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**Cod farming at the intersection
of fisheries and aquaculture**

by

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Cod farming at the intersection of fisheries and aquaculture

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Abstract

Over the past three decades, the powerful combination of capital, research, and promising prospects has propelled salmon aquaculture to a mature, billion dollar, worldwide industry. Aquaculture entrepreneurs now search for new opportunities, but so far these attempts do not generate profit. Cod is targeted as a promising species, and here we explore the opportunities for the farming of cod. Two questions arise: (1) What characterizes cod as a farmed species? (2) How do these characteristics affect the window of possible opportunities for initiating cod-farming operations? Three pillars constitute cod as a farmed species. The market structure determines the prices through a supply/demand balance. Scientific knowledge provides species-specific biological characteristics that demand tailored technical solutions. And production systems (such as conventional coastal cod fisheries and industrial fish farming) provide preexisting institutions that govern activity. We argue that the advantage of cod as a farmed species in a starting-up phase is, firstly, the price stability provided by a market structure maintained by a large, "conventional" cod-fisheries sector. Secondly, the huge library of practical and scientific knowledge about cod and cod fisheries comprises a valuable resource. Thirdly, the general familiarity with cod as a species (among fish processors, fish buyers and exporters, in large consumer groups, and among public managers and supervisors), ensures a realistic anticipation of future problems. Lastly, the availability of cod fisheries institutions that direct focus, create attention, and organize decisions constitutes significant potential support for cod aquaculture. However, the path to a future cod-farming industry is not pre-determined. Strategic choices are continuously made that open and close further organizational options. We present and discuss models for industrial organization.

Introduction

The German philosopher Arthur Schopenhauer once said that every truth passes through three stages on its way to confirmation – first it is ridiculed, then it is resisted, before it is seen as obvious. Aquaculturists that have tried to make a living of farming cod have experienced laughter as well as opposition during the past years. But cod farming, which a few years ago was launched as a crisis solution in a period with severe quota cut backs (Aarset and Foss, 1996), can prove to be a viable enterprise. We will not discuss biological or technical sides of the cod-farming project here, just state that continuous advances have been achieved and that the general knowledge is good. We will neither take a position to whether farming of cod ought to be based on captured cod or farm-hatched fry. The main question, however, that we will pose and answer here, is **why cod farming is a good idea**.

Two research questions arise at this stage. What characterizes cod as a farmed species? And how do these properties affect the window of opportunities for cod-farming operations? Over the past three decades, the powerful combination of capital, research, and promising prospects has propelled salmon aquaculture to a mature, billion dollars, and worldwide industry. Aquaculture entrepreneurs now search for new opportunities and in Norway, cod is targeted as 'one of the promising species'. We will focus at cod farming for several reasons: Cod is economically and politically the most important species in the Norwegian fisheries, and the cod sector is thus saturated with powerful institutions. The cod market is huge – the landings of cod in the north Atlantic alone are 1,4 million ton, and included its closest substitutes the global cod market is in the size of 4 million ton. The market structure is significantly different from that of other aspiring farm-species, which may well be priced higher. Moreover, the analysis contests the conception of technological refinement as the only way to aquaculture development.

About 10 years ago approximately 400 cod farming licenses were distributed along the Norwegian coast. Since then the number of licenses have decreased. The Directorate of Fisheries reports that the number of cod farming licenses decreased from 152 to 118 from 1996 to 1999, while the number of licenses for farming of 'marine species' has increased from 66 to 89 in the same period (Directorate of Fisheries, 2000). The production of farmed cod has always been marginal, in the range of 100 and 500 tons. So what is new in the year 2000? According to several entries in the fisheries press there seems to be a growing faith in the concept of cod

farming. The reason for this renewed interest is explained by a recent TAC¹ decrease, expectations of a lasting quota depression, and a growing insecurity of the long term situation of the cod fisheries, but also with the inspiring rises of the cod prices. Increased industrialization and professionalization at all levels of the fishing industry, which demands a need for stable supply and prices, combined with some accumulated aquaculture experience also add to the explanation of these expectations.

