Nylon fever:
Technological Innovation, Diffusion and Control in Norwegian Fisheries during the 1950s

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Abstract The main issue in this paper is the change from natural to synthetic fibre in the Norwegian fisheries during the 1950s. The focus is on the innovation process and changes in net fishing. Early in the 1950s, the State and the private fishermen conducted parallel fishing tests especially for cod with synthetic fibre nets. The fishermen's tests showed an increase in catches which were measured up to 400% compared with natural fibre nets, while the State was a more reluctant supporter of the new materials. Early on in the development of synthetic fibre, the big multinational companies like Du Pont and I G Farben pushed the market based on the great demand for synthetic fibre nets. An important question is whether this transition was fast or slow. The statistics for all fishing gear show that it was really slow, but is that the whole story?

Introduction

Hemp was almost the only material used for fishing nets until 1900 when it found competition in the form of cotton especially in herring nets. But in the early 1950s, hemp and cotton were still the preferred material in cod nets. This changed dramatically changed during the course of the 1950s and we witnessed a kind of change in fishery with the introduction of polyamide (nylon) which in many ways can be described as a fever. The Norwegian factories producing fishing nets found the new material difficult to handle because it was much more slippery than hemp and cotton. The new material required new and enforced knots to function. This made it difficult to produce nets on the old machines and the first nets sold to the fishermen in the early 1950s were of poor quality. This was an example of how multinational companies had an impact on the Norwegian producers of synthetic fibre nets at an early stage of their introduction in the fisheries in the 1950s. Who was pushing to get the fishermen to use polyamide nets? The demand for polyamide cod nets from the fishermen was bigger and grew faster than the producer's ability to improve the technology. This was one of the reasons why the nylon thread in the first fishing nets was not fully developed. We will look at the diffusion of the new material from its introduction in 1948 and how it developed during the 1950s. I will try to explain the conversion to synthetic fibre through the theories of C. Freeman and J. A. Schumpeter, but I will also focus on the fisherman as

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an active actor in the changes. I have not focused on a broad presentation of the theoretical perspectives in this paper since the paper of *Morten Karnøe Søndergaard* provides a good overview of theories on innovation processes.

In my opinion, the fisherman with his practical knowledge about fishing gear and different kinds of fishery played an important role in the conversion. We will see whether this is true in this process. The introduction of synthetic fibres in fishing gear from around 1950 changed a way of using natural materials that goes back several thousands of years. A new material conquered the hegemony in net fishing.

Historical Background

The use of natural fibre nets has a long tradition all over the world. In our part of the world, it goes back to the salmon and herring fisheries from the Viking Age and the medieval period, where they used seines both along the Norwegian coast and the coast of Bohuslän (Sweden).[1] New archaeological findings from the Czech Republic show a print in clay of an ordinary knot used in natural fibre nets. This print is between 25,000 and 27,000 years old.[2] This knot was commonly used in natural fibre nets in the 1950s and the 1960s and it was also used in nets made of synthetic fibre with different enforcements. In the traditional cod fisheries, we know that natural fibre nets were used from the 17th century. Before this time, the cod was caught with hand lines.[3] This method was still used in the 1950s. Lines and cod nets were most probably introduced in the cod fisheries in Norway in the 16th and the 17th centuries and used alongside long lines.[4] There was great opposition to this new fishing gear both in Lofoten and other fishing communities along the coast.[5] The nets were expensive and required bigger boats and only a few fishermen could afford to invest in such gear.[6] Hemp was almost the only material for fishing gear until 1900 when it found competition from cotton. Until the 1950s, cotton had totally conquered the hegemony in fishing nets for herring and seines. But still in the early 1950s, hemp and cotton were the preferred material in cod nets. It took some time for this innovation to break through in the cod fisheries. In the seasonal fisheries for cod in Lofoten some fishermen actually started to use cotton cod nets in 1935.[7] However we still find more hemp nets than cotton nets for cod fishing until 1950.[8]

