



Social innovation – A future pathway for Blue growth?

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ABSTRACT

The European Union has launched the Blue growth concept as a strategy for stimulating economic growth in European seas. It is accompanying the core principles of the Green growth paradigm that seek to stimulate smart, sustainable and inclusive growth of economic activities. Focusing on Blue growth, this article examines its adequacy to enable social innovation as a strategy for the use and management of marine resources. Social innovation is interpreted as the changing behaviour of a group of actors joined in a network, leading to new and improved ways of collaborative action within the group and beyond. Social innovation can contribute to changing behaviour across different institutional settings, across markets and public sectors, and to enhancing bottom-up responsible inventiveness towards integration of social, economic and environmental objectives. Based on case-study research it is concluded that, to secure long-term sustainable development over short-term benefits, a social innovation perspective in the maritime domain will depend on cooperation, inclusiveness and trust.

1. Introduction¹

The European Union has launched the Blue growth concept as a strategy for economic growth in European seas in the context of climate change, increased scarcity of natural resources, the increased vulnerability of the planet, growth in urbanization and the concentration of humans in coastal regions [1]. Blue growth is an extension of the land based policy strategy referred to as Green growth, which the EU has introduced in 2010. In response to economic challenges, in the context of climate change and overexploitation of natural resources, the principles of Green growth [2] as a policy strategy aim at: 1) smart growth – developing an economy based on knowledge and innovation, 2) sustainable growth – promoting a more resource efficient, greener and more competitive economy and 3) inclusive growth – fostering a high-employment economy delivering economic, social and territorial cohesion. Likewise, the Blue growth concept operates in the scope of smart, sustainable and inclusive growth, while actually intending to capture a precautionary approach, which refers to “principles that preventive action should be taken, that environmental damage should, as a priority, be rectified at source and that the polluter should pay” ([3] p. 22).

The Blue growth strategy is however dominated by promises of technological progress, of technology innovations that contribute to economic progress, whilst securing sustainable management of natural,

marine resources. Underestimating the importance of the social dimension of change, the strategy is likely to become a simple technology-oriented approach. Experiences in natural resource management show that such an approach will not sustain in the long run [4].

Still, it is unclear how the seemingly opposite ambitions of Blue growth can be integrated in practice. This is further complicated by social and institutional barriers to these new developments, such as laws and regulations or earlier (bad) experiences with innovation. A core challenge to innovations is to facilitate change, given existing institutions and sensitivities of the marine ecosystems.

Against this background, this article is aiming at examining the usefulness of the concept ‘social innovation’ for the Blue growth strategy. The examination refers to; on the one hand, a theoretical discussion about the two terms ‘Blue growth’ and ‘social innovation’, and on the other hand, an empirical case in which mussel producers are interviewed in the Dutch North Sea to address possible barriers to social innovation within the scope of Blue growth.

This article first provides a discussion of potential links between principles of Blue growth and social innovation in theory (Section 2), which is followed by a briefing of the empirical case, in which critical factors for social innovation in practice are addressed (Section 3). At last, a discussion and concluding remarks are provided with further recommendation for follow-up research topics (Section 4).

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¹ This article represents interpretations made by the authors and does not necessarily represent the views of associated organizations or project partners.

2. Blue growth and social innovation

In this section the core reasoning behind the Blue growth concept is explored some further, and a link is made with the social innovation concept, which is defined and explained. At the end of this section the two concepts are brought together.

2.1. Blue growth

The Blue growth concept is strategic because it turns a negative approach of natural degradation and climate change into a positive one, to attract new ideas and opportunities with potentially low impacts on the environment [5]. It is a strategy forwarding the core principles of Green growth by means of harnessing ‘the untapped potential of Europe’s oceans, seas and coasts for jobs and growth’, based on the idea that ‘we are increasingly aware that land and fresh water are finite resources’ [6]. In attempts to encourage Blue growth, new legislation were adopted in 2014, by the so-called Maritime Spatial Planning Directive (MSPD) [7,8]. This directive is accommodating other EU directives and communications, such as the Marine Strategy Framework Directive (MSFD) [3] and the Integrated Framework Policy (IMP) [9]. The Blue growth concept particularly refers to the energy, aquaculture, tourism, mining and biotechnology sectors in the offshore marine and coastal environment [6]. Innovations in these sectors are welcomed as contributions to increase employment and economic growth in environmental friendly manners, referred to as so-called ‘eco-innovations’ [10]. In a global context, FAO promotes Blue growth as: “a cohesive approach for environmentally compatible integrated and socio-economic sensitive management of aquatic resources including marine, freshwater and brackish water environment” ([11], p. 552). To the core of these developments is thus the use of environmentally friendly technologies that can develop products with lower impacts on the environment.