In our opinion this rather peculiar and genuinely Norwegian story may have some interest for a broader international audience as well. While the procurement of fish globally is organized as a 'hunter' enterprise, aquaculture is organized similar to modern agriculture – based on capital and science as the most valuable inputs. However, there are synergic effects in joining forces. Each fishery carries an institutional structure originating from a particular historical situation. These institutions organize the relations between the producer (i.e. the fisherman and/or the aquaculturist) and the market. Emerging aquaculture enterprises are based on existing (big or small) markets, and any prospective aquaculture operation will thus have a relation to a wild capture sector and an established market. The issue is what impact this relation will have on the enterprise.

This paper is organized, first, with a presentation of theory and the study approach. Then the cod is presented, as a significant historical subject in the development of Norwegian coastal societies (and the nation), as a biological creature, and as a product and source of income. All of these aspects have consequences for the cod farming operation. Thirdly, four possible models for how to farm cod is presented, before the paper is closed by a discussion of whether future cod farming will be 'part of' a coastal cod fishery, a 'salmon-like' aquaculture industry, or develop an industrial identity of its own.

Approach

The study of cod farming is the study of something that does not exist, or more precisely, only exist as an idea somewhere between salmon aquaculture and coastal cod fishery. However, the field of 'fish production' is filled with practices and experiences that is potentially useful in a future cod farming industry. The prospect of cod aquaculture is thus as an economic enterprise bounded by the ramifications provided by biology, technology, economy, regulations, etc.

¹ TAC: Total Allowable Catch.

Industrial entrepreneurs will have an affluence of institutional resources available to their entrepreneurial activity. Here, two basic perspectives on the analysis of the opportunities for cod farming entrepreneurs are launched. First, the concept of organization as a three level activity is employed (Parsons, 1960; Thompson, 1967; Scott, 1992), which provide the opportunity to separate the different tasks the cod aquaculture enterprise will be confronted with. Then the perspective of transaction cost is employed (Williamson, 1975; Petersen, 1993). This perspective will be used to study the rationale for economic and/or technical integration in the cod aquaculture industry.

The prospective cod aquaculturist has to make choices continuously, and they will organize to reduce uncertainty. Even if cod aquaculture seems like a good idea, the actors will choose to use their limited resources at projects that they are familiar with and thus have confidence in. There is a 'short term'/'long term' tension here. What might seem like a sub-optimal solution in the short term might be fruitful in a longer perspective. Short term here implies decisions based on 'alternative calculation', what the fishermen receive for the actual catch weighed up against expected outcome from the farm operation. In the long term, however, stock and quota fluctuations and a possible continuous downward trend, over-capacity problems, reduction of the number of small and medium sized vessels, and need for stable supply stimulate a call for alternative and flexible solutions to cod and cod fish supply.

Industrial organization can be seen as an activity on three different levels (Parsons, 1960; Scott, 1992){Thompson 1967}, the technical, the organizational and the institutional levels. At the technical level resources are transformed to products. At the organizational level, resources are acquired, production is controlled, and product flow is organized. At the institutional level the organization is connected to the surrounding environment and the limits and domain of the organization are determined. Each level refers to tasks that demand a response from the organization. Similarly, an action at one level has consequences for actions at another.

A precondition within the transaction cost theory is that transactions are not priceless, and that economic rationality determining how the actors act in order to reduce such costs. However, vertical integration is no precondition (or hindrance) for improved economic profitability within fish capture and processing (Vassdal et al., 1998; Dreyer, 1997). Correspondingly, there are large variations in profitability within small enterprises in the fishing industry. Advantages and disadvantages of vertical integration refer to the extremes 'market' and 'hierarchy'. Horizontal

integration refers to the competitive aspect and organization across similar actors, while vertical integration is concerned with dependence between actors at different levels in a 'value chain'. Here the focus is on when market or hierarchy is the optimal forms of organization (Williamson, 1975; Williamson, 1985). This insight is used to discuss how fishermen or aquaculturists organize their relationship. The intermediate forms between market and hierarchy illustrate the degree of strength and type of connection between the transaction partners.