This gives us reason to believe that, when it comes to natural fibre, there was a changeover from hemp to cotton at the same time as the introduction of synthetic fibre around 1950. We can look at cotton as a technical material improvement innovation compared with hemp, which amongst other things was heavier than cotton when wet. The diffusion of cotton as a new material in cod nets developed very slowly and it took almost 50 years from 1900 to 1950 before it made any real changes in the cod fishery. During the 1950s, theses changes and new synthetic fibres were introduced and got the hegemony in net fishing, especially for cod. There was a continuing conversion from natural to synthetic fibres to other types of fishing nets like saithe nets and also other fishing gear such as lines, ropes, etc. The conversion proceeded quite fast compared with cotton and started with government tests with synthetic fibre in fishing gear shortly before 1950. Tests with synthetic fibre in cod nets were carried out just after 1950. We will study the

time span for the acceptance of synthetic fibre in net fishing. Who was pushing to get the fishermen to use nets made of the new synthetic fibre? Did the fishermen play an active role in the conversion? The fishermen seemed to be willing to invest in new gear, even if they already had hemp and cotton nets. Such investments led to rising costs for the fisherman and we will look at how this was solved by the different actors. The State Fishing Gear import (Statens fiskeredskapsimport, from now on called SF) claimed that nylon (polyamide) in fishing gear first came into serious use in 1954.[9] At this time both nets and thread made of nylon were imported on a private basis.

The study in this paper is mainly concerned with the period between 1948 and 1960. This was the first phase in the conversion from natural to synthetic fibre in fishing gear in Norway, especially in cod nets. 1948 was the first year in which tests were performed with synthetic fibre in fishing gear and in 1960 the synthetic fibre for fishing gear were subsidised by the government. We will also shed some light on the conversion from natural to synthetic fibre to other types of fishing gear from 1960 and later as a comparison to what happened in net fishing during the 1950s.

Innovation and Diffusion

In the study, the terms *innovation* and *diffusion (spreading)* will be essential to explain the development in the period. The term innovation has been particularly attached to theories about production development and the introduction of new technology in working life.[10] The development of new products has been the main focus in economic studies, as it has been described in various historical studies during the 1970s and 1980s.[11] The reason for this was mainly the renewed interest in Josef Schumpeter's economic theories. He claimed, amongst other things, that waves in industrial innovations were the source and basis for economic growth.[12]

Innovation and diffusion of new products often starts with the science and technology push by scientists and inventors to create new markets for the materials they have developed. Consumers in the market will then request or demand new innovations (demand-pull) as a result of the pressure from the scientist.[13] Chris Freeman looks at these aspects of innovation processes as closely knitted together and he is more concerned with the connection between them (science push and demand pull) and the continuous changes that occur in technology and the market due to the diffusion of new products.[14] In my opinion, the fishermen play an active role in this as users of new technology and they give their feedback to the producers if the devices do not work, thus creating new innovations. They also conducted their own tests with nylon nets as we will see later on.

When it comes to synthetic fibre in fishing gear, we can view the introduction of nylon (polyamide) as an innovation of technical material improvement in the same way as the conversion from hemp to cotton. Actually the basic innovation was the development of nylon as a new material and the ongoing improvements of this innovation. The demand (market) for nylon thread to produce fishing nets was bigger and grew faster than the producers' ability to follow up with new innovations in the 1950s. This led to a lag in the development of the new products presented

in the market mainly because the nylon thread was not fully developed for nets. It took quite a time before the existing fishing gear industry in Norway adapted its production lines to the new material. The new synthetic materials came as a result of prolonged scientific research and development by the large chemical concerns like Du Pont in the USA and I. G. Farben in Germany.[15]

Innovation can be defined as alternative use of existing resources or coordination of resources in new ways.[16] In the fisheries in the 1950s this appeared, for example, as a conversion to new raw materials (cotton and nylon). At the same time the fishing gear factories changed their production and adapted their machines to synthetic fibre. With the establishment of the State Fishing Gear Import (SF) in 1953, the fishing gear industry was monopolized by the Norwegian government.