In order to clarify the core principles of Blue growth, the Green growth principles must be explored some further. Analytically, different interpretations of Green growth build on different traditional economic schools [5]. This includes a long term macro-economic perspective along the Keynesian focus on possibilities for the government to influence by means of spending on social- and environmental capital (e.g. [12]), and a micro-economic perspective following a Pigouvian perspective concentrating on market externalities and market failures; analysing how governmental interventions in terms of tax and subsidies may influence these (e.g. [13]). Another perspective is directly linked to resource scarcity [14]. Referring to the American Henry George (1839–1897), who was one of the earliest writers demarcating the Malthusian concerns about risks for running out of natural resources given population growth, this perspective insists that these risks can be dealt with by the possibilities for increased effectiveness of natural resource exploitation; by adapting production strategies and applying new technological development. Moreover, the Georgian perspective encourages reduced risks by a strategic shift to alternative products and production techniques before the resources become scarce [5]. As such, Green growth consolidates recycling of goods by means of eco-innovations, which eventually evolve into integrated value creation and resource use in circular economy reasoning [15]. This reasoning of Green growth also applies to Blue growth.

2.2. Social innovation

The Blue growth strategy clearly has a strong background in economic theory. However, Blue growth not only refers to economic optimisation, or more effective use of resources [13], it also refers to creation of change in the context of existing social relations. The idea is that vulnerabilities of the marine ecosystem can benefit by adaptations of norms, values and behaviour as integrative parts of the economy [16]. Blue growth encompasses public interventions by multi-actors;

such as government, NGOs and citizens, among others. ‘Interactions between public and/or private entities aiming at the realization of collective goals’ [17] – *not limited to governmental actors* – is deemed necessary for creating societal change [18]; including Blue growth.

Social innovation transpires as a relevant concept to explore social and governance aspects of Blue growth. In the literature the theoretical term social innovation is extensively explored (e.g. [19–23]). Although it is unclear whether the Blue growth concept is tailored to social innovations, there are some remarkable links between them. Whereas social innovation stems from bottom-up initiatives that promote change by so-called enablers, they are aiming for impacts beyond individual level, to a broader scope of social and/or ecological contexts [20–22].

Social innovation has been defined as “changes of attitudes, behaviour or perceptions of a group of people joined in a network of aligned interests that, in relation to the group’s horizon of experiences, lead to new and improved ways of collaborative action within the group and beyond” ([22] p. 2). Social innovation can be explained both as process and outcome, which are strongly interwoven [21]. As process it refers to the interaction among actors through phases of problematization, expression of interest, and delineation and co-ordination [22]. Throughout the process, social innovation fully depends on acting at individual level, when enablers perform to realize change by means of network interactions and activities [20–22]. As outcome social innovation develops new institutional structures, for instance network structures, that can deal with the particular needs for change to realize intended societal impacts. Institutional impacts of social innovation can be assessed by means of three core characteristics [21]:

- Scale, referring to the directly and indirectly affected number of people,
- Scope, referring to the level of change towards new institutional settings, and
- Resonance, referring to the peoples imagination and belief in what is possible.

Baker and Mehmood [21] elaborate on social innovation; focusing on ways of collaborative action they argue that any action will have an impact on its surroundings. Not only will institutional settings in terms of scale, scope and resonance be impacted, but also the environment, including marine space with its ecosystems. They insist that long term well-being is context dependent, and contexts consist of both built and natural environments. The link between social life and ecological conditions is considered a core cause to the present environmental crisis [21]. Social innovation, i.e. the collaborative action within a group and beyond, can shape the ecological conditions in practice, because these actions can in one way or the other impact ecological systems, such as use of marine resources. Actually, social innovation depends on contextual social, environmental and economic resources [21]. In this sense, social innovation relates with the core dimensions of sustainability, covering economic, social and the ecological aspects. As such, social innovation reinforces three societal functions [21]:

- Basic individual and collective needs,
- Social relations and relations with ecosystems, and
- Social-economic capabilities to influence social innovation.