The success of the transformation process depends on inherited characteristics of the actors. Small enterprises with limited resources can be the prime initiator of this type of production systems. Capture and farming can be organized in separate units, where the transactions take place between independent parties (Standal, 1999; Aarset, 1996). The production can also be organized as integrated enterprises. Lack of success can be explained as institutional: as a lack of public design, as economic: as lack of profitability, or as lack of adequate and common comprehension of the crisis – which is seen as a necessary precondition for rapid and extensive change.

Conceptualizing cod

Cod is 'The Most Prominent Fish' in the history of the Norwegian fisheries. The cod fishery has been the engine of the settlement in coastal Norway. As a consequence of the species historically high value, huge volume, and seasonal availability, it became important to find proper solutions for how to organize the utility of this vast resource (as a common good). Issues as whom the rights to fish belong to, what the appropriate fishing practice was, and how the fish was supposed to be traded were determined by specialized and historically conditioned institutions. These institutions also provide pre-organized relations to the market, and thus the possibility of stable prices, for cod fishermen as well as for aquaculturists.

Three separate elements constitute the product 'farmed cod'. The market determines the price through structural properties and the supply/demand balance. Science provides species-specific biological knowledge that demand tailored technical solutions. And past practice provides patterns of regulative directives and normative behavior – in short institutions - that govern what is possible to do and what is preferable to do. Such institutions are rooted in conventional coastal cod fisheries as well as in industrial fish farming and cannot be ignored in the attempts to farm cod.

History, institutions, and politics

Compared to the fisheries, the aquaculture industry in Norway is a relatively new enterprise, and so far it is dominated by salmon and trout aquaculture. The aquaculture policy was developed as a 'concerted action' between state, industry, and organizations in the 1970s. After extensive bankruptcy 10 years ago, creditors controlled a large proportion of the total number of concessions. This led to an extensive sale of farms with a total restructuring of the industry as a result. Today there are tendencies to owner-concentrations and multinational buy-ups. Despite the industrial transformation of the aquaculture industry – removal of regulated first hand trade and one license per farmer (Aarset, 1998) – the industry is still strongly regulated by the use of a licensing system and feed quotas, and by a salmon aquaculture specific trade agreement with EU.

Farming of cod goes more than 100 years back, but it was not until the end of the 1980s that cod farming was launched as a specific strategy in typical fishing regions. With a dramatic decrease in the Norwegian cod stock and historically low quotas for the coastal as well as the high seas fishing fleet, the idea of feeding of captured cod was launched (Aarset and Foss, 1996). A combination of traditional coastal cod fishery and salmon aquaculture provided a technique for enhancing limited cod quotas. Feeding of captured cod, many imagined, could buffer the market, as fish would be available at any time. Serving high paying markets with stable deliveries most of the year would maximize this strategy. The industry itself as well as the government and the research community anticipated that this was the solution to old problems. Within the first couple of years, the Fisheries Directorate issued some 400 licenses for farming of cod (Foss, 1994). After a few years with commercial farming combined with a continuous increase in the captured quotas, however, hardly anyone were engaged in cod farming. Today, the interest in cod farming has re-surfaced, the quotas are decreasing, the prices are high, and some aquaculture techniques are refined.

The cod fishery represents a regulated fishery where strong institutions organize the activity in all parts of the value chain. The cod stock is regulated by an extensive regulative management regime, the criteria for the conduct of and participation in the fishery are regulated, and so is the trade of the capture. In a historical perspective this system has ensured the fishermen strong influence in the development of the fisheries. Legally, this influence is ensured by the Raw Fish Act (established in the 1930s), which gives the fishermen a legal right to determine minimum

prices, combined with the Participation Act that determines that the ownership of fishing vessels is an exclusive right to active fishermen in Norway.