Nylon Fever and the Diffusion of Nylon

Studying various articles in the local newspaper in Lofoten (Lofotposten) during the 1950s, I have discovered a picture of the first diffusion of nylon in net fishing. It gives us a clear picture of the conversion as it was experienced by the fishermen and the local community. This quotation from January 1956 shows that the conversion from natural to synthetic fibre was proceeding apace:

> The nylon fever is stronger than ever and everybody is gambling on nets and lines of nylon thread. The nylon fever has spread more than ever before, and experts reckon that the need for new nylon nets this year will exceed 70,000 to 80,000.[17] (Author's translation)

This description of the demand for the new material as feverish gives us the impression that nylon was much sought-after by the fishermen. They were almost desperate to get hold of this new wonder material. This is further underlined later in the same article where it describes the nylon nets as superior to hemp and cotton in terms of the number of catches. It also referred to good operating results for nylon nets and lines for 1955. It was also claimed that the number of boats fishing with nets would double in 1956.[18]

It is obvious that the new material created high expectations and attracted more fishermen. The official fishery statistics show an increase in the number of net boats during the fishery in Lofoten from 593 in 1955 to 1072 in 1956, and the number of fishermen increased from 3725 to 6273.[19] The local newspaper continued to publish new stories about great catches on nylon nets during the rest of the season. These stories were read and familiar to most of the fishermen and therefore strengthened demand for and expectations regarding the new material.

> 600 spawning cods on 8 nylon nets. {.....}They could not get up the rest of the nets in the chain as they had been torn off {.....}. The spawning cod stood as herring in the meshes.[20] (Author's translation)

This is just one example of how the newspaper described the situation and contributed to creating a feverish atmosphere with regard to the new material. At the same

time, we see protests from the fishermen and other parties against nylon. It was claimed that nylon nets reduced the quality of the fish compared with hemp and cotton nets. Some fishermen had received poor quality nylon nets.[21] Ultimately, this was debated and proposed as an issue by a Norwegian politician and the question was whether the State would do anything to get control over the import of synthetic fibre for fishing gear or not. This most certainly led to the SF taking over control of the import of synthetic fibre for fishing gear on 1 May 1956.[22] The State had thus introduced a monopoly on synthetic fibre for fishing gear.

The price of nylon nets was high at this moment, costing more than twice as much as traditional hemp and cotton nets. For many of the fishermen, poor quality of the nylon nets could lead to financial ruin. Since 1955, the fishermen's organisations had raised the issue of subsidising nylon gear.[23] Natural fibre nets were subsidised by 20% at this time.[24] In 1955, the Ministry of Fisheries recommended a loan arrangement for nylon fishing gear as a result of the pressure from the fishermen's professional organisations. One of the organisations (Norges Fiskarlag) proposed lowering the prices of nylon gear by autumn 1953 but this was not successful.[25]

It seems as if there was a total conversion of net fishing during the 1950s. Who were the actors who made it possible to start using this new synthetic material in net fishing? Initially, the results with nylon nets were not entirely positive and there was resistance and scepticism towards the new material from both fishermen and producers of fishing nets. Higher efficiency in net fishing and higher catches using synthetic fibre nets were some of the factors that encouraged the fishermen to invest in synthetic fibre nets. We must remember that they were willing to do so even though they were already fully equipped with natural fibre nets. We will shed some light on government and private fishing tests of synthetic fibre before 1956. It will be interesting to see when nylon nets were introduced and when they experienced their breakthrough in Lofoten during the 1950s.

