future trawlers which will replace the old vessels no longer used for fishing, it is relevant to take a starting point on the quota basis allowed by the structural system. Were we to take a starting point on the quota basis for large trawlers (quota factor 1.0) for 2004, we would come to the following catch basis:

Table 2
Quota (tons) for cod-trawlers with quota-factor 1.0, 2004.

Species		Factory trawler	freshfish-/freezing trawl (hg)
Cod	:	716	716
Haddock	:	319	319
Saithe nord of 62N:		663	502
Saithe south of 62N:		1400	1000 .
Total (tons):		3098	2537 .

Source: [19].

This table shows identical catch bases for factory trawlers and freezer trawlers in the case of cod and haddock. However, factory trawlers have a larger quota of saithe north and south of 62N[5]. With a quota factor of 1.0 this will give a collective quota basis of 3,098 tons for a factory trawler and 2,537 for a fresh fish/freezer trawler. Based on the quota basis for 2004 and the new structural system this will give a catch basis of about 6,200 round tons weight per vessel and an estimated gross catch income of about NOK 60 millions[6]. The new quota basis is an important input for the future dimensioning of new vessels:

[4] For the period 1995 – 2004 the renewal of the fleet is almost exclusively limited to vessels which operate combined cod and shrimp trawling.
[5] The fact that factory trawlers have larger quotas of saithe, refers to the fact that the group has caught larger quantities of saithe than the fresh fish -/freezer trawlers [20].
[6] The new structrural system does not form the basis for an increased quota for saithe south of 62 N, but can be tripled north of 62 N.

Table 3
Technical parameters and capacity factor for different vessels [7].

Name vessel:	Varak	Persfjord	Kasfjord	Vesttind
Building year:	1974	1971	1974	2002
Price (mill NOK)				180
Length (m):	46.54	46.54	45.41	70.10
Breadth (m):	8.95	9.02	9.23	14.60
GRT:	548	548	527	2846
HP:	1500	1500	2240	8046
No. trawl:	1	1	1	2-3
Production :	fresh/hg	fresh/hg	fresh/hg	shrimp/freezing cod (hg)
Crew:	14	14	14	20
Cap. factor:	1.3	1.3	1.7	6.2

Source: [30].

The three trawlers which were built in the seventies, are all typical for their time and represent the classical fresh fish/freezer trawlers which supply untreated catches for land-based processing. The vessels are about 47 metres long and 9 metres broad with a main engine of about 1,500 HP. The vessels were equipped with one set of sweeping winches and horseshoe on the trawling deck for handling of only one trawl equipment during fishing. The latest generation of trawlers is here represented by M/Tr Vesttind. This vessel was built almost 30 years later and is among the newest and largest trawlers in Norway. Its length is as much as 70 metres with a breadth of almost 15 metres. Its high capacity is clearly expressed with a gross tonnage (GRT) of as much as 2,846 tons. The vessel has a main engine of 8,046 HP and uses a double trawl for fishing for cod and other white fish as well as a triple trawl for shrimp fishing. The construction cost in 2002 was about NOK 170 millions.

Should new vessels be built with both catch- and production capacity to handle 3 quotas on board or more than 6,000 tons annually (see Table 2), then the categories of factory trawlers, combined factory trawlers/shrimp trawlers and whole fish freezer trawlers/shrimp trawlers will have the most space-consuming production categories on board. In addition, all the catch is frozen on board and the vessels are therefore not limited by weekly deliveries of raw materials. From the industrial point of view a vessel is required of about 70 metres long and 15 metres broad in order to meet the demands of sufficient production capacity combined with a flexible adaptability between fillet production/whole-fish freezing and sorting of catch as well as a production line for treatment of shrimp[8].

However, according to the regulations for permission to operate trawl fishing in the zone between 4 and 12 nautical miles from the base line outside the Norwegian mainland [31], the

[7] Calculations of capacity factor for the vessels, ref. footnote No. 4. Source of the vessels' technical data is Norsk Illustrert Skipsliste [30]
[8] A vessel of such a size, corresponds to a gross tonnage (GRT) of about 2,800 tons.

size of such a vessel has a gross tonnage which will limit the vessel to fishing outside 12 nautical miles. The regulations are formed in such a way that if the vessel has a gross tonnage which is over 1,200 gross tons according to the 1969 Convention size limitations[9], the vessel has to be outside the 12-mile zone. However, should the vessel have a gross tonnage between 700 and 1,200 tons, then the vessel can fish as far as the 6-mile zone whilst vessels under 700 gross tons can fish as far as the 4-mile zone [24].

