Exploring Ecopreneurship in the Blue Growth: A Grounded Theory Approach

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ABSTRACT

Fisheries and aquacultures, the farming of fish, provide people livelihoods in rural and coastal societies all over the world. Fish, mussels, crabs and seaweed are captured in wild seas, lakes, and rivers or farmed in ponds, raceways, and cage cultures. Simultaneously, the fisheries sector faces many challenges: Overfishing endangers biodiversity and the natural regeneration capacity of marine resources; inequality occurs in case of the distribution of fishing permissions and technologies; the skyrocketing economic growth of aquaculture (so called 'Blue Growth') can lead to high environmental risks. All these dynamics cause social changes for fishers and fish farmers and in consequence for the future of their enterprises.

In particular, the imbalance between supply from overfished oceans and the increasing demand for seafood grows from year to year. Modernising the aquaculture sector and its intensification seem to be the only possibility to close this gap and is one of the most important aims of the current reform of the Common Fisheries Policy of the European Commission. Thus, to match the challenges for marine fisheries in the near future is closely related to the further development of marine and inland aquaculture. But, conventional aquacultures are often connected with environmental risks. One possibility to overcome the environmental challenges and to reduce the pollution output of aquacultures at the same time can be seen in an ecological modernisation of the sector. The central protagonist in an ecological modernisation is the ecological orientated entrepreneur (ecopreneur). In the last decades a few ecopreneurial inland fish farmers have started to adopt two very different ecological innovations: idea–based organic practices or technology–based recirculating aquaculture systems. Nowadays, it is not certain whether these both 'green' innovations will diffuse or not in the aquacultural sector.

Using the Grounded Theory approach, biographical interviews with German fish farmers, both ecopreneurial pioneers and conventional farmers, were conducted and analysed to carry out the underlying reasons for or against the implementation of ecological innovations from the point of view of the adopting unit: the fish farmers. Building on empirical insights as well as sociologies of social change and diffusion of innovations, a middle–range theory of ecopreneurships in aquaculture was developed, which addressed the apparently simple question: Why do some fish farmers adopt an ecological innovation, and some do not?

Basically, our results show, that fish farmers' decision–making–process towards an ecological innovation is not only guided by economic cost–benefit calculation, but by a complex of patterns, where economic perspectives meet ecological motives as well as social aspects. By trend, those fish farmers, who had a strong ecological motivation, were embedded into a 'green–minded' social network and had a high degree of identification with their innovative production method, were willing to take higher risks in the adaption process of an ecological innovation than their conventional colleagues. Furthermore, our article argues that there is a need for further sociological approaches in fisheries and aquaculture research to understand patterns of acting motivation among seafood protagonists in deep. Understanding the fish farmers' perspectives, their construction of reality, can provide a sustainable fisheries and aquaculture management policy, which will be widely accepted by the individuals concerned.

Keywords: aquaculture, blue growth, diffusion of innovation, ecopreneurship, Everett M. Rogers, fish farmers, grounded theory, qualitative research, social change

1. Introduction

World fisheries and aquaculture provide livelihoods for people in rural and coastal societies. Fish, mussels, crabs and seaweed are captured wild in seas, lakes and rivers or farmed in ponds, raceways and cage cultures. In 2010, almost 55 million people worked

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in fisheries and aquaculture (FAO 2012: 10). But, overfishing the oceans endangers the biodiversity and natural regeneration capacity of marine resources (FAO 2012: 52–62). The effects of tightening up the situation, alongside global population growth, mean that a mismatch has emerged as a result of the continuously increasing demand for seafood and controls on available supply (FAO 2012: 82–89).

William F. Ogburn characterises such disparity between developments in a society as "cultural lag" (Ogburn 1964: 86). To overcome a cultural lag, the adoption of innovations is necessary. In its reform of the Common Fisheries Policy (CFP), the European Commission focuses on the intensification and modernisation of aquacultural production as an alternative to production through capture fisheries (European Commission 2013). Thus, to match the challenges for marine fisheries in the near future is closely related to the further development of marine and inland aquaculture. However, an increase in aquaculture activity can be accompanied by environmental problems arising from current production methods: sedimentation, changes in bio–geochemistry, pathogen transmission, inter–breeding with wild organisms, the introduction of alien species and indirect pressures on the ecosystem are all critical aspects of conventional production methods (Huntington et al. 2006). In regard to the economic, social and ecological aspects of imbalance in the fishery sector, Ogburns 'cultural lag' can be better specified as 'socio–ecological lag' for our observations.

From a theoretical perspective, an opportunity for overcoming socio–ecological lag is presented by ecological modernisation (Jänicke 1994: 41–57). In order to succeed in dealing with limited wild fish resources, growing demand for seafood and the environmental risks of conventional aquaculture, and in securing the livelihoods of people in rural and coastal societies, the adoption of eco–friendly innovations is needed in the fishery sector. Therefore, entrepreneurs are the central protagonists (OECD 2009: 3). Entrepreneurs as economic protagonists discover, create and exploit opportunities in an unconventional way and, in an ecological modernisation, they act in an eco–orientated manner (Patzelt, Shepherd 2011: 631–633). Robert A. Isaak (1998) defines this eco–version of an entrepreneur as an 'ecopreneur'. An ecopreneur reduces pollution and simultaneously generates profit for his business. He is an individual who introduces eco–friendly innovations into the community and provides ecological modernisation. Obviously, ecological modernisation has implications for social change (Diekmann, Preisendörfer 2001: 29–32).

Notwithstanding, social science approaches have rarely been applied in European fishery research (Schultz 2012: XIV). On the contrary, in the US where socio–cultural analyses have taken "The Long Voyage" (Abbott–Jamieson and Clay 2010) into the National Marine Fisheries Service, there are only a few studies looking at the European fisheries sector from a more socio–scientific angle (e. g. Bartłomiejski 2011). Not only for this reason, our article focuses on the phenomenon of ecopreneurship in aquaculture from a sociological perspective, because "social science data collection and research helps in making fishery management decisions" (Abbott–Jamieson, Clay 2010: 72).