Early Tests with Synthetic Fibre

The Norwegian Fishery Directorate had already started tests with synthetic fibre in 1948. This was ten years after Du Pont developed the new polyamide (nylon) material after many years of research and development in their laboratories.[26]

Norway started its tests with synthetic fibre in fishing gear as early as other comparable fishery nations. The first nylon fishing nets emerged in Japan in 1949.[27] Japan, the largest fishery nation in the world, performed their first tests with nylon in trawls in 1950.[28] From Hull in England, there are examples of producers of synthetic fibre who had already joined forces with the fishermen in 1949 to test the characteristics of synthetic fibre in fishing gear. Numerous tests were conducted with trawls made of synthetic fibre (terylene/polyester) which created quite a stir. The tests were initiated by Imperial Chemical Industries (I.C.I.) in England to try out probable markets for synthetic fibre, especially terylene/polyester. Reports showed that polyester had great resistance against wear and tear and that the strength was twice that of manila and sisal. Polyester (terylene) absorbs less water than nylon and therefore does not lose strength like nylon when wet.[29]

The Norwegian tests with synthetic fibre started in 1948 and lasted throughout the 1950s under the direction of the Norwegian Fishery Directorate and in cooperation with the fishermen. The reason for starting the tests was to increase the amount of catches and make fishing more profitable.

Government Fishing Tests with Synthetic Fibre

In 1949 the first test with nylon trawl for herring was carried out with positive results. The nylon trawl did catch more herring than natural fibre trawls, but it took many years before the nylon trawl came into regular use. In 1960 trawls made of synthetic fibre constituted around 21% of the total amount of trawls.[30] In 1950 a test was carried out with one nylon cod net made. The next year, ten nylon cod nets were used during the fishery season for cod in Lofoten. The tests were carried out by the Norwegian Fishery Directorate's fishing gear office. The nylon nets were supplied by the firm Ayello in Dunkerque and mounted by the firm Campbell Andersen's Enke AS in Bergen.

A private fisherman was given the nets and did the tests. He put the ten nets in a chain with ten nets made of natural fibre. The result was that the nylon nets had 50% higher catches than the natural fibre nets. Another fisherman tried the same nylon nets together with a chain of 64 nets. The result was the same and nylon nets produced higher catches in ten of eleven attempts. This was in an early phase of the tests and the representatives for the fishing gear office explained the results as a "*coincidence*" and that they supposed the new material (nylon) 'could' have been conclusive. The fishery consultant did mention that he thought the thread was too thick and that they ought to try a thinner thread next year.[31] The fishermen who had conducted the tests claimed that the thread of the nylon nets was too thick and was incorrectly mounted, and that this had resulted in poorer catches than expected. The quote below reveals the fishermen's attitudes towards the new material:

> This shows that all hauls benefit from nylon nets, so my personal view is that nylon nets are the gear for the future. And besides, the nets were really strong and good to work with.[32] (Author's translation)

The tests were continued in 1952 with the same nets and with the same result as in 1951: around 50% higher catches on nylon nets. In 1953, and as suggested by the fishermen in 1951, the thread used in the nets was made thinner. The tests in 1953 and 1954 produced catches that were three times as big as those using natural fibre nets. These results were so good that in 1954 the Norwegian Fishery Directorate started tests with other types of nets like saithe and mackerel. But this was not as successful as for cod. The reason for this is probably because the technology was not adapted to this kind of fishing. It seems as if the Directorate tried to transfer the knowledge they had acquired from the tests with synthetic cod nets directly to saithe and mackerel nets without obtaining the same good results.
The fishermen complained that the mounting of the nets was wrong and that there were too many lose meshes on the bottom line compared with their own natural

fibre nets. The fishing tests for saithe and mackerel are an example of where the Directorate did not use the fishermen's practical knowledge about how to mount fishing nets for specific fishery and their knowledge about different kinds of fishery. The Directorate ordered that the nets be mounted directly from the factory. As a comparison we can mention that in the tests in 1953 and 1954 for cod the fishermen were given the nets unmounted and mounted them themselves. In that case, the fishermen used their traditional knowledge about mounting nets transferred from generation to generation of fishermen.