Social innovation agitates against business innovation approaches building solely on profit maximization as a core motivation [23]. Social innovation as such does not only refer to invented new ideas and products, but encompasses processes which encourage creativity of inventing, supporting and implementing novel social and ecological solutions to public needs [24]. In brief, the social innovation concept thus has an acting component that consists of people with particular *attitudes and perceptions* about what innovation is, aiming for more societal impacts than making profit as such, with whom acting involves *learning, networking and collaboration*. Social innovation also has an impact

component, which can be addressed according to *scale, scope and resonance*.

2.3. Relationship between Blue growth and social innovation

Blue growth encourages smart, sustainable and integrative solutions. In particular, the EU instructs integration of different uses along the coast. For instance, it commands that “Maritime spatial planning should aim to integrate the maritime dimension of some coastal uses or activities and their impacts and ultimately allow an integrated and strategic vision” ([7] p. 138). This will require cooperation across sectors, across governance arrangements, across stakeholders, as well as integration of policy goals, activities and stakeholder roles [25,26]. At this general level the Blue growth justifies social innovations. For instance, a network based social innovation approach is inclusive to the network participants by definition, and gives possibilities for exchange of knowledge and ideas for innovation. Moreover, social innovation relates with the sustainability principle for economic growth, triggers innovation beyond solely profit based innovation purposes, and searches for long term solutions.

While certainly not covering the full scope of social innovation, in this article it is hypothesised that social innovation may foster and enhance Blue growth by aiming at long term social and ecological qualities, beyond economic development only. As such it is possible to propose social innovation as a potential means to enhance smart, sustainable and inclusive Blue growth (Fig. 1).

By definition, social innovation can have implications for the role of public managers and policy making. In theory, transparent and inclusive decision-making processes, that are judged legitimate by stakeholders, are a precondition for effective governance systems [25,27], implying that different types of knowledge are required [28–30]. In practice, this is not always achievable. For instance, marine governance tends to base decision making on scientific information more than on local knowledge, due to incompatibility of knowledge systems [31]. By failing to incorporate the knowledge that resource users have, management plans based on an incomplete understanding of the resource are, ultimately, frail [32]. Blue growth encourages developments which are inclusive of stakeholders and smart by involving different types of knowledge. Still, it remains unclear whether bottom-up social innovation can fit into this scope in practice.

Based on the social innovation literature, the following key concepts

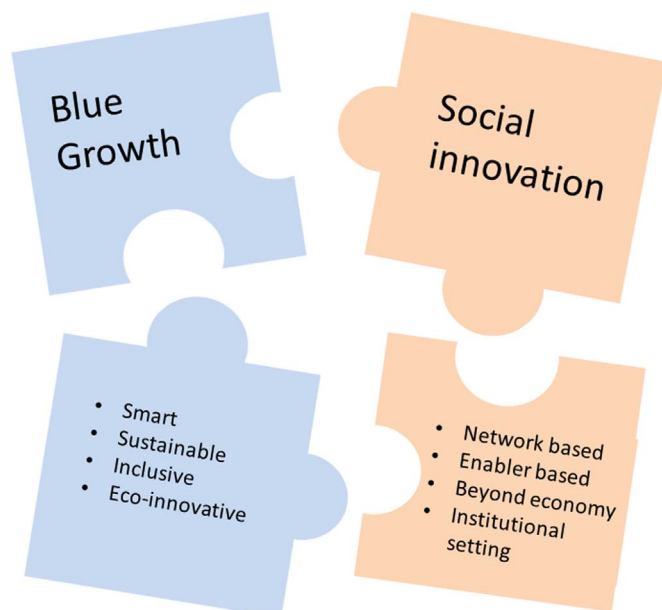


Fig. 1. Can social innovation strengthen Blue growth?

are used to explore an empirical case-study in the next section:

- *Attitude and perception*: What attitudes do different mussel companies hold? To what extents are they open to innovation, and do they frame their business interest in a wider societal context?
- *Learning, networking and collaboration*: Is there a joint learning process in which various actors collaborate to develop new knowledge, new experiences and innovation? What factors can possibly explain the (lack of) cooperation between actors? Who are included in networks and who are not?
- *Scale, scope and resonance*: Who are or should be included in a network? Within what scope (e.g. economic, environmental and/or social) are arguments about innovation presented? What are the future imaginations, i.e. the resonance?