While little research has been undertaken so far on the phenomenon of ecopreneurship in fisheries – and in aquacultures in particular – we know a great deal about the diffusion of innovations in general. The rural sociologist Everett M. Rogers developed his concept "Diffusion of Innovations" (2003, first 1962) in view of the industrialisation of US agriculture in the 1960s, the so–called 'Green Revolution'. Again and again, Rogers enhanced and updated his concept. Nowadays, it can be seen as a widely accepted macro–theory relating to the phenomenon of diffusion of innovation in general used by a variety of authors (e. g. Padel 2001). To our knowledge, there are only two studies using innovation approaches in fisheries science so far: Dewees and Hawkes (1988) investigated additional innovations such as new trawls and sonar in New England fisheries, while Tango–Lowy and Robertson (2002) have analysed the adoption of offshore aquaculture methods by traditional fishermen in New England. Devees and Hawkes mentioned the lack of information when applying Rogers' general concept directly to specific innovations (1988: 233). Tango–Lowy and Robertson pointed out the importance of Rogers' concept in the

general orientation of research, they emphasised a need to adjust the concept for the study of separate innovations as well (2002: 242, 249).

With regard to the abovementioned considerations towards applying innovation theory for phenomena in fisheries, we adjust Rogers' general approach to the specific research field of ecopreneurship in aquaculture. Rogers' approach delivers as an important theoretical framework for our sample selection and later analysis of the adoption process of ecological innovation in aquaculture. In spite of the relative strong theoretical pre–assumptions of innovation–adoption in our study, we risk to combine this deductive approach with a method which is well–known as strongly inductive: the Grounded Theory (GT). Nevertheless, it is precisely the deductive–inductive interplay which enables the exploration of the principles of ecopreneurship. Our article constructs a middle–range GT of ecopreneurship in aquaculture at the end, which addresses step by step the questions of an ecological modernisation of aquaculture on the individual level of acting: Why do some fish farmers decide to adopt ecological innovations and become ecopreneurs while other fish farmers do not? What are the driving forces and underlying motive patterns for ecopreneurship in aquaculture?

The first section of our article reviews the state of knowledge on innovation research and links them with the ecopreneurship approach. In section two, we identify production methods in aquaculture, which can be defined as ecological innovations and explain how they contribute to ecological modernisation from a theoretical point of view. Section three outlines the sampling of interviewees, methods of qualitative interviews and analysis used. In particular, we describe the combined inductive–deductive coding process applied. Section four summarises our findings and elaborates a GT on ecopreneurships in aquaculture. In the last section, we discuss the contribution of social science approaches to fishery management and the role of qualitative methods in innovation diffusion research regarding our results.

2. The adoption of innovations and ecopreneurship as theoretical framework

The phenomenon of ecopreneurship is closely connected with the principles of the development and diffusion of innovation. In literature, innovations occur because of unfulfilled needs (Rogers 2003: 172). From the macro–sociological perspective, needs are the results of a cultural lag:

> "A cultural lag occurs when one or two parts of culture which are correlated changes before or in a greater degree than the other part does, thereby causing less adjustment between the two parts than existed previously" (Ogburn 1964: 86).

Consequently, innovations are caused by a cultural lag and provide the chance to overcome the lag at the same time. The term 'innovation' is usually defined as "an idea, practice, or object that is perceived as new by an individual" (Rogers 2003: 12). In particular, 'subjective innovations' are most interesting, because they influence human behaviour directly (Mokhtar 2006: 11). However, the initiative for an innovation is no guarantee of restoring balance to 'unbalanced' elements of culture. On the contrary, the appearance of innovation often provokes social resistance, because innovation leads to uncertainty. It is worth mentioning that this resistance tries to maintain old–established ideas, practices and objects (Hauschildt, Salomo 2007: 178–208).

With regard to the micro–sociological level, the individual passes through the process of decision–making in awareness of an innovation:

> "The innovation–decision process is the process through which an individual (or other decision–making unit) passes from gaining initial knowledge of an innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision" (Rogers 2003: 168).

Many influencing variables relating to the innovation–decision process are known and presented by Rogers (2003: 168–218). In summary, the individual passes through five stages while adopting an innovation: knowledge, persuasion, decision, implementation and

confirmation. The knowledge stage commences when an individual perceives an innovation for the first time (Kiefer 1967: 40). However, individuals are not usually isolated, but live in societal networks. Societal networks influence the perception of old–established practices, the lags that have occurred, and the degree of open–mindedness towards new ideas (Rogers 2003: 171–174). In the next stage of persuasion, the individual evaluates the innovation in terms of its advantages, its compatibility with existing practices, and its manageability. Above all, the relative advantages that are perceived will influence the degree to which an individual is, or is not, attracted by the innovation (Rogers 2003: 223). Beside economic criteria, increases in social prestige or altruistic objectives are other possible advantages (Rogers 2003: 229). Innovation–adopting individuals tend to have distinctive characteristics, such as endurance and the readiness to take risks (Rogers 2003: 288–292). After the first two stages of knowledge and persuasion, the individual evaluates all the beneficial characteristics of the innovation and decides whether or not to adopt it.

Fish farmers are individuals who act in the economic sphere. From a macroeconomic perspective, cultural lags are perceived as changed market situations. Without adjustments, market inefficiencies will occur (Patzelt, Shepherd 2011: 632). In this manner, the adoption of economic innovations leads to entrepreneurship: "The economic dynamism inherent in entrepreneurship is believed to be an important way to safeguard the long–run viability and competitiveness of national economies" (OECD 2009: 3).

From the microeconomic perspective, the central players in economic development are the entrepreneurs. As committed market actors, entrepreneurs search systematically for market inefficiencies and recognise them as opportunities for gain. In classical economic approaches, entrepreneurs try to maximise profit first and foremost (Cohen, Winn 2007: 36), creating employment and increasing welfare and consumption (Patzelt, Shepard 2011: 637).

Therefore, entrepreneurs use new resources and organise them in an unconventional way (Fueglistaller et al. 2008: 7). Current literature also assumes the existence of several non–economic gains (e.g. Schaper 2005: 8). With regard to ecological modernisation in the fishery sector, one type of altruistic entrepreneur is highly interesting for us: the ecopreneur. The term 'ecopreneur' reflects the "environmentally–responsible entrepreneur" (Schaper 2005: 8). The ecopreneur uses entrepreneurial opportunities to adopt environmentally–friendly production methods or to introduce new eco–friendly products to the market. In brief, the ecopreneur is an economic innovator, using ecological innovations to overcome a cultural or, more precisely, a socio–ecological lag.