Private Fishing Tests with Synthetic Fibre

The first private tests with nylon nets started in around1950, almost simultaneously with the government tests. That meant that private fishing tests with nylon paid for by the fishermen took place alongside the government tests during the 1950s. To my knowledge, the fishermen's tests were not as systematic as the tests carried out by the Directorate. The Directorate required the fishermen who took part in the tests to write a log about all the catches and count all fish caught on either nylon or natural fibre nets. We know of many examples where the fishermen made their own nylon cod nets or bought nets and mounted them themselves early in the 1950s. They also bought nylon thread and made the nets themselves. They put the nylon nets in the chain with natural fibre nets to see if the catches increased. In contrast to the tests carried out by the Directorate, there are no known statistics for the number of fish caught on nylon nets in the private tests, but this was referred to with regard to the reviews of the government fishing tests. The reviews highlighted the fact that the fishermen claimed the fishing ability for nylon nets was higher than the results of the tests carried out by the Directorate.

The first private fishing test with synthetic fibre that I am aware of took place in the northwest of Norway (Nordmøre) shortly after 1950. The story goes like this. A fisherman got a length of hawser (rope) from his son who was in England as a skipper on a Norwegian trawler. The fisherman unravelled the rope and made three nets from the thread. He put the nets out in the sea with all the three nets in a chain, but when he was hauling the nets the day after he could not get them up. Other fishermen came to help him and got the nets up and they found the nets full of fish. This was new to them and now they all wanted nylon nets. The story has it that in order to deal with the enormous haul, the fisherman had to sit in the boat all night to get the fish out of the nets.[33] As a result of this experience, the fisherman caught pneumonia and died not long after. This story can explain to some extent why the fisherman claimed that the fishing ability for nylon nets was higher than the results of the tests carried out by the Directorate.

The government tests were carried out to stimulate development in the fisheries. The goal was to create change, a transition, in net fishing. In our period this was a result of active government politics to rationalize the traditional Norwegian cod fisheries.[34] I choose in this connection to consider the private fishing tests with nylon as a voluntary experiment with new technology to increase the catches and maximise fishing profit. The fishermen were used to taking chances and were fully aware of the fact that their own efforts were decisive for the profits of fishing. In

this context, we must remember that the ownership structure in the Norwegian Fisheries at that time was basically that the nets were owned by the fishermen themselves. In 1948, 95.6% of all cod nets were owned by active fishermen.[35] In 1960 the figure was 88.5%. In 1960 the groups of cod nets were divided into natural and synthetic fibre. The percentage for cod nets owned by the fishermen alone in 1960 was 89.5% for natural fibre and 88.4% for synthetic fibre.[36] This shows that the fishermen had to pay for the nets themselves. Every fisherman was also responsible for their maintenance and had to replace the nets if they were destroyed or became worn out during the fishing season. There were certain systems used by the fishermen to secure some sort of equal wear and tear of the nets during the fishing season. It was also common to use one or two natural fibre nets at the ends of the chain to avoid destroying the expensive nylon nets. This shows that the risk of the investments were spread over many hands and actually made it easier for the fishermen to invest.

In the light of this I will claim that the private fishing tests with synthetic fibre show that the fishermen were developers (entrepreneurs) and important active actors and factors in the transition from natural to synthetic fibre in net fishing for cod. In this connection we must not forget that there was an ongoing transition from hemp to cotton both before and at the same time as the conversion to synthetic fibre. This shows that there was an ongoing improvement based material innovation within natural fibre, which made it easier to create a breakthrough for synthetic fibre when it was introduced in net fishing. Incidentally, it is also a fact that the nylon nets needed less maintenance when it came to drying and impregnation than hemp and cotton nets. The fishermen did not need a double set of nylon nets as they did for natural fibre nets which made it necessary for the fishermen to have one set hanging to dry while one set was used for fishing. This also made the work easier, the fishermen required less time to maintain the nets and much of the hard labour with the heavy hemp and cotton nets disappeared.

