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Diversity in narratives to green the Norwegian salmon farming industry

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ABSTRACT

Despite being an economic success and generating considerable profit, the Norwegian salmon farming industry face environmental challenges that need to be solved. Since 2014, all new licenses to farm salmon are labelled either "light-green", dark-green" or "development licenses". The industry is nevertheless characterized by the open net-pen as a hegemonic technology, and is susceptible to both cognitive and political lock-in. In the article, it is defined which narratives on "greening criteria" that are dominant and an analysis is presented on how narratives influence new licenses for salmon farming. The data is derived from 52 qualitative interviews and a broad qualitative analysis of trends and debates in the industry. From the perspective of evolutionary economic geography and the sub-concept path dependency, narratives on greening criteria for future salmon farming are divided in three categories: path extension, modest path renewal and strong path renewal. The findings reveal that although most licenses are linked to mere path extension, development licenses might disrupt this trend.

1. Introduction

The importance of greening the salmon farming industry is stressed by the official "watcher of the watcher" to the Norwegian parliament. On March 6th, 2012 it is stated by the Office of the Auditor General's investigation into the management of aquaculture, submitted to the Norwegian parliament [1]:

> "The aquaculture industry in Norway has grown considerably for several years and it is an important industry and employer. The Office of the Auditor General's investigations shows that the strong growth also has a significant environmental impact, particularly in areas with extensive, high density aquaculture production."

Since this statement, it has been more acknowledged, even in industry journals, to discuss the environmental problems of salmon farming. It is uncontroversial to assert that Norwegian salmon farming is a financial success, both for companies and for tax-receiving municipalities and the state. The turnover of the industry grows faster than the number of new licenses for farming. The turnover growth has been 45% from 2011 to 2014, compared to 11% growth in new licenses over the same period [2]. This discrepancy cannot only be explained by higher salmon prices, because the spot price for salmon increased a mere few percent over the same period. It follows logically that the productivity and density of production animals at each production site must be growing. Looking at the execution among salmon farming public limitied liability companies (i.e. stock listed companies) on the Oslo stock exchange, greening is at least not negative for the investment community. There is a trend towards more greening, even though it is arguably a slow trend. As an example: The two companies with the lowest execution of green technologies yielded lower stock returns than the average salmon firm from 2011 to 2014.

Salmon farming preconditions licenses allocated by the government. In parallel with an increasing recognition of environmental issues among most actors somehow engaged to Norwegian salmon farming, the Norwegian Directorate for fisheries has defined specific and future licenses for salmon farming as "light green", "dark green" and "development" licenses. These licenses mark a shift in the government's attitude, both because an expansion of licenses is thus more likely to occur, and because of the overt attitude to focus on green technology. New licenses are at high demand, but low supply. The low supply of new licenses is partly the reason for consistently high salmon prices while prices of most other commodities have declined particularly in 2015. Policy makers are thus in a position to indirectly regulate salmon prices and directly to regulate which technologies that are preferred.

Criteria to green salmon farming production are widely discussed, and are in this article identified as linked to three, main narratives. The focus on sea lice and wild salmon has been emphasized for many years [3], but recently also other problems receive increased attention. Different solutions to improve the industry do not only imply different degrees of innovation, but also different levels of "greening potential". How the greening potential reside in narratives is therefore important.

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A bank loan or private loan may for example be very dependent on the narratives residing in the creditors. Political decisions are likely influenced not only by optimal, technological solutions, but also by narratives. Because salmon farming still operates with open net-pens as a dominant technology, it is too early to evaluate all benefits and disadvantages of different solutions. The government both supports and inhibits various, new technology trajectories in language and in practice. The aim of the article is not do define *a priori* what is green, but rather to analyze which narratives that compete to define and construct how green licenses are designed. From a logical perspective, high level of potential greening impact is not identical with high, potential success rate, but should nevertheless be identical to the total efficiency (output/input) of a solution, when all externalities are included in the calculation.

This article has a theoretical part, with a discussion on how green solutions are most likely to be implemented considering both industry specific path dependencies/institutions, demands of the market and government policies. The theoretical aim is to expand the traditional material/technological focus in evolutionary economic geography by analyzing how narratives contribute to political decisions on licenses, greening criteria and technology. The article also has a practical part, with an analysis that deals with how different narratives on solutions, fixes and technologies define adequate greening differently. The salmon farming industry in Norway is a particularly good case for an analysis of the influence of language and opinions on political decision making, because it is political decision making that determines the number of farming licenses and the technological preconditions of each license.