The fish trade organizations have a monopoly on first hand trade of fish. This position implies quota control, organization of trade, and determination of minimum prices. When the interest in farming of captured cod took place in the late 1980s, the Sales Organization for Captured Codfish (Råfisklaget) practiced a system where fish buyers had to be certified by a buyers license, issued by the sales organization. The legal framework is now liberalized, and general buyers' licenses for fresh fish are issued. When a fisherman deliver cod, an End Form has to be signed by the fisherman as well as a representative for the sales organization, and submitted to the authorities (Directorate of Fisheries). This End Form is a registration of captured fish that the sales organization (the authorities) uses to adjust the fisherman's quota. The End Form provide the information the sales organizations needed to fulfill their obligation as quota controllers. Where the fisherman feed and farm 'self-fished' fish, there are no transaction and thus no 'End Form' registration. In that case, an End Form is submitted with delivery of farmed quantum. If the growth has been good, it can, of course, be a significant difference between quantum in to the farm and deliverance from the farm.

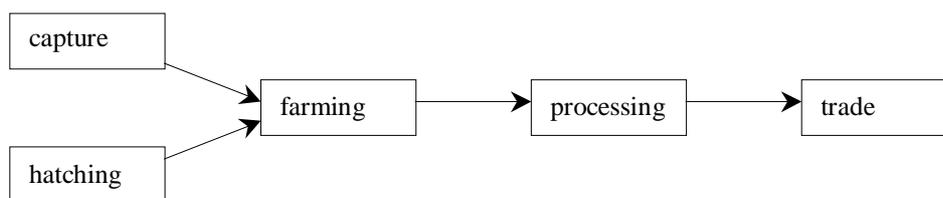
Cod farming is basically regulated as other 'marine species', which means that there is no upper limit of licenses and that if the license criteria is fulfilled, a licenses will be granted. In this case the license is limited to 12000m³, and the license subject to ordinary 'common' criteria. There are, however, two exceptions. First, if the farming is based on captured cod, the trade will be subject to regulations determined by the fish sales organizations. And in 1991 a particular management system was tested, where coastal cod fishermen were permitted to farm their own catch. In the latter case, the concession was limited to 1000m³, and the DoF demanded full removal of the fish within 9 months farming. The choice of model for storage and farming thus determine the organization of the further production.

Biology and technology

Cod farming is, with an exception of the supply of cod to the farm, relatively similar to salmon farming (Figure 1). The choice of cod as a 'farm subject' demands particular knowledge and competence, and the appropriate knowledge is not automatically available in the salmon-farming sector. The cod has a large mouth compared to its body size, which leads to a problem of cannibalism. The flesh is leaner than in salmonids and cod thus have a diet with lower fat

content. Here, however, we will focus at the fry/fingerling part of the production process. There are four different strategies to provide cod for grow out farms. First, the intensive cod fry production method, where the fry is feeded with enhanced plankton cultures under closed conditions. Secondly, the extensive production method, where fry is produced in open systems with natural influx of plankton or some artificial accumulation of plankton. Thirdly, capture of fry in open waters, which is presently forbidden in Norwegian waters. And lastly, capture of young fish above allowable minimum size (47 cm and approximately 1,5 kilo). A mix of the first and the last strategy is used in the comprehensive pilot projects. The cod eggs and fry are much smaller than salmon and thus more complicated to rear successfully. Fishing of cod at the size limit introduces technological problems of catching and storing the fish alive.

Figure 1: Technical organization of the cod farming operation.