There was enormous interest among the fishermen in the new material and there was extensive private import both of thread and nets in the years before 1956 when the State Fishery Gear Import (SF) took over the import. A letter from a private fisherman to the director of Norwegian Fishery Directorate shows this:

> Could you please tell me if a private fisherman would be allowed to import nylon nets from abroad e.g. Japan [.....]. By using some nylon nets in the fishing season last winter, almost 400 % higher catches were obtained on nylon nets than on hemp and cotton nets.[37] (Author's translation)

The fisherman's question about importing nylon nets and establishing the fantastic fishing ability of the nylon nets brings us right to the processes of conversion in the Norwegian net fishing for cod.

The Breakthrough for Synthetic Fibre in Net Fishing

It is a fact that synthetic fibre had its breakthrough during the winter of 1954 – 1955. One of the results was that the sale of cotton thread no. 12 (the most common thread for making cod nets) and other thin threads for cod nets more or less stopped at this time.[38] Another consequence of the conversion to synthetic fibre was that the SF sensed a drop in demand for hemp in the Norwegian spinning-mills. This could also be explained by a general decline in the demand for fishing gear. In its annual report, the controlling body of SF had noted that the use of synthetic fibre could make current goods of natural fibre less popular.[39]

Still in 1955 the general dispensation for private import of nylon fishing gear and thread was in force. Related to the breakthrough of synthetic fibre during the winter of 1954-1955, there were also large private imports of nylon thread and nets. This particularly applied to cod nets but also to some extent nets to saithe, salmon, flounder, mackerel and lines.[40] At this time, it was in net gear that nylon had gained particular acceptance amongst the fishermen. This could most certainly be connected to the expansion of the Directorate's fishing test to larger part of the Norwegian coastline and also including more kinds of fish than cod (e.g. saithe and mackerel). In addition many fishermen had conducted their own fishing tests with nylon fibre.

If we see the conversion to synthetic fibre as a tendency, in 1955-1956 we can still see that the SF reported a decline in the sale of cotton thread no. 12 for cod nets. This was now seen as a direct result of the increasing use of nylon nets.[41] It was underlined that the transition to nylon had continued during the winter of 1955-1956 at an increasing pace. By this time, the SF regarded nylon nets as regular fishing gear and consequently the general dispensation to import nylon was abolished.

In 1955 it was possible for the fishermen to get a loan from the government to buy fishing nets made of synthetic fibre for cod and saithe. The loan would cover 75% of the price for a nylon net but not above 100 Norwegian kroner per net. In 1955, the average price for a nylon net (unmounted) was 135 Norwegian kroner. The price for a fully mounted nylon net for the fisherman was 180-200 Norwegian kroner[42] per net and in addition the fishermen had to buy ropes, floating and sinkers. For top and bottom line, they used natural fibre when mounting the nets throughout the 1950s. The fishermen actually only got about 50% of the costs covered by the loan. This meant that in addition to the loan, the fisherman actually had to invest the same amount of money himself to get a nylon net he could use. As a result, the transition to nylon could be a very risky investment for the fishermen if the fishing went wrong. In 1955, the subsidised prices for cod nets (unmounted) made of natural fibre were 54.25 for hemp and 59.25 Norwegian kroner for cotton.[43] We must also remember that the fishermen made this investment despite already owning nets of natural fibre. This also shows that the fishermen were an important actor in the conversion from natural to synthetic fibre during the 1950s.

The loans dramatically boosted the conversion to nylon during the winter of 1955-1956. The Lofotposten newspaper featured headings like 'The nylon fever has caught the fishermen in Lofoten'[44] and later mentioned that there were bargains

in nylon nets everywhere and 'around the fisherman's shacks in Lofoten today you will see many fishermen mounting their newly purchased nylon nets.'[45] From this report, we can see that the fishermen were working hard to get the nylon nets finished for the winter. This was because the loans were paid out very late in 1955. There was a Klondike mood among the fishermen and it was easy to sell nylon nets. The word nylon was on everyone's lips. The Lofotposten newspaper carried regular cartoons of a fisherman called Lydevart commenting on life in the community during the fishing season. In the middle of the 'nylon fever' in 1956, this was the comment from Lydevart:

Figure 1. *Drawing of Lydevart. Source: Lofotposten 5t March 1956*

Translated into English, the comment goes like this: "What is the greatest similarity between the ladies of the town and the cod? Yeah, they are both going in nylon". (Author's translation).