3. An empirical case in the Dutch North Sea

In this section, the case study and the method applied are introduced, and the core findings based on interviews of mussel producers in the Netherlands are presented.

3.1. Case description and method

The Dutch government has put considerable efforts in investigating Blue growth options to adapt the maritime spatial plans to expected future developments [33]. Comprehensive research efforts explored the feasibility of different sector combinations in the Dutch North Sea, with the aim of finding the most appropriate sector combinations that possibly can reduce impacts on vulnerable marine ecosystems [34–37]. The outcome of this research recommends a combination of mussel aquaculture in offshore wind farms as a most favourable co-use possibility.

Fig. 2 shows the planned future offshore locations of windfarm areas in the Dutch North Sea. The figure shows that the distance from shore is about 22 km (i.e. 12 nautical miles), just outside the boarder of the economic exclusive zone of the Netherlands. Whereas the two planned areas further north (Zuid-Holland and Noord-Holland) are around 25 m in depth, the one further south is deeper with a more diverse depth pattern (Borssele) [38].

Even though it from a theoretical point of view was judged favourable to cultivate mussels in offshore windfarms, the absence of real-life offshore mussel cultivation suggests there are barriers to actual implement such co-use. Research has been carried out to find whether biological conditions offshore are favourable to sufficient growth of mussels [38]. While this was found to be positive, it remained unclear whether socio-economic conditions existed, that could support a realization of mussel production offshore. Therefore, further research was carried out to examine the incentives of mussel farmers to invest offshore, and to identify socio-economic barriers to aquaculture offshore [38].

A total of five interviews were conducted with the mussel sector in the Netherlands,² in which one interviewee was representing the sector organization, and four were owning one or more firms. Although they as owners were representing only a small share (5 of 85), these companies all play a major role in the Dutch market, and are actively involved in an innovation programme exploring new mussel cultivation techniques [39]. The in depth interviews were carried out by means of open questions to gain a better understanding of socio-economic production conditions [40]. After asking an open question, the respondent's answer provided clues about what follow-up questions should be asked. The core open questions were:

² The interviewees want to stay anonymous, and are therefore not described in detail, but the study can be found in Kamermans et al. [38]. The authors are fully aware that in presenting the results, their own interpretations of interviewees play a role, besides actual information exchange, although full objectivity is a core strive.