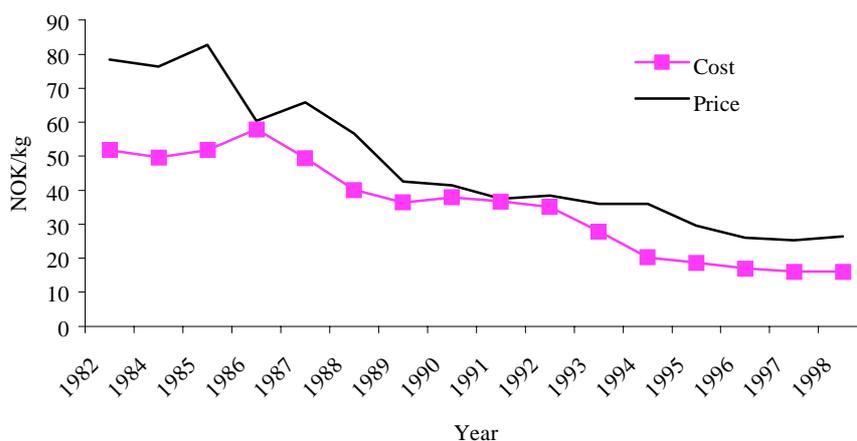


The cod as a species is not institutionalized or predetermine any particular set of institutions. The history of cod farming provides an interesting case that exemplifies this. In the 1980s, when cod farming was in its infancy, the Fish Farmers' Sales Organization, which was delegated the right to trade all farmed fish species, wanted to organize the trade of farmed cod as well. They did not want to distinguish between live caught and farm-hatched cod. The Sales Organization for Captured Codfish contested this decision. Both sales monopolies were protected by the Raw Fish Act that placed the right to trade fish at first hand with the fisherman/farmer. The Ministry of Fisheries cut through this knot by making an amendment in the Raw Fish Act that decided that farmed cod based on captured specimens should be traded by the Sales Organization of Captured Codfish, while farm-hatched (and raised) cod could be traded freely. In other words, cod as a biological creature did not predetermine further handling, but the way the fish was produced did.

Economy and market structure

Salmon was the first species for which intensive aquaculture was successful in the sense that substantial quantities were produced. When farmed salmon was introduced, the species already had a market that was paying very well for the product. The high prices made the enterprise profitable from 'day one' in spite of high production costs. A problem of high-priced products, however, is that only a very limited quantity of the product can be sold to a high price. In order to be able to increase the quantity of salmon and ensure a profitable development of the industry, the costs had to be reduced and thus the productivity development had to be positive. This is also what happened as both production cost and price in real terms was reduced by about 70% from the mid 1980s to the late 1990s (Figure 2).² Sea bass and sea bream have also been successful species measured by produced quantities. These species were also initially high priced. As the production increased, the prices decreased substantially.³ These species had in common that they were initially high priced, and that the supply of captured fish in general was low. The high initial prices also made high initial production costs possible. The pioneers can learn appropriate farm practices while they make a profit from farming. These kinds of products have in common a market structure that determines that an extension of the enterprise only can take place by a significant reduction in prices, and thus production costs.

Figure 2: Real production cost and export price for Norwegian salmon.



² See Asche (1997) for a discussion of the productivity growth and reduction of prices for Norwegian salmon farmers.

Cod is not particularly high priced compared to the species mentioned above. In addition, the supply of captured cod is already very high. In any market, fluctuations in supply (and demand) affect prices. However, the larger the market, the larger the changes in supply have to be to affect the prices. The sea bass and sea bream market is about 50000 tons, and a 10000 ton change will make a great difference, as it constitutes a 20% change in the supplied quantity. In the 'white fish' market (about 4 million tons) 10000 tons will hardly be noticed as it only changes the supplied quantity by 0.25%. Hence, the market structure faced by cod farmers is very different from the market structure initially faced by salmon and sea bass/sea bream farmers. Farmed cod compete in a large market compared to the other farmed species presented above.⁴ Farmed cod will probably be in the highest price segment in this market, but it will still be in the same market. A consequence is that aspiring cod farmers will have no pull effect from a high paying luxury market in an introductory phase. But on the other side, if it is possible to produce the farmed fish to a cost that make the production profitable at the market price, a large increase of the production will be possible without detrimental price effects. If the production volume is 1000 or 100000 ton is of less importance, it is a relatively small amount in the market anyway. Hence, we can say that potential cod farmers faces a much more elastic demand than farmers of salmon, sea bass and sea bream did. This connection between market structure and price and quantity adaptation is an advantage when the aim is to create a large and viable industry. In this case, the industry's profits will to a much greater extent increase with the production than what has been the case with salmon and sea bass/sea bream farming as the prices will not have to be reduced to any extent in order to increase the production.