Despite strong demand for nylon nets and competition between the Norwegian fishing gear factories producing synthetic cod nets for the inland market, during the 1950s the prices, as predicted by the director of the Fishery Directorate when going for loans instead of subsidising nylon nets, did not fall.[at] The prices did actually fall slightly in 1958 and 1959, e.g. the price of nylon thread fell by 11%.[au] The first cod nets produced for the cod fisheries were of varying

quality as we pointed out earlier in this paper. The first nylon nets lasted no longer than the natural fibre ones. It was not until the end of our period (1957/1958) that the fishing gear factories acquired special machines which could handle synthetic fibre and the specific problems with the slippery material and enforcement of the knots, which was necessary to make good nets of synthetic material.[av] For the fishermen, access to the governmental loan arrangement was a way to interact and become an actor in the conversion to a new a more efficient fishing gear.

On 1 October 1960 the government decided to subsidise fishing gear made of synthetic fibre and at that time we actually saw a fall in prices. The prices for unmounted nets fell by 20%. In 1960, fishing gear made of natural fibre still received the same funding as earlier.

The Use of Synthetic Fibre in Fishing Gear after 1960

In 1960, 95% of all fishing nets used to catch cod were made of synthetic fibre (mainly nylon/polyamide). As I see it, the conversion from natural to synthetic fibre in net fishing for cod was fully completed at this time. The transition was accelerating in around 1960 and onwards for nets, trawls and lines. If we look at all types of fishing gear, we must conclude that the conversion slowed down after 1962. In 1957, 4% of all fishing gear in Norway was made of synthetic fibre; in 1962 62% and we have to move all the way to 1975 before we reach 95% for all kinds of fishing gear.[aw]

Fibre Gear	Polyamide	Polyester	Polyethylen	Polyprophylen	Polyvinyl-alcohol
Net	x				
Seine	x				
Line	x	x			**x**
Ropes	x	x	x	x	
Trawl	**x**	**x**	**x**	**x**	

Figure 2. *Synthetic fibre used for fishing gear. Source: "Syntetfibre i fiskeredskap", SF, 1972.*

The use of polyamide (nylon) shows that this fibre is the most used fibre in fishing gear, and if we look at 1971 the use of polyamide constitutes 76% of all synthetic fibre in fishing gear in Norway.[ax] Figure 2 shows the different synthetic materials used for fishing gear.

Conclusion

Until 1954, hemp and cotton was the preferred material in cod nets. This changed dramatically during the 1950s and we witnessed a change in fishery with the introduction of polyamide (nylon) which can be described as a fever in many ways. We focused on the process of change in net fishing for cod, for which the conversion was complete by 1960.

The Norwegian factories producing fishing nets had many problems with the new material because it was much more slippery than the hemp and cotton. The new material demanded new and enforced knots to function. This made it difficult to produce nets on the old machines and the first nets sold to the fishermen in the early 1950s were of poor quality. We asked who was pushing to get the fishermen to use nets made of nylon. The answer is a combination of multinational chemical firms, gear developers, advertisers, newspaper articles, governmental and private fishing tests, the fisherman's practical knowledge and the fisherman as an active actor. In the 1960s we know of gear developers and multinational chemical firms who were offering nets of new synthetic materials directly to the fishermen to test for free. But that is another story. The demand for polyamide cod nets from the fishermen was greater and grew faster than the producer's ability to improve the technology. That is one of the reasons the first fishing nets were not fully developed until the end of the period.