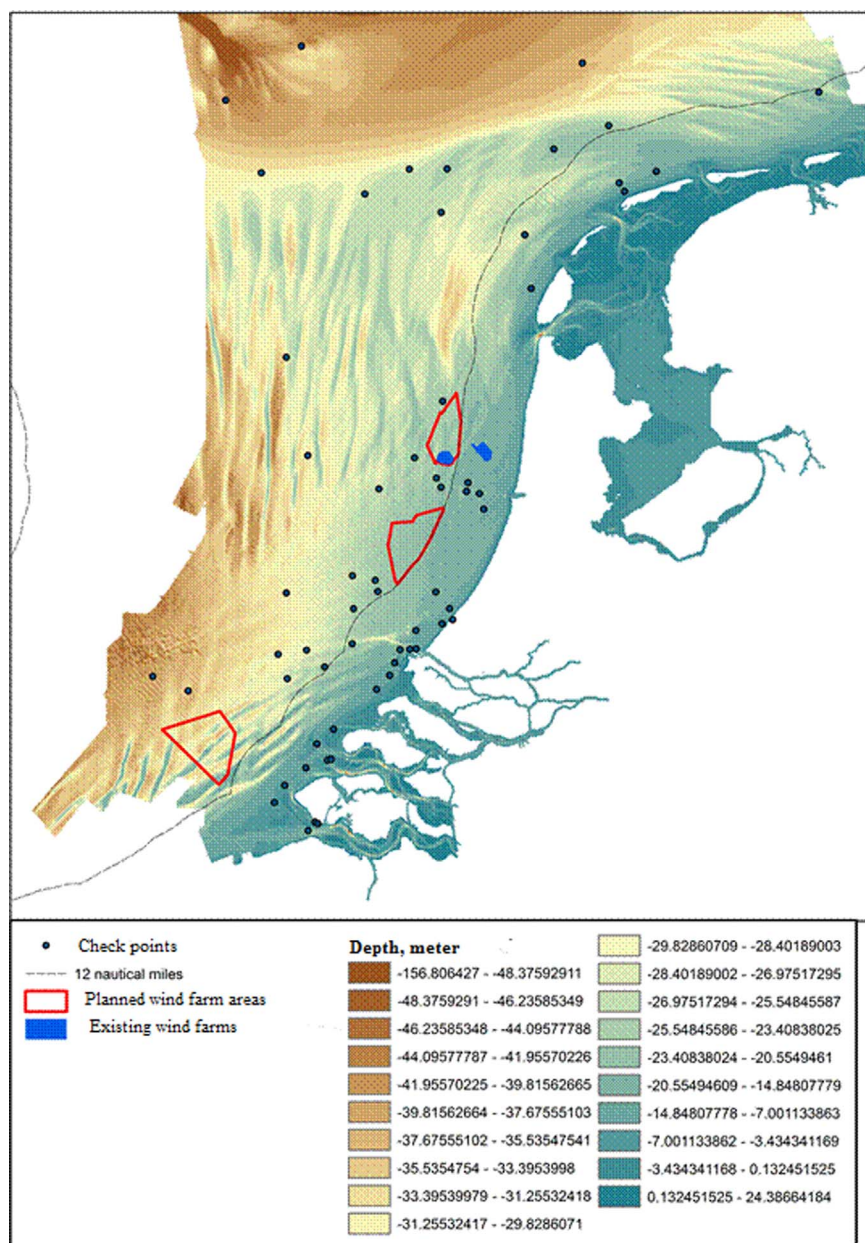


Fig. 2. Potential wind farm offshore areas (red) (Borssele, Zuid-Holland and Noord-Holland), and existing wind farms (blue) (OWEZ in the very north; Princes Amalia windfarm in Noord-Holland; Luchterduinen - not yet finished in Zuid-Holland) (source: Kamermans et al.) [38]. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article).

- What conditions are hampering realization of mussel production in offshore windfarms from a sector/firm perspective?
- What are critical success factors? In other words, what is needed to actually overcome the barriers to realize offshore mussel production?
- Would you be interested in taking part in a future pilot project supported by the government?

The follow-up questions thus depended on what interviewees answered to these basic questions, and required sufficient expertise of interviewer. Throughout follow-up questions, the particular focus was on exploring: 1) attitudes and perception, 2) learning, networking and collaboration as components of acting, as well as 3) scale, scope and resonance. One of the benefits of an open question interview strategy is that research frame does not restrict responses of interviewees, but allow their full story to be recorded [40]. These interviews were analysed from a social innovation perspective to find barriers and possibilities for social innovation as contributions to Blue growth. Core findings are presented in the following section.

3.2. Core findings

A number of core pre-conditions for successful offshore production are recognised by all respondents. They include, for instance, that extensive technological investments are needed for dealing with the conditions offshore (harsh storms, long travel time, depth, currency, etc.), including mussel production systems and fishing vessels. Moreover, they agree that fuel and time needed for the travelling distance from shore will require extra costs. Also, production offshore involves risks, and producers insist that they would need reasonable insurances to make sure they would not go bankrupt with accidents. Extra costs must eventually be covered by sufficient increase in income. For generating more income, effective mussel production systems are needed, which today are non-existing offshore. Further, a shared pre-condition stated was that the new possibilities offshore should *not* imply that mussel seed farming in marine areas attractive to nature conservation should be banned (Wadden Sea). They also informed that cooperation between public managers and the mussel business sector would need to improve, as earlier efforts have led to a rather low trust

level due to sometimes different perceptions about what is right and wrong.

For some arguments, opinions differ. For instance, four interviewees insist that a mussel producer cannot take part alone, but must operate together with all sector partners, and that a pilot is only interesting if the public sector covers all costs. One respondent has a different perspective on this. He informs that a pilot is interesting only if the mussel producer investing receives in return an area based long term private user right to produce (e.g. a long term licence). He also insists that an enabler is needed to facilitate interactive processes among different actors, including public managers and private market actors, in order to ensure that communication enhances trust among different stakeholders.