3. Organic aquaculture and recirculating systems as ecological innovations

In aquaculture, two production methods can be seen of interest thinking about ecological innovation: organic aquaculture and recirculating aquaculture systems. Organic aquacultures are fish farms that use certified extensive production methods, highlighting animal welfare and environmental conservation aspects. In the first instance, fish farmers and organic agriculture associations in Austria and Germany started to develop such production methods for carp farming in 1994 and 1995 (Bergleiter and Censkowsky 2010: 7). In 2008, there were about 240 aquaculture projects in 29 countries (Prein et al. 2012: 552). In 2011, the production of organic seafood was estimated at 80,000 tons, which was only 0.1% of total global aquacultural production (Prein et al. 2012: 563). The majority of organic aquacultural projects are located in Europe, which is also the most important market for organic seafood (Prein et al. 2012: 552). Germany, as a country with 'roots' in the early development of organic aquaculture, is the largest market for organic seafood within Europe. But, based on data from 2009 (Lasner et al. 2010) and further research (interview Altena 2011), only 22 German fish farmers had converted their farms to organic by 2011. In 2013, the number of organic farms was estimated at 30 farms (Weiler 2013).

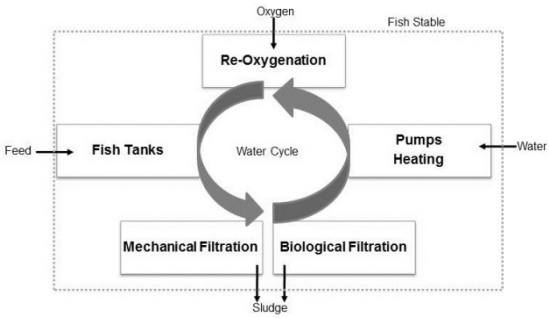
Figure 1. Organic trout aquaculture

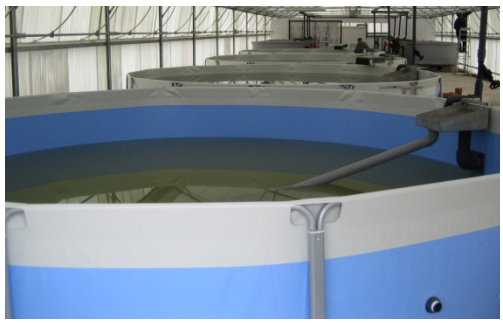
Figure 2. Conventional trout aquaculture

Altogether, German organic fish farmers may produce about 270 tons of organic fish per year, mainly carp and trout. German conventional aquaculture production amounts to about 44,000 tons (Brämick 2011: 2)[2]; thus the organic share of the aquacultural market was less than 1% of the German market in 2011.

In contrast to organic aquaculture, the recirculating aquaculture system (RAS) is a highly technological method of intensive production. Recirculating aquaculture systems are aquacultures in which the water used for production is reconditioned. While conventional aquacultures usually use raceways, ponds or tanks through which water flows one way, RAS is an almost closed water management system (Pillay, Kutty 2005: 81–82). The use of fresh water is minimised. This is an important as freshwater resources are scarce in many regions. Furthermore, the recirculating systems are compact and designed to be space saving. In the 1960s, German fish farmers began to experiment with RAS technology (interview Stähler 2011). Private and public research institutes then developed the technology into a market–ready innovation during the 1980s (Rümmler 2010: 41).

Figure 3. Recirculating aquaculture system (RAS). Source: FAO





Nevertheless, the first plants were very expensive and often not as effective as anticipated, particularly because of the high energy costs of water treatment (Wedekind 2008). Around 2006, a new wave of RAS foundings was initiated by government subsidies for the biogas sector. The biogas plants were an optimal supplement to the RAS plants which could then be supplied with cheap energy. However, the exact number of recirculating aquaculture systems in Germany is currently unknown. Literature (e.g. Schmidt–Puckhaber et al. 2010) and own research suggest that there are at least 36 privately–owned RAS plants in Germany. Together, RAS fish farmers may produce about 1,600 tons of seafood per year (Destatis 2013).

[2] Newer official data (Destatis 2013) assumes that the aquacultural production is less at all (about 20,000 tons per year). Due to changes in the survey methods, this data has been strongly opposed inside the German fisheries science community (e. g. Meinelt et al. 2014: 51). In consequence, we refer mainly to the last data accepted in 2011. But, we have to mention that there is still an uncertainty about the exact structure and production of the German aquaculture sector left in general. Notwithstanding for our observation, the data available is completely sufficient to identify groups of "innovators" and "early adopters" in aquaculture.

Both of the abovementioned types of aquaculture, organic and recirculating systems, can be seen as innovations of the late 20th century. Both innovations enable their adopters to reduce ecological costs in fish farming in very different ways. Organic aquaculture methods aspire to a 'close to nature' fish farming practice. In contrast, recirculating aquaculture systems use high–tech to pursue a fish farming practice that is almost independent of environmental exchange, so as to prevent pollution. Both practices are, by theoretical definition, environmental innovations, which can be seen as major change innovations as well, because their adoption accompanies with a radical change in production and/or business operating for the ecopreneurial fish farmer. Finally, both methods have not diffused widely yet. In conclusion, fish farmers who adopted organic aquacultural or recirculating aquacultural methods in the recent past are pioneers from an innovation theoretical angle. They are ecopreneurs of the first generation, who have introduced ecological major change innovations in their fisheries communities. That is why, to analyse their decision–making inside the adoption process is most remarkable to understand the guiding individual perspectives and patterns, which lead to an ecopreneurship.

4. A qualitative approach towards an explanation of the practice of ecopreneurship

To understand the motivation for adoption of ecological innovation, the 'perception–acting' systems of the ecopreneur must be determined. Quantitative research methods are rarely able to disclose the complexity of individual adoption processes (Rogers 2003: 115); moreover, a qualitative approach is commensurate with the research phenomena addressed (Schaper 2005: 11; Davidsson 2004: 56). A qualitative approach focuses on the subject and the subject's interpretation of a situation to explain how individuals come to a decision. Because a range of established (general) theories and concepts of diffusion of innovation and entre–/ecopreneurship exists, our qualitative research approach has to include the abovementioned theories (deductive), as well as remain open to unexpected insights from empirical data (inductive). Therefore, the method applied has been oriented towards the Grounded Theory (GT) approach of Glaser and Strauss (2008, first 1967), to guarantee an inductive–deductive interplay. GT enables the discovery of hypotheses about the phenomenon of ecopreneurships in aquaculture by using systematic and, concurrently, open–minded data collection and data analysis methods (Glaser, Strauss 2008: 3).