The variation in the cod prices is relatively small even if the supply varies substantially. Prospective cod farmers can utilize this characteristic of the market structure as even a rather large farm operation will influence the prices only to a very limited extent. In other words, the cod farmer has a huge 'shadow volume' in the capture sector that stabilizes the prices for the farmer. This will probably lower the unrealistic expectations of extraordinary high farmed-cod prices in the project phase. On the other hand, and more important here, it will also lead to realism in the price assumptions in the pre-project phase. This means that if a cod project are

³ Turbot is still high priced, but the turbot farming has not been successful in the sense that production has increased as for salmon and sea bass/sea bream.

stipulated with a reasonable price, a price it is possible to live with for the farmer, then there is a chance that this assumption will hold, independent of their own and other farmers production. And exactly the lack of (secure) price predictions has been a significant vulnerability by other new farm enterprises.

So how does this insight influence our understanding of the organization of cod sector innovations?

Models - market or hierarchy?

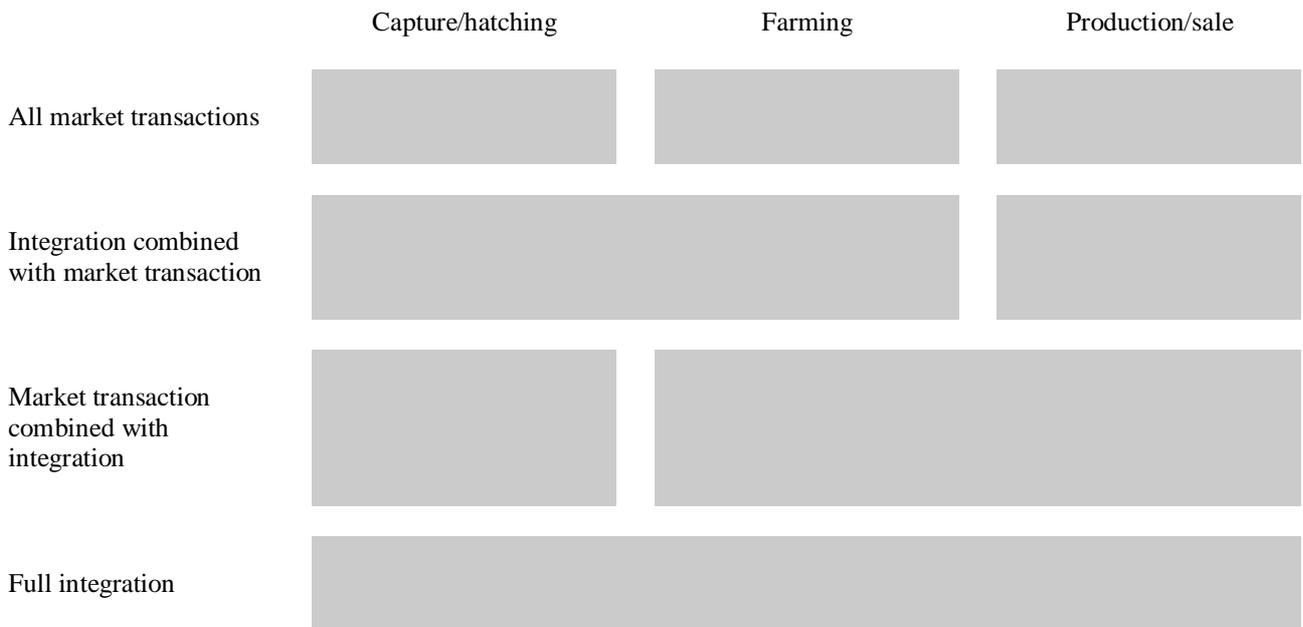
A successful combination of various production systems is a precondition for cod farming. Capture and farming are two separate decision systems with inherited traditions, institutions, and organizational forms. Profit is a precondition for the set up of new production forms. Here, that implies that the alternative costs by standing outside have to be larger than to participate for each element of an integrated live storage and farming system (Standal, 1999).