These last findings already point to two distinctly different points of view on innovation. The follow up questions explore differences and similarities of core social innovation features, such as 1) attitude and perception, 2) learning, networking and collaboration and 3) scale, scope and resonance. These are examined in the following.

3.2.1. Attitude and perception

Based on the five in-depth interviews, it is obvious that the attitudes of the respondents differ. Basically, two completely different attitudes and perceptions can be distinguished. While four respondents show a *reluctant attitude*, one *aspires to change*. The reluctant interviewees emphasise technological limits, for instance, explaining how current cultivation systems are designed for shallow waters nearby coast and not offshore. Offshore cultivation would imply increase in financial risks because they would need to invest in new not yet existing cultivation systems to be developed, and new offshore going vessels, among others. The difficulties of ecological conditions offshore, such as inclement weather, potential mussel predators and depth of sea, are stressed by this group. The economic performance is expected to be low or non-existing because of the extra costs for time and fuel needed to travel offshore during different phases of the mussel production cycle. Failures during new technology development of production systems suited to offshore would increase costs further. They are also sceptical to the role of environmental NGOs and the Ministry, as they could just as much have a strategy to exclude them from the Wadden Sea, an area where their current mussel seed collection practices are criticised because of predicted environmental impacts [41]. The last, but maybe most important reason for a reluctant attitude; the mussel producers nowadays are operating under favourable conditions, with good economic performance, and do not see any urgent need for change.

Still, one mussel producer foresees benefits of being an early participant in new developments, as a strategy to be first when attractive marine spaces and opportunities will be distributed and explored, and as such to be profitable in a long term. Notwithstanding, he also refers to reasons beyond, referring to a global context, arguing that the world is suffering from food insecurity. He argues that mussels are favourable for dealing with food insecurity worldwide because they do not need expensive inputs in terms of feed, irrigation and/or fertilisers, but instead can grow everywhere if sun, favourable marine space and algae are available, notably, in absence of for instance toxic algae. At the same time, a mussel production system is relatively environmentally friendly, as pollution is low while they re-fresh the waters by making use of particles as feed. Still, to be willing to invest in development of new technologies and practices, this producer sets one condition. He refers to the need of area based long term private user rights to operate in offshore marine waters. He bases this argument on reasoning of what he considers the largest risk, namely governmental practice; when the government distributes to all what is invested by only a few. He is thus hesitant to be victim of free-riders. Core characteristics of reluctant and aspired motivations are provided in Table 1.

3.2.2. Learning, networking and collaboration

Having a reluctant or aspiring attitude influences how respondents

look at matters of learning, networking and collaboration; because these components of acting come to have different meanings. From the reluctant perspective, references are frequently made to the existing network of organised producers. Within the network, intense levels of learning and collaboration takes place. Any new development or effort will be shared. These interviewees argue that being part of a mussel production network makes it complicated to speak on behalf of the community without discussing internally first. They are not directly concerned about global developments of food security issues and environmental change.

In contrast, the respondent with the aspiring attitude discusses offshore cultivation from a societal rather than a sector perspective, arguing that mussel production offshore offers opportunities for increased supply of mussels as well as a sustainable, secure supply of food. He explains that differences exist among producers; about one third of mussel producers could fit into a risk adverse behaviour category and about one third would fit into a risk seeking category. The middle category of risk neutral operators would follow the strongest trendsetters of the two other categories. Consequentially, he argues that the producers willing to change would be more suitable for a network, which also could include NGOs, science community, public administration and policy makers at different levels, etc. Further, he claims that enablers would be necessary to allow for change. As indicated above, the bottlenecks to this person to invest for change are linked with existing cooperation barriers between private and public sector activities.

3.2.3. Scale, scope and resonance

Scale, scope and resonance are important characteristics of social innovation, and have different meanings to the reluctant and aspired attitudes. As for the reluctant attitude, the scale is defined by the right to distribute any new development to the associated members of the group of organised mussel producers. In this sense, the scale is wide by allowing all producers, including risk averse, risk neutral and risk seeking mussel producers to benefit from arrivals of new suitable technologies to offshore mussel production in future. Still, to this group, the scale is limited in the sense that they do not seek people beyond existing network of mussel producers. They also get reluctant by their own imagination and belief in what is possible, arguing that existing production system would not work offshore (i.e. reference is low).