In a first step, the sample of interviewees was determined. Qualitative surveys usually work with small samples, as qualitative interviews and their analyses are very time–consuming. Qualitative sampling is based on the principle of an optimal contrast, which is a major logic of GT theoretical sampling (Glaser, Strauss 2008: 45–60). Comparing very similar and very diverse cases in one sample is the precondition for analysing a wide variety of phenomenon. Thus, the initial sampling procedure considered the following criteria: ecopreneurs should be full–time fish farmers; their implementation of the ecological innovation should be complete; interviewees should be sole proprietors (as is usual in the German fishery sector) to be the only decision–making unit; ecopreneurships should differ in some characteristics (farm size, produced species, location, point of adoption and fish farmers' socio–demographical data). According to these criteria, 22 organic and RAS fish farmers were identified as ecopreneurs of the first generation and ranked by principle of contrast. Subsequently, for the interviews, Andreas Witzel's (2000) problem–centred interview design was used, which also traces back to GT methodology. The problem–centred interview satisfies two different requirements in one design. On the one hand, a strong narrative element fulfils the qualitative principle of being open–minded (for the individual's relevance system) by using a storytelling stimulus. Unlike to common one–dimensional narrative stimuli, we developed a multi–dimensional stimulus which was positively tested in pilot interviews. It stimulated extensive narrations from the interviewees themselves at the beginning of each interview:

> "Please tell me, when and how you first recognised organic aquaculture methods/recirculating aquaculture systems, and in consequence, tell me, when and why you decided to convert your fish farm to organic/to build

a recirculating aquaculture system? Please take your time. Start at a point where you think your story began, and end with your story in the present".

On the other hand, a field manual with guidelines for the interview was used, structured according to the thematic framework of ecopreneurship and innovation theories. This second part of the interview consisted of a total of 38 one–dimensional open–ended questions addressing four thematic groups: communication behaviour, reaction of the social environment, used resources and how/why the opportunity was originally identified. Finally, the interviewer asked the fish farmers to evaluate their decision–making retrospectively and to rate other production methods. Following GT logic of theoretical saturation (Glaser, Strauss 2008: 61–77), the first round of data collection amounted to ten interviews with ecopreneurs: five organic and five RAS fish farmers. Then, data collection turned to counterexamples in the field: the conventional fish farmers who were aware of the production principles of existing ecopreneurships (e. g. through living in the neighbourhood of an ecopreneur), but had decided not to use organic or RAS fish farming methods. In GT methodology, data collection and analysis are interconnected. The interview procedure responds to ongoing analysis with respect to new empirical knowledge, until theoretical saturation. All in all, the theoretical saturation for the counterexamples was reached following ten interviews with conventional fish farmers during the second step of data collection. Table 1 shows the whole sample in detail:

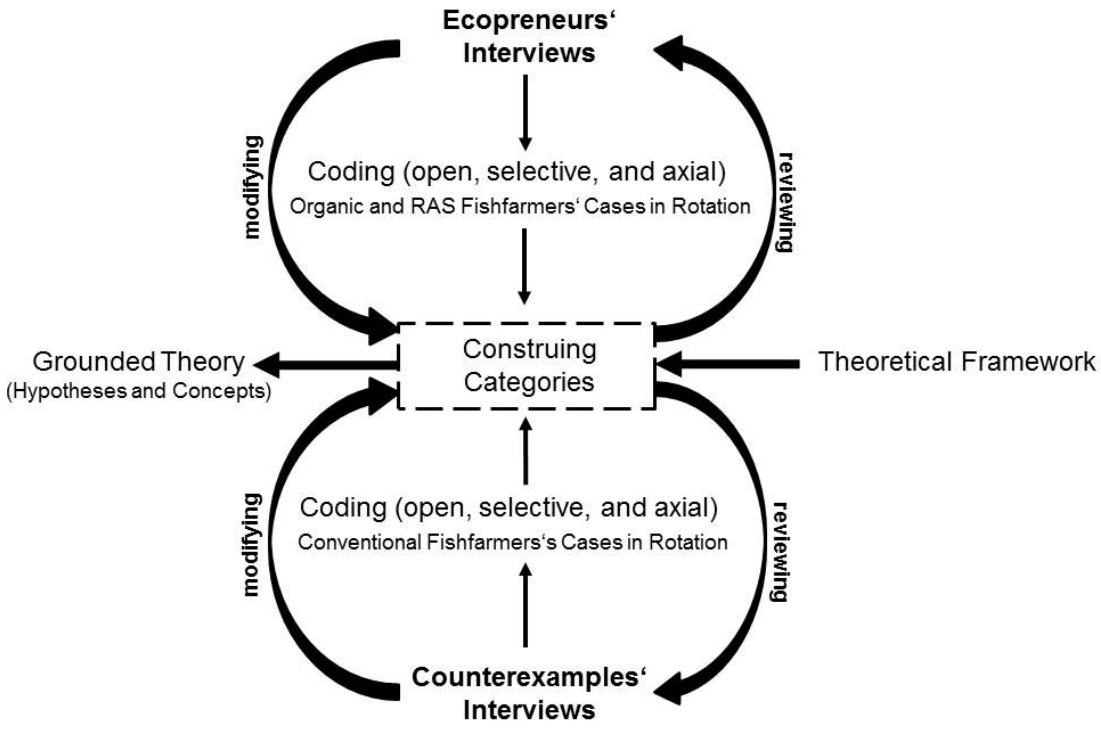
Table 1. Sample characteristics

Criteria	Five Organic Fish Farmers	Five RAS Fish Farmers	Ten Conventional Fish Farmers
Point of Adaptation (Year)	1995, 2003, 2003, 2004, 2008	1966, 1987, 1992, 1997, 2006	-
Ecopreneurs' Age: Point in Time Adoption / Conventional Fish Farmer's Age: Point in Time Interview	between 33 and 69	between 26 and 62	between 34 and 64
Education	secondary school, junior high school, A level, technical college, university diploma	secondary school, junior high school, university diploma	junior high school, A level, technical college, university diploma
Profession	master fish farmer, agricultural engineer business economist, PhD chemist, farmer	master fish farmer, fish farmer, farmer, business economist	master fish farmer, fish farmer, farmer, mechanic, plumber, engineer
Produced Species	trout, char, carp	eel, catfish, European catfish, carp, koi carp, sturgeon	European catfish, trout, carp, sturgeon, pikeperch
Annual Production	2 up to 20 tons	50 up to 150 tons	5 up to 80 tons

To summarise, ten interviews with organic and RAS fish farmers, pioneers in the fishery sector, and a further ten with conventional fish farmers were conducted in eight federal German states. The interviews took place between October 8th 2010 and November 7th 2011. Each ecopreneur interview lasted up to 1.5 hours; each counterexample interview took up to 30 minutes.