In section two, evolutionary theory is presented as a theoretical perspective which is applied to the analysis [4,5]. In section three, the methodology to analyze narratives is presented. Section four deals with how different actors part-take and construct narratives on innovations to green the industry. Various solutions to green the industry is presented and linked to a specific narrative. Section five is an analysis of the relationship between narratives and policy. Section six is a discussion relating to all of the above chapters and there are conclusions in section seven.

2. Theory – an evolutionary perspective

2.1. Path dependence

Recently, evolutionary economic geography and the sub-concept path dependence theory has been rejuvenated and gained increased importance in studies of industries and technology development [6–9]. A key issue is that *"… the emergence of self-reinforcing effects steer a technology, industry or a regional economy along one path rather than another"* [10]. An industry path can be defined as the course of interrelated events *"…in which one of the available technological, institutional or organizational options gains momentum in time-space"* [11]. Thus, the establishment of a path is triggered by a certain event, such as, for example, the introduction of open net pens in Norwegian salmon farming in the late 1960s. The pen technology became the unifying factor reducing the search for alternative solutions and set the future trajectory of the salmon industry path [12,13]. Moreover, in addition to the technology and the firm population, an industry path includes policy arrangement, governmental institutions, research institutions, public organizations etc. The success of an industry path presupposes the presence of supporting institutions [14].

The development of an industry path includes the twin processes of continuation and change [15,16]. Some periods can be characterized by continuation, while other can be dominated by change. The continuation dimension is closely linked to self-reinforcing processes. Events that are aligned to each other foster the course of the path in an overall direction. The self-reinforcing process is driven by positive feedback, adaptations and learning effects [17]. The general trend is that an industry becomes established around specific technology solutions, taken-for-granted practice and institutionalized rules. This *may* lead the system into a state of lock in, i.e. a situation characterized by rigidity and erosion of adaptability. In such situations, a path becomes *"…confined to a single solution that does not need to be efficient"* [18]. Such extreme "single solution situations" are relatively rare in real life, especially in studies of the development of industry paths [19]. However, systems can have tendencies of lock-in and can be characterized by rigidity. There are different types of lock-in. One is technological lock-in, where the technological development becomes locked into a certain trajectory, even if alternative and sometimes more efficient technologies are available [20]. A second type is cognitive lock-in, i.e. the development of a collective mindset within an industry that is focused on outdated solutions when confronted with new challenges, for instance linked to the need for a "greener" production. A third type is political lock-in, i.e. when political institutions are self-reproducing over time and this may slow down industry renewal [21].

The change dimension is associated with the dynamic nature of a path. Contributions within evolutionary thinking have introduced three mechanisms that may foster path evolution: *layering, conversion and recombining* [22–24]. The notion of layering implies that the industry path and its institutional framework is gradually changed by the adding on of new procedures and practices. Still, the dominant technological solution is being maintained, while mode of organizing and the way it operates is being altered. The conversion mechanism is linked to the introduction of some new technological solutions and some new regulatory principles, still the new solutions are closely associated and building on existing technological paradigm. The final mechanism, recombination, provides the most radical change within a path, and is linked to the introduction of radical new technological solutions and new institutional principles. Relatedness between technologies used in different industry paths and technology development through co-evolution between industry paths where the cognitive distance is neither too large nor too small are important factors for recombination [25,26].

In a stylistic manner, it can be argued that industries that over time are dominated by continuation and lock-in tendencies combined with some element of layering and conversion will be characterized by path extension [27–29], i.e. to a large degree "more of the same" and an development along well-established technological trajectories. On the other hand, industries with a prominent occurrence of both layering, conversion and especially recombining mechanisms will be characterized by path renewal. New technologies are introduced, new markets are being exploited and the structure of the industry and its regulation framework is changing. Thus, there is strong degree of novelty within the path [30,31].

It is argued that 'un-locking' of an industry path can be triggered by external originated shocks or through co-evolution between related industry path sharing related knowledge and competence [32–35]. Still, there is lack of theorizing of how such transformation and renewal can be triggered and facilitated through policy. Apart from a few exceptions [36–38], the importance of policy interventions has received little attention in empirical analyses of path renewal. There has also been only moderate emphasis on the role of language and narratives for the introduction and development of new, dominant technological solutions. A narrative analysis may also reveal the existence of lock-in in various actors or groups.

Path dependency is a meaningful concept in the context of salmon farming both from a macro-perspective and micro-perspective. In a macro-perspective, Norway has long traditions as a resource based economy, which would benefit salmon farming because institutions for resource industries are strong. From a micro-perspective, salmon farming has arguably developed a path dependency of giving less priority to environmental problems. As an example of the latter, there is agreement among veterinarians and biologists that ceteris paribus higher density of salmon at a specific location yields higher levels of most viruses and parasites [39–42]. Most producers of farmed salmon