As for the aspired attitude, the scale would refer to affected people beyond the Dutch mussel producers, with potential production possibilities and consumers worldwide, as well as involvements of NGOs and research institutes working for food security issues. This resonance goes far beyond existing thinking of what is possible. The scope of new institutional settings needed for facilitation of food security would include an extended international market worldwide for the trade of mussels. Scope also refers to new local production facilities such as private user right. Private user rights for mussel production could be defined in terms of long term private user rights at sea. The sharing of rights among producers is seen less important, according to the free-riding risk mentioned above.

The case study thus reflects on some central difficulties in applying social innovation to practice. For instance, in defining learning and collaboration in networks, the reluctant attitude would refer to an existing producer network based on sharing of knowledge and information, and full exclusion of NGOs, while the aspiring attitude would refer to a network with other producers (e.g. technology developers, wind farm developers), government, potential international NGOs, and/or universities, but excluding a large share of mussel producers. Both attitudes are thus excluding specific audiences. While social innovation is defined as inclusive to people who share specific norms [21], this indeed implies that people with different norms are excluded from the network. Notably, with complete social inclusiveness, too much time and effort would be spent on interaction among tremendous numbers of people, with no more time for the actual innovation. Linked with this is the question about poverty alleviation, which can be obtained in two

Table 1
Core characteristics of reluctant and aspired motivations.

Social innovation properties	Reluctant	Aspired
Attitude and perception with references to:	<ul style="list-style-type: none"> • Technological limits • Weather conditions, depth • Time and fuel • Economic loss/ risks • No urgency to change 	<ul style="list-style-type: none"> • Strategic to be early involved in new developments • Food insecurity • Mussels are favourable product to grow • Low needs for inputs and low polluting • Needs for private user rights in response to private investments
Acting in terms of learning, networking and collaboration with reference to:	<ul style="list-style-type: none"> • Existing network of mussel producers • Learning and collaboration within the network 	<ul style="list-style-type: none"> • New network with multiple actors including NGOs, public managers, research communities, etc. • Only small share of mussel producers part of network • Learning and collaboration at an international network level • Need for enablers
Scale, scope and resonance with reference to:	<ul style="list-style-type: none"> • Traditional mussel producer sector • Existing institutional setting • Imagination within existing settings 	<ul style="list-style-type: none"> • Extended international coverage with multiple groups of people across the world • New institutional settings (international, private user rights) • Imagination far beyond existing technical and institutional settings

ways; on the one hand, by including poor mussel producers to allow earnings, or on the other hand, to provide cheap proteins to the world's poor consumers. While the first is not relevant to the Dutch case because the mussel producers in the Netherlands is a rather small but rich exclusive group who would be reluctant to change if risks are high, the second could theoretically have a future impact, in accordance with the aspiring attitude.

The case hence illustrates that one producer is aspired to changing existing practices, advocating offshore mussel cultivation as a possibility to contribute to food security, economic development and sustainable use of the North Sea. Actual placement of (test) mussel production is hampered by lack of a regulatory framework that enables the innovators to reap the benefits of their innovation. Given the financial risk that goes hand in hand with offshore innovations, no private actor can afford to make large investments under the condition that foremost free-riders will benefit. This contradicts a public sector view, which would be keen to share all new mussel development opportunities across all producers when established, to avoid a future monopoly of multinational that produces all mussels in future. There is thus a conflicting view about how to define area based long term private user rights across public and private sectors, in space and throughout time, which have implications to social innovation in practice. The increasing demand for area based long term private user rights at sea in the scope of Blue growth is a new way of resource allocation offshore that needs to get some more attention in future.

4. Discussion and concluding remarks

In this article, the Blue growth policies at European level have been addressed, and an empirical case at local level in the Dutch North Sea has been introduced with the aim to examine what the Blue growth strategy can win by following a social innovation approach. Potential match and mismatch can be discussed at three levels; 1) from a theoretical perspective, 2) at an EU policy level and 3) at a case study level based on an empirical study in the mussel sector in the Netherlands.