The interviews were analysed using constant comparative GT coding procedures (Glaser and Strauss 2008: 101–115) with one exception: as usual, concepts and later categories were created by intensive inductive–deductive interplay, but reviewed innovation and entrepreneur theories provided a strong heuristic. The following figure illustrates the coding method used.

Figure 4. Coding process



According to the coding process, the empirical material was step by step categorised. While construing the categories, the analysis was theoretically sensitive and empirically open as regards the main subject of study: ecopreneurships in aquaculture.

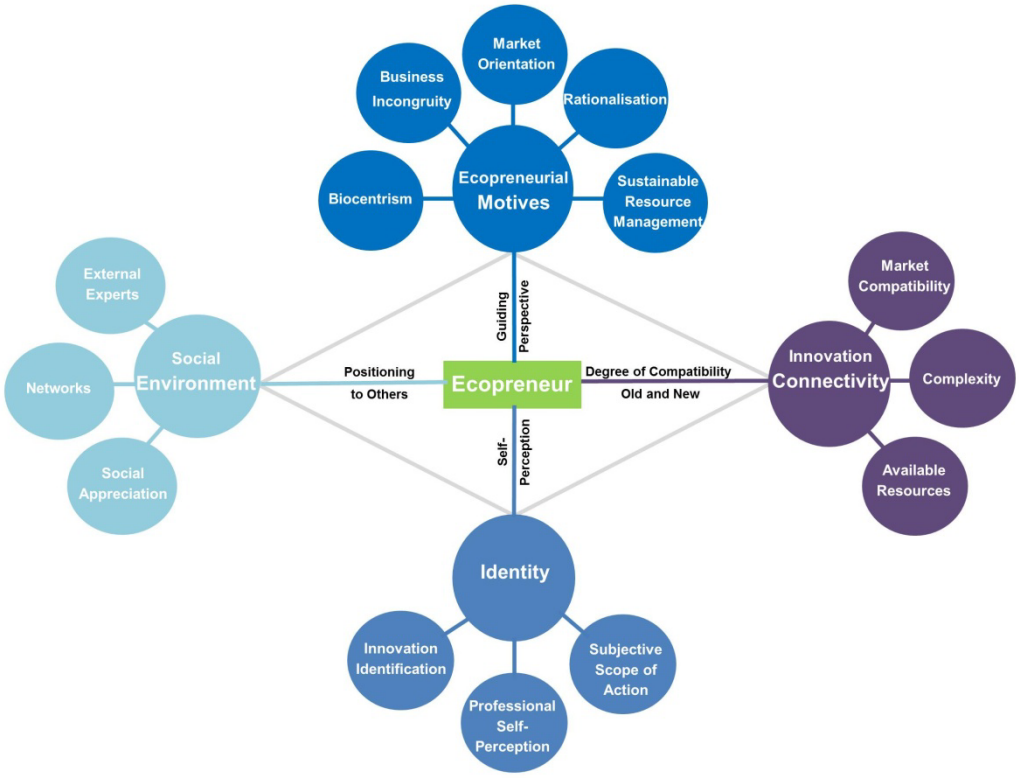
5. A Grounded Theory of ecopreneurships in aquaculture

As a result of the analysis, four code families with 14 different categories were developed, which structured the text material of the transcribed interviews:

a) *Ecopreneurial motives*: business incongruity, biocentrism, sustainable resource management, rationalisation, market orientation,
b) *Innovation connectivity*: available resources, complexity, market compatibility,
c) *Identity*: professional self–perception, innovation identification, subjective scope of action,
d) *Social environment*: networks, external experts, social appreciation.

Altogether, the code families and categories developed have provided the basis to explain the motivation patterns of ecopreneurships in aquaculture. This section reviews the insights gained from the analysis as shown in figure 5.

Figure 5. Categorised ecopreneurial decision–making in aquaculture



To illustrate the results of our study of ecopreneurships in aquaculture, selected quotations from the interviewees are presented. These are cited anonymously by paragraph of interview, and the authors have translated all verbatim quotes. By definition, ecopreneurship incorporates both economic and ecological motivation patterns. For ecopreneurial fish farmers, the search for an innovation starts with confrontation by an economic crisis. The crisis puts the previous characteristics of the fish farmers' business model directly into question and causes a *business incongruity*. Such a crisis occurs through recession in production or distribution caused by water supply problems, fish loss through predators or diseases, or changes in the market environment.

> "Weekly, we placed an advertisement in our regional newspaper which cost 180 D–Mark. But nobody came. Nobody wanted to buy our conventional carp. Of course, some customers came, but too few" (Organic fish farmer E: 73).
>
> "We simply built one recirculating system […], because there was no water anymore" (RAS fish farmer A: 149).

Crises that have occurred are often perceived by the fish farmers to have been imposed by external factors. In consequence, fish farmers feel forced to search for an appropriate problem–solving method (forced reaction). In spite of the severity of crises, leaving the fishery or agricultural sector is not an option for the protagonists. Their professional identity encourages a search within the fishery sector or related field of agriculture, as some of the RAS fish farmers have roots in agriculture. In another form of crisis, which is perceived to be less significant by the fish farmers, protagonists identify inefficiencies in their production or distribution system which could be optimised (voluntary pro–action). In this case, fish farmers' search for a solution is often driven by a *market orientation*. The consequences of both forms of crisis affect

the fish farms directly and are apparent to the fish farmers. The innovation search goes hand in hand with activating *networks*, in particular seeking for positive archetypes who demonstrate a problem–solving strategy through their ecopreneurship. Positive archetypes act as stimuli for imitation. First and foremost, the positive archetypes that are located in the close neighbourhood (observability), and whose preconditions (e.g. organic farmers) are transferable to fish farmers (analogy), influence the decision–making process that leads towards an ecopreneurship. Furthermore, the fish farmer's family is also regularly integrated into the decision–making process.