The decision whether to integrate vertically includes communication, predictability, control and learning that affect the transaction costs. Specificity and an analytical separation of immaterial and material assets are part of this discussion (Williamson, 1985). The latter is investments performed to make transactions that are directed to specific markets. Immaterial assets, on the other hand, refer to 'human capital' and the establishment of contact by cooperation. Human capital has a particular significance when the transactions are technically complicated, when routines are needed, and when there are an influx of opportunism as when one part agrees on agreements that they cannot keep. Increased complexity and uncertainty leads to a situation where the companies to a very limited extent are able to prescribe what the future will bring and what other actors will do. Unstable environment, dependence on other transaction partners, and vulnerability towards opportunism, are hindrances for rational choices that rise the possibility for higher transaction costs. Transaction costs is defined as the costs of collecting and exchanging information, negotiating and closing contracts, future development, finding loyal transaction partners, and achieve special assets and human capacities. Organization is aimed at reducing

⁴ One should note that it is possible that there exists a small market that pays a considerable price premium for fresh cod of high quality. However, if the aim is to develop a significant industry, the agent has to compete in the total white fish market.

these to an acceptable level; the matter here is to find the appropriate mix of integration and market along the value chain (Figure 3).

Figure 3: Models for the economic organization (see Aarset (1996)).



Below each alternative is outlined with respect to the different characteristics of cod farming.

All market transactions describe a situation where the separate units are independent actors and the cooperation is focused at each transaction where prices are determined by the market. Live fish is purchased from private hatcheries or fishermen. As explained above, the purchase of captured cod is organized by the sales organizations, while the purchase of hatched fry is not regulated. For investments in storage on board and live storage to be an alternative, it is a requirement that the price for live capture is significantly higher than the listing price for cod. An open market situation here is hardly tempting for a fisherman. When the fisherman has made the necessary investments, he will be in a very weak bargaining position. Hatched fry, on the other hand, will be adapted to an open market situation. Production of cod fry is capital and competence intensive, demands large investments, and there are thus large-scale advantages. The amount and delivery time of fry will also be predictable, and there will thus be easier to set up contracts with buyers. Farming here, as a separate activity, will be 'full scale' farming.

Integration combined with market transaction is represented by two alternatives, where integrated capture and aquaculture operations sell fish to independent sales companies. First, fishermen have the opportunity to invest in a pen farm to store the captured fish for a limited time. In that case, the licensing application will be 'simplified', as the Directorate of Fisheries (DoF) will issue limited licenses up to 1000 m³. In addition the directorate dispense from other requirements such as formal education, but they require that all fish be processed during the season. This alternative is thus limited to small-scale enterprises. Secondly, fishermen cooperate to apply for a full farm-license limited up to 12000 m³. In that case they must document formal education within aquaculture. Preconditioned by good access of fish, it is possible to utilize large-scale advantages by farming. Within this model it is possible to utilize the farm on a whole year basis. Since the fishermen farm their own fish it is conceivable that most of the vessels operating time is directed towards live capture activity. A hatching-farming integration is also conceivable, but hardly likely at this stage. Hatching and farming are so different operations that each demands full concentration. There is a full technical dependence between the two elements (hatching and farming), so price/cost and supply have to be sorted out by communication.

Market transaction combined with integration is described by processors that integrate backward into the farm operation and thus engage in different types of arrangements with the capture or hatchery sector about deliverance of live fish. Such interaction might vary from common ownership in the farm enterprise, long term agreements about deliverance, or that the industry/farm operation purchase live fish in a spot market. A fish processor will initially have approved purchase license for fish, and there will thus be no institutional constraints on purchase of large quantities of fish. A fish processor will also have an organized relation to the market. In case the processing plant uses the raw fish from the farm, the farm has to be designed to fit to the demands of the processing plant. Independent of this situation, it is possible for a processing plant to establish live storage of fish as a buffer against fluctuations in the raw fish supply. The lack of raw fish leads to sub-optimal utility of the capital sunken in expensive processing equipment, which again increase the costs per produced unit. Fish processors have the same opportunity to choose a limited requirement farm license as the fishermen (limited to 1000 m³). The question here is thus whether the investment in the farm operation compensate for instability in the raw fish supply.