We have shown that the introduction of synthetic fibre in fishing gear from around 1950 changed the way of using natural materials that goes back several thousands of years concerning the knots. The use of synthetic fibre in the fisheries must be characterized as revolutionary when it comes to the amount of catches, which increased by almost 400 % in net fishing for cod compared with hemp and cotton. Some of the factors that accelerated the diffusion of synthetic fibre (polyamide/nylon) were the official and private fishing tests with nylon nets together with a government loan for fishermen, which allowed the fishermen to borrow money to buy new and more efficient but also more expensive nylon fishing nets. The price of nylon nets was more than twice the price for hemp and cotton nets and it was quite a risky investment if the fishing went wrong. As we have seen, the loan could only pay for half the price of the nets. The increase in catches also contributed and made it easier for the fishermen to invest in new gear. For the fishermen, access to the government loan arrangement was a way to interact and become an active actor in the transition to new and more efficient fishing gear.

We have proved the fact that the conversion from natural to synthetic fibre in the net fishing for cod in Norway was quite fast and was completed by 1960, despite the fact that official fishery statistics from 1957 show that only 4% of all fishing gear in Norway was made of synthetic fibre. In 1960, 95% of all fishing nets used to catch cod were made of synthetic fibre. The successful change from natural to synthetic fibre in net fishing, especially for cod, in the 1950s, was a strong factor contributing to the acceleration in the conversion from natural to synthetic fibre to other types of fishing gear from 1960 onwards. But we have to move all the way to 1975 before we reach the same percentage (95%) for all fishing gear made of synthetic fibre. From this perspective, the conversion with regard to all kinds of fishing gears was quite slow.

This study also shows that if we had focused on the conversion from natural to synthetic fibre for all kinds of fishing gear in Norway in this period, the transition would have appeared quite slow and we would not have seen the dramatic changes that took place during the 1950s. In my opinion it is very important to conduct research on this field through micro studies to reveal what really happened in this period and to discover who were the actors in the process and the real entrepreneurs.

The study also shows the complexity of technological innovation, the spreading of new materials in fishing gear and who was trying to control the process.

Notes

1 Iversen, Thor, "Utviklingen av fiske og fiskemetoder i Norge" in *Årsberetning vedkommende Noregs Fiskerier 1937, nr 4, p. 60 and Nordgaard, Ole, "Utviklingsfaser i norsk fiskeri", pp 6-7* in special edition of NIDAROS *1928.*

2 Illustrert Vitenskap nr 7, 1999, p 29. The archaeologist Olga Soffer claims that these nets were used for small game hunting in the Ice Age. The nets were made of hemp and nestle. We also know prehistoric findings of parts of nets from Finland from the Stone Age most probably made of nestle. This is mentioned in *"The Development of Fishing in Prehistoric Europe"* by J. G. D. Clark in *The Antiquaries Journal, vol. XXVIII*, p 56, 1948.

3 *Kulturhistiorisk Leksikon for Nordisk Middelalder*, b. 4, p 326, 2. edtion 1981.

4 Nordgaard, op.cit., 1928, p 20

5 Iversen, op.cit., 1937, nr 4, p 44.

6 Iversen, op.cit., p 43. For instance in 1641 cod nets were forbidden in the fisheries outside Skudesnes in the western part of Norway.

7 Informant, fisherman Gunnar Vornes, Myre in Vesterålen. Interview dated 29.06.1998.

8 Strømsheim, Marius, Norsk fiskereiskapsindustri, unpublished paper, early 1970ies, chapter 14, p 4.

9 In a letter to the Norwegian Department of Fishery dated November 12th 1955 from the States Fishing Gear Import (SF), the State Archive (Statsarkivet, SAB).

10 Martinussen, Atle Ove, *"Teknologi i arbeidsliv – innovasjonsprosesser og deres betydning. Hva gjør museene?"*, p 30 in *Museumsnettverk 3 – Teknologi, arbeidsliv og industrihistorie*, Oslo 1993.

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