In the period of innovation search, *external experts* can fulfil different functions: as change agents, they might direct the fish farmer's attention to an innovation, initiate contact with positive archetypes, and provide information about the innovation to reduce uncertainty. Interestingly, our fish farmers had usually contacted change agents after their decision–making. This notable late contact with change agents is rooted in an ambivalent attitude towards experts, whereby experts are perceived as foreign carriers of theoretical information, in comparison with the fish farmer's practical knowledge.

> "And then I heard that the organic farmer association was planning to develop the first guidelines for organic aquaculture. I called them and asked if I could take a look at their outline as a practitioner […]. I got a version and put in my two–penneth. But, I never got the final version and no 'thank you', to be honest. I did it voluntarily, to prevent rubbish. Because this often happens, when only theorisers and scientists work on something, and no practitioner. […] In the case of the guidelines, you immediately recognised that the responsible persons had no clue about fish farming" (Organic fish farmer B: 39).

A feeling of paternalism occurs. Fish farmers often anticipate that external experts – perceived as strangers – value their theoretical knowledge more highly than that of practitioners. This perception builds resistance towards experts.

On the other hand, the ecopreneurial fish farmers are dependent on experts for the final implementation of an ecological innovation: change agents possess special knowledge of handling the innovation (RAS fish farming) or authorising market entry through institutional certification (organic fish farming).

While the onset of the innovation process is caused basically by economic crises close by, sensitivity towards ecological crises at a distance becomes coactive later on in the process. These 'distant' crises are not directly observable for the fish farmers and do not directly affect their farm. Above all, the socio–ecological lag in the fishery sector then becomes coactive.

> "If you've got the possibility of producing fish in an acceptable way, in a recirculating aquaculture system, as we do it, there is no ecological doubt in consuming such products. […] I simply do something good for nature, in consequence, too. That is to say, the marine fish resources have a chance to be restored. It's [RAS] a way of conservation fish production" (RAS fish farmer C: 11).

Ecopreneurial fish farmers frame their ambition to overcome a personal observable economic crisis with an impersonal non–observable ecological crisis. In addition to the socio–ecological lag in the fishery sector, other eco–frames are used: questions of energy and water supply management, animal welfare or safeguarding global food security. Experiencing direct economic crisis and framing it within a socio–ecological crisis create the initial situation for an aquacultural ecopreneurship.

Generally speaking, all ecopreneurs question the current production methods of the fishery sector, in terms of economic efficiency and/or their environmental compatibility. However, ecopreneurs differ with regard to i) the nature of their criticism and consequently, ii) their choice of ecological innovation, according to their point of view. RAS fish farmers perceive the recirculating aquaculture system as an innovative means of production. Adoption results from being persuaded that an

efficient production system (*rationalism*) provides ecological benefits as well (*sustainable resource management*). In this case, ecological benefit deals primarily with the logic of reduced resource consumption. In particular, the recirculating aquaculture system addresses water treatment and renewable energy use. Additionally, the fish are seen as resources too. Innovative systems such as the RAS are directed mainly towards production, that is, the supply side and their products serve the conventional seafood market. RAS production techniques might be new ('hardware innovation'), but the main objective of increasing production can be seen as a common aim throughout the sector and highly acceptable for conventional fish farmers, too.

> "It [RAS] would be one way to increase fish production and reduce water consumption at the same time. That's the aim" (Conventional fish farmer D: 46).

In contrast, organic fish farmers see organic aquaculture as an innovative paradigm. Organic fish farming questions the degree of intervention in nature that is acceptable, as well as following the logic of rationalism and the priority of efficient organisation of production. In spite of aiming at more control over natural processes, organic fish farmers recognise human self–effacement as a moral 'good' which enables the development of nature, independent of human interference. This ethical standpoint is based on *biocentrism*.

> "The creature we'd like to eat, has a right to know weather conditions and seasons. Has the right to wallow in mud, if it's a pig. And a fish has the right to grub in pond mud, if it is a carp […] and to have a variety of food in his foraging, tasting certainly better then industrial fish food" (Organic fish farmer E: 217).

Above all, organic fish farmers focus on animal welfare. Fish are seen as individual creatures in their own right and should be embedded, as much as is possible, in a close to nature production environment. Therefore, the ecopreneurs reject intensive production methods. Following this logic ('software innovation'), biocentrism usually leads to less production. Organic certification enables organic fish farmers to participate in the market for organic food and thus to sell their organic fish at premium prices. However, selling fish for considerably higher prices carries the risk of losing former customers after conversion, and having to explore new market segments in the organic food sector.

The confirmation stage of an ecological innovation is influenced by economic motives, above all market compatibility. However, when there are economic setbacks during the adoption process, ecopreneurs tend to keep the adaptations running because of their ecological beliefs and *identification with 'their' innovation*. Economic motives, such as overcoming business incongruity, rationalism, and market orientation, interact in the decision–making process with ecological motives like biocentrism and sustainable resource management. Nevertheless, the decision to adopt an ecological innovation comes with uncertainty of 'the new'. This is why, in their own minds, fish farmers may link their (unknown) ecopreneurship with other (known) production practices.

> "The RAS fish production is anything but completely dependent on nature, as the normal fishery is. The RAS fish production is widely, yes, I use this unlovely word, an industrial production. […] I have a farm, in which livestock farming is efficiently organised. And likewise, this is possible for aquaculture, too" (RAS fish farmer F: 61).

Ecopreneurs compare their adopted innovation with present practices in order to reduce uncertainty and to position themselves within the current dialogue concerning environmental pollution. Thereby, they describe the situation in terms of archetypes: modern industrial fish farming or traditional handcraft aquaculture; controlled production, independent of natural conditions, or 'close to wilderness' production. Organic fish farming is mainly seen as the re–establishment of a former balance in

economic and ecological orientation: a balance identified in previous traditional aquacultural practices which has now been lost. Conversely, RAS fish farming is seen as establishing a modern aquacultural production method. RAS fish farmers are aware of several technical challenges associated with their ecopreneurship, such as the, often difficult, use of renewable energy for their RAS plants. Nevertheless, they are convinced that their production system is able to achieve a balance between economic and ecological orientation in the near future.

In spite of these positive attitudes, ecopreneurs also use negative counterexamples to highlight their (intangible) ecological motivation. In this context, organic fish farmers contrast their own breeding practices with those of industrialised aquaculture methods, which create pollution and endanger animal welfare and biodiversity. A problematic relationship between ecological and economic perspectives is often pointed out.