The full integration model incorporates all elements of the production into the same enterprise. With reference to the presentation above, the arguments for vertical integration are predictability,

control, and stability in relation to raw fish supply and as strategies to various markets. However, a precondition is that the achievement of the resources involves a minimum of transaction costs. With integrated corporations it is also possible to utilize internal pricing and decide the location of profit in a given value chain. An integrated strategy is based on a 12000 m³ fish farm where the applicant has to document the competence demand. A fully integrated cod farm will have the opportunity the switch between live capture and hatched fry, dependent on price, availability, local conditions, etc. Given the development within salmon aquaculture and other parts of the fishing industry, increased vertical integration is a likely path of development. However, technology and competence for each section has to be developed, and that will probably take place in smaller firms with a limited goal for their activity.

The first model describes a professional cod hatchery sector that sell cod fry to a specter of grow out farmers (the salmon aquaculture model). The second model is the fishermen that feed and farm their own capture, or even buy live cod from others as well (the cod fisheries model). The third is the fish processors that farm cod to increase the utility of their equipment and manage the negative effects of raw fish supply (the fish processor model). The fourth model is the conceivable future way to farm cod (the future model). A technical integration of model one and two seems to describe present attempts, which may lead to model four if it proves successful. Model three is probably less likely given the traditional rigidity of the processing industry.

Discussion

The strength of cod farming is the capture sector and its price stabilizing effect. The cod product is well known, the market channels exist, and there is thus no expected market resistance. On the contrary, the cod has a good standing in the market. Given the high volumes, the fish is paid reasonably well. Farmed cod will not disrupt this picture in a foreseeable future, which is the main argument for why we propose cod farming as a good idea. There are, however, several other good reasons to farm cod. The seasonal variations in the cod fishery lead to an unsure situation for the coastal fishermen. Cod farming based on captured fish provides the fisherman with a form of resource control and the possibility to sell fish all year, which again improves the opportunity to negotiate a good price in the market. Cod farming also improves the provision of the volume and the quality the market wants. And then, usually, larger fish leads to higher price. Farmed based production is also an opportunity for the conventional processing industries along the coast to utilize their capacity outside the seasons.

An extensive cod farming industry opens for new organizational features. The species 'cod' offers an opportunity to combine purchase of captured cod with the purchase of farm-hatched cod fry, and thus phase one source out and the other in, dependent on price, quality, and supply. If an enterprise starts with captured cod, the farmer can concentrate on the market and sales work. As the marketing effort is established, farmed fry can be channeled into production to ensure continuity. The production form thus represents new opportunities in the adaptation between fisheries and farming and fisheries and processing.

Cod is a species with a long history and a dominant position in the Norwegian (and western) kitchen. However, it is perceivable that cod, even if it is available all year (from farm operations), will not be purchased during the summer months (the months without an 'r'), because the captured cod is known to be of lesser quality in that period. Even if the farmed cod can document superior quality during these months it may prove difficult to sell. Cognitive conceptions of cod may be projected on farmed cod, which might pose a problem for a cod farming industry.

An appropriate research question is thus what industrial structure is most robust for farming of captured or farm-hatched fish.

We argue that the advantage of cod as a farmed species in a starting-up phase is, first, the price stability provided by a market structure maintained by a large 'conventional' cod-fisheries sector. Secondly, the huge library of practical and scientific knowledge about cod and cod fisheries comprises a valuable resource. Thirdly, the general familiarity with cod as a species (among fish processors, fish buyers and exporters, in large consumer groups, and among public managers and supervisors) ensures a realistic anticipation of future problems. Lastly, the availability of cod fisheries institutions that direct focus, create attention, and organize decisions constitutes significant potential support for cod aquaculture. However, the path to a future cod-farming industry is not predetermined. Strategic choices are continuously made that open and close further organizational options.

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