For participants who have a larger vertically-integrated industry and which concentrate on land-based processing of fresh fish, for example, then it will be decisive to have vessels which can fish as close to land as possible or have a gross tonnage which is under 700 GRT. The rules related to tonnage thus have decisive influence on the choice of a vessel's size. Vessels have been specially built which satisfy the need to fish up to 4 nautical miles in accordance with the IMO's measurement regulations (the 1969 convention) and the requirement to fish within 4 nautical miles from the baseline:

Table 4

Technical parameters for old and new cod trawlers with gross tonnage lower than 700 GRT.

	Name		
vessel:	Varak	Persfjord	Broegg
Building year:	1974	1971	2001
Price (mill. NOK):			80
Length (m):	46.54	46.54	39.99
Breadth (m):	8.95	9.02	10.50
GRT:	548	548	681
HP:	1500	1500	2500
No. trawl	1	1	1-2
Production	fresh/hg	fresh/hg	fresh/hg
Kap. faktor:	1.3	1.3	1.9

Kilde: [30].

A comparison between old and new trawlers which can fish within 4 nautical miles, shows that there have been considerable changes as to design and technical capabilities. In the first instance we can see that newer vessels are considerably broader in relation to length whilst the main engine shows a considerable increase in HP. This development shows that the vessels' catch capacity per metre length increases even though the newest vessels in isolation are shorter than the previous generation. In addition the new vessels have a length/breadth relationship and main engine capacity to allow an extra winch arrangement on the trawl deck for fishing with a double trawl. Should a double trawl be installed, the catch capacity will increase beyond the calculations in Table 4.

However, should several old vessels be replaced by new vessels which can fish up to 4 nautical miles, then we can see that even vessels 40 metres long, would have difficulty in achieving

[9] The 1947 – and 1969 Convention presents the International Maritime Organization's (IMO) different measuring regulations for gross tonnage.

sufficient catch- and processing ability to fish up to 3 quotas or about 6,000 tons per annum. The particular difficulty in obtaining processing capacity as a result of limited space on the factory deck, would be a bottleneck in relation to the catch capacity which is achieved by use of a double trawl. In addition, vessels will have to stop fishing after 7-9 days in order to deliver the fresh fish to land. Should the participants choose to replace old vessels with new vessels which can fish up to 4 nautical miles, then it would be most realistic to assume that the two new vessels would replace two old vessels. Thus analysis of the technical capacity development in Table 6 shows that if two older vessels with a total capacity of 2.6 are replaced with one new vessel with an estimated capacity factor of 1.9 then the structural measures contribute to a reduction of the catch capacity.

The above analyses show that the participants' strategic choice of new vessels to replace old tonnage can lead to both an increase and a reduction of catch capacity. At the same time, widespread changes are built into the new structural measures whereby the quota basis from up to three vessels can now be concentrated on one vessel or that 30 vessels are replaced by a minimum of 10 units. In addition, it is apparent that the new structural measures also form the basis for a longed-for fleet renewal through an increased catch basis and gross catch income for the remaining units.

With the extensive structural benefits which are built into new structural measures, it is clear that the system can potentially rationalise a large number of vessels in the trawler fleet.

The new structural system will most probably lead to broad structural changes in the trawler fleet. On the other hand, it is uncertain as to whether the structural system will contribute to the realisation of the political aim of reducing the catch capacity. The analyses in Tables 3 and 4 show that the choice of the type of new vessels can contribute to both increased or reduced catch capacity. A number of studies of capacity development in other sectors of the Norwegian fishing industry, however, indicates that catch capacity increases even though the number of vessels is reduced [33] [9], [22], [34]. Even though this will also be the effect of the new structural system, the new measure does not represent "the final solution" for the capacity problems in the fleet, but it does contribute to the redistribution of fish resources. In such a case, new rounds of future structural measures will be required, with an additional reduction in the number of vessels and even greater concentration of fishing rights.

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