> "I've got a colleague, […] who produces over 100 tons of trout […] and he makes a pretty penny. […] Probably, he has another relationship to the creature, I don't mean, he is maltreating the fishes, but to my mind, it isn't totally appropriate to the fish" (Organic fish farmer B: 175).

On the other hand, RAS fish farmers also contrast their aquacultural methods with traditional practices, which are seen as being too inefficient to solve environmental and food security challenges simultaneously.

However, organic aquaculture and recirculating aquaculture systems are major change innovations. If the ecopreneur decides to adopt an ecological innovation, he has to change his production system. As RAS is an intensive farming method and mainly characterised by hardware investments, including new tanks, pumps, temperature regulation and water treatment systems, RAS fish farmers cannot resort to (previously) *available resources* from their former production system. Thus, investment costs and the *complexity* of new RAS technology are very high. In contrast, the conversion to organic aquaculture is based on the idea of a close to nature fish farming practice. The major challenge of adoption is certification of the fishery according to organic guidelines, defined by the EU regulation and organic farming associations (e.g. only native stocks, low stocking density, prohibition as regards the application of chemicals and some synthetic substances). For the majority of fish farmers, it is not difficult to fulfil these requirements, because German fish farms usually have extensive production practices. Thus, the idea of certified organic aquaculture might be new, but is often highly compatible with previous resource use. The main challenge for organic fish farmers is the organisation of organic feedstuff which, in case of farming salmon and trout, consists partly of fishmeal derived from wild capture.

Conventional fish farmers see the appearance of ecological innovations as deviance. Ecopreneurship breaks routine practices. Furthermore, the existence of ecopreneurs puts current production methods into question. Thus, conventional fish farmers automatically feel forced to legitimise their production methods. As a result, resistance towards ecopreneurship occurs: conventional fish farmers, as representatives of the old system, often see themselves as being threatened by the ecopreneurs as regards economic (in their market share) and ethical (in their ecological orientation) issues. This resistance can lower the *social reputation* of ecopreneurs in their fish farmer community. In brief, the resistance patterns identified can be summed up as follows. Ecopreneurs must demonstrate economic success:

> "[…] because how else should it function? Sooner or later, an unprofitable venture can't exist" (Organic fish farmer G: 227).

The most obvious basis for resistance is doubt about ecopreneurial success. With regard to recirculating aquaculture systems, the innovation causes substantial

investment in the plant, and high operational costs especially for energy. Altogether, these costs are seen as high barriers to the adoption of this innovation.

> "First, all these technical things you need, all these efforts you need [in operating RAS]. All is run by energy. There's really nothing, nothing, there's no free run in these systems. Everything is run by electricity, and the costs for energy are too high" (Conventional fish farmer H: 20).

Furthermore, the fact that RAS fish farmers are not able to market their regular supply of fish directly to consumers, and are therefore dependent on wholesalers who pay only low prices for seafood is seen as a disadvantage.

On the other hand, organic aquaculture is perceived to be insufficient, as fish production is low while the costs of organic feed and labour input are high. The proportion of consumers who are willing to pay a premium price for organic fish is regarded as too small and, as these consumers mainly live in urban areas, it is hard to reach them.

> "I like the idea of organic aquaculture and that they get such prices. If we would operate close to a large city, it would be certainly different for us, too. But we are in the countryside, here, no one will pay the price for organic fish" (Conventional farmer I: 26).

Most criticisms address the low *market compatibility* of recirculating aquaculture and organic aquaculture systems. Principally, conventional fish farmers agree with the idea of ecological innovation, because eco–friendly behaviour is deep–rooted, and has positive connotations in the collective consciousness of German society. In conclusion, arguments about rejecting ecological innovations do not question the ecological idea behind the innovation but doubt their economic adaptability. Conventional fish farmers usually refer to the needs of the external market as an anonymous foreign power that reduces their *subjective scope of action*, whereas ecopreneurs appear to disprove this interpretation. So, conventional fish farmers observe the conditions of ecopreneurial fish farming in isolation: as apparently individual and non–transferable. They perceive the ecopreneur as an interesting but abnormal exception that cannot be taken as a positive archetype, particularly in terms of a business idea. Besides, there is also a second aspect of their criticism which challenges the ecological orientation of the ecopreneurships. Because the ecological–economic balance of RAS is not always achieved, conventional fish farmers blame RAS fish farmers in terms of high energy consumption, which is not seen as sustainable. They also criticise high stocking density as inappropriate to the welfare of the fish. To emphasise their own ecological orientation, conventional fish farmers evoke images of an extensive eco–friendly, in contrast to industrialised aquaculture.

> "If I can grow out fish under natural conditions like we do in our region, it is not logical to build a recirculating system. It would not use those natural resources and I would produce unnecessary pollution by consuming electricity for heating the water in spite of using the sun. And I would need artificial feed and not the natural one, which exists in nature ponds […]" (Conventional fish farmer I: 70).

As another result of the portrayal of 'ecological orientation' and of non–organic farms as operating in a similar way to organic ones, conventional fish farmers negate the real difference between conventional and organic fish farming. In the eyes of conventional fish farmers, organic aquaculture is no innovation, but merely a new term for well–known and common breeding practices:

> "What we do is organic aquaculture!" (Conventional fish farmer J: 3).

The formal definition of organic aquaculture ((EC) 710/2009) is seen as paternalism which is established by external theorisers and conservationists and as a threat to the conventional fishery sector. For conventional fish farmers, acceptance of organic

aquaculture as an eco–friendly fish farming method by definition, runs the risk of being stigmatised as 'not eco–friendly' by comparison. Thus, the underlying resistance of conventional fish farmers towards organic aquaculture seems to be rooted more deeply than that associated with RAS, and accompanied by prejudice. The conventional fish farmers' persistence in rejecting such innovation is based on the absence of a coactive crisis: the experience of a personal economic crisis framed by a distant ecological one.

Ecopreneurs see such resistance in the fishery community, and it directly influences *ecopreneurial self–perception*. Experience of resistance plays a role in the decision–making process of the ecopreneurs and can lead them to either continue or interrupt the adoption of their innovation. Ecopreneurs deal with the resistance of colleagues
by using different strategies for self–perception. One of these is associated with the role of the 'conventional fish farmer'. Ecopreneurs that address this normalisation strategy try to challenge the differences between new and old practices, just as the conventional farmers do. They negate their role as innovators and perceive themselves as conventional or 'normal' fish farmers. In order to do this, they highlight their economic perspectives, which are discussed within the fishery community in a much less controversial manner than are ecological motives. Through illustrating innovation adoption as routine business management, they demonstrate established (so–called) rational decision–making. From this standpoint, defining the adoption process as re–innovation – the revival of traditions within a new framework – can also be seen as a normalisation strategy, whereby some ecopreneurs try to reduce resistance to the innovation by connecting their ecopreneurship to well–known ideas and practices.

In contrast, other ecopreneurs accept their role as deviant and redefine it positively. By taking an offensive pioneer role, they emphasise the difference between themselves and conventional fish farmers. On account of this role–taking, they do not receive social appreciation from within the fishery community but, rather, from non–fish farmers, such as neighbours, consumers, change agents, ecopreneurs from other social fields, politicians and environmental organisations.

> "Well, the social community, I have to say, was happy, that someone did something [...]. You have to consider, I provided eight new jobs in the new aquaculture. [...] For the village, which is not big, this is a very positive matter" (RAS fish farmer F: 125).

External agents are probably more open–minded towards the ecological innovation than fish farmers in general, because they are not directly affected by ecopreneurs in the case of competition or ethical issues.

Although both strategies – normalisation and pioneer role–taking – appear to be exclusive, both actually correspond with each other. Ecopreneurs are continuously in a process of positioning and stress, until the ecological innovation diffuses. The more the innovation diffuses, the more it will be accepted and the more the position of the ecopreneur will be legitimised. Also, ecopreneurial pioneers cannot be inclined towards social exclusion, as they must look for supporters and adopters of the innovation among other fish farmers, who would then help to strengthen the diffusion process.

6. Discussion and conclusion

Our investigations are rooted in a strong theoretical framework which, for its own part, has been influenced essentially by Everett M. Rogers' "Diffusion of Innovations" (2003). In addition, we have combined Rogers' concept with current entre–/ecopreneurship theories, so as to explore the various aspects of ecopreneurship in the context of ecological modernisation in aquaculture. As an empirical example of the phenomenon, we have chosen ecopreneurial pioneers of the first generation in the German fish farming community, which is influenced by the development

of two very different ecological innovations: organic and RAS practices. To apply a theoretical framework using GT methodology is not very common, as existing theories might deductively influence the research (Strauss 2004: 443). However, the theoretical framework has provided a heuristic for us and, thereby, an excellent tool with which to structure data in the inductive–deductive interplay of coding. On this basis, a middle–range theory about ecopreneurship in aquaculture has been developed. This theory literally addresses a limited field (aquaculture) and applies to a specific time period (first adopter generation) (Wienold 2011: 688).

Our findings help to generate some general recommendations for further innovation research: one driving factor for the adoption process of ecopreneurial fish farmers is their role set. How do we deal with the ascribed role of deviant? The principle of transforming the deviant role to a positive pioneer role, or of redefining de–construct it as the role of a 'normal conventional fish farmer', significantly affects the innovation–decision process. In particular, the special case of ecopreneurial fish farmers indicates the importance of role sets for innovations which are perceived as controversial in the social field. Finally, role sets strongly influence the relationship between ecopreneurs and other protagonists such as colleagues, change agents, politicians, etc.

Rogers has highlighted the “relative advantage” of the innovation that is perceived by the adopting unit, as one central criterion influencing the innovation–decision process (2003: 223). However, we could not identify this particular criterion as a central one in our data. As an abstract criterion, “relative advantage” might fulfil its function in a macro–theory approach to innovation adoption, but it could not satisfactorily explain ecopreneurship in detail. This is exemplified by the biocentrism perspective, whereby animal welfare through low stocking densities is obviously perceived as an advantage by organic fish farmers, while RAS fish farmers value intensive aquaculture with, conversely, high stocking densities as an advantage. Similar differences have been registered with regard to other issues such as traditional egocentric motives like profit maximisation, and current altruistic motives like sustainability for entre–/ecopreneurship (Davidsson 2004: 1–16). While these theoretical concepts aim to explain phenomena at a general level, they only suggest basic orientation in the case of practical ecopreneurships. They cannot explain the underlying driving factors in the decision–making process of ecopreneurs.

Notwithstanding these observations, interviews with ecopreneurs who have completed the decision–making process can be seen as critical. It can be assumed that ecopreneurs who are still engaged in decisions about the adoption of an innovation perceive the decision–making process differently from those who have already adopted the innovation. However, with respect to the small population of ecopreneurs in aquaculture, it has not been feasible to identify, and sample, enough interviewees engaged in the decision–making process. Instead, and based on the recommendations of previous studies (e.g. Rogers 2003: 112–114; Dewees, Hawkes 1988: 224–225), we compared two very different innovations in the same social field. This strategy enabled pro–innovation bias to be overcome (Rogers 2003: 106–118) and gave more stability to the resulting hypotheses (Dewees, Hawkes 1988: 225). While researchers have mainly analysed 'successful' innovations, which are rarely accompanied by resistance, the analysis of resistance towards an innovation provides notable findings about barriers to adaptation and about the diffusion of innovation process itself (e.g. Bauer 2006). Without the analysis of conventional counterexamples to the fish farming ecopreneurs, the struggle to answer the question 'what is eco–friendly fish farming?', as a barrier to diffusion, could not have been elaborated.

In summary, our investigations have shown that social science approaches can be reasonably addressed to fishery phenomena and can contribute to management objectives for fisheries policy, by explaining the origins of barriers to ecological

modernisation on individual level. Based on our findings we cannot predict, if organic aquaculture or RAS will widely diffuse as ecological innovations within the fisheries sector or not. Indeed, that has not been our task. We wanted to explore and explain the underlying decision–making process of first generation ecopreneurs in aquaculture to understand what happens on the micro–level of social change in the fisheries sector. Only the understanding of the fish farmers' perspectives, their construction of reality, whether or not aquacultural scientists, politicians and other stakeholders share his perceptions of realities, can provide a sustainable fisheries and aquaculture management policy, which will be widely accepted by the individuals concerned.

However, in the face of the increasing awareness of ecopreneurial organic or RAS fish farming methods in expert communities and in the general public, the majority of conventional fish farmers might be forced to deal with the appearance of ecological innovation as alternative aquacultural practice. Regardless of whether or not the two kinds of investigated ecopreneurships will diffuse to a great extent, they have created an example for ecological modernisation in fisheries.

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