First, from a theoretical perspective, social innovation is presented as a new improved way of collaborative action based on changes in attitudes, behaviour or perceptions of a group of people joined in a network of aligned interest [22]. It is based on the belief that enablers; people with initiatives that go beyond making profit to also aim for social and/or ecological well-being, can perform and influence commonly defined societal goals based on shared norms, values and understanding that motivate cooperation. Social innovation therefore holds different attitudes and promotes different behaviour than how such properties of a firm traditionally are defined. In contrast, the analytical reasoning of Blue growth clearly operates within a market institutional setting. Although the analytics of Blue growth differ with respect to how they perceive macro-economic and micro-economic

perspectives [5], they share some typical market based reasoning. For instance, they focus on the externalities (impacts that they have outside the scope of the market context) [13], the importance of how scarcity of resources influence market conditions [42], and the role of new technologies within the market [15]. They thus share that they operate within a market context with assumed utility and profit maximization based behaviours [43]. From a theoretical perspective, the assumed behaviour of social innovation thus differs to market based behaviour.

Second, at an EU policy level, it appears that coherence among different EU Directives and Policy documents are not always straightforward. As such, comparing the Blue growth strategy with other EU regulations that attach different incentives to, for instance, sustainability and ecosystem-based management, a mismatch can be observed. While the MSPD states that “the application of an ecosystem-based approach will contribute to promoting the sustainable development and growth of the maritime and coastal economies and the sustainable use of marine and coastal resources” ([7] p. 135), the MSFD instructs that “... applying an ecosystem-based management approach to the management of human activities..., priority should be given to achieving or maintaining good environmental status” ([3] p. 20). Moreover, while the Blue growth policy document refers to the marine natural resources as “untapped resources”, the MSFD states that “It is evident that pressure on natural marine resources and the demand for marine ecological services are often too high...” ([3] p. 19) and that “The marine environment is a precious heritage that must be protected, preserved and, where practicable, restored with the ultimate aim of maintaining biodiversity and providing diverse and dynamic oceans and seas which are clean, healthy and productive” ([3] p. 19). Obviously, there is thus a need for balancing economic growth and precautionary principles concerning the environment. In this article, it is hypothesised that social innovation can contribute to a more balanced strategy.

Third, the case of offshore mussel cultivation points to some challenges for social innovation to become realized in practice [38]. Technological and financial objections to offshore cultivation are used to counter the plea for innovation. Earlier experiments and pilots have led to a certain rigidity of the larger part of the sector, impeding innovation. The case-study illustrates that four of five interviewees prefer to stick to current practices and dismiss offshore cultivation as a risky, financially unattractive option. Still, the case offers clues why social innovation is needed in Blue growth, and at the same time why it can be difficult to realize. Social innovation is associated with a process of alignment, where different stakeholders exchange values and ideas to come to a shared understanding of problems and the best solutions. In the absence of alignment, attempts to realize innovation quickly turn into top-down efforts to create innovation. While processes of alignment have led to mussel seed innovation efforts at earlier stages, the network now suffers from dis-trust among public and private actors. More experience in facilitating private – public efforts is thus needed.

Social innovation of offshore cultivation can potentially increase the capacity of the sector; to become operational under different conditions of social and ecological change. The required technological innovation may be brought about without social innovation. Alternatively, new ways of framing offshore mussel cultivation can take place – emphasising the larger benefits of smart, sustainable and inclusive conditions. As of now, at least one mussel producers is open to this point of view, but involving a larger part of the sector would be desirable to encourage shared learning and experimentation within the sector.

In linking Blue growth with social innovation, the traditional distinction made in our societies between market institutions and public sectors are actually merging. Consequently, formal rules and regulations need to be adapted, as public rights and procedures often differ for market- and public actors. Informally, such links suggest that the norms and values developed in these two settings can be combined and interrelate, implying that enablers, who may as well stem from a firm or public management, can take responsibilities for ecological and social challenges that impact our quality of life. This discussion has taken place theoretically, for instance in discussions about trends of globalization and information age [44,45], among others. While the two contexts obviously have a long tradition in interacting in practice, it is new that they are brought together as merged institutional settings in an empirical context. This obviously also brings with it a lot of questions about how credible such a system would be. For instance, in practice, who will take responsibilities for public values, and who will go for individual profit only? How accountable and trustworthy are the ones that actually innovate socially?

Against this background, a potential fit between social innovation and Blue growth is hampered at different levels. Some five core challenges have been identified for future research;

- 1) To what extent is a social innovative network inclusive or exclusive in terms of conditions set for people to be part, and what are the consequences of these conditions for equality and competitive advantages?
- 2) In the scope of Blue growth the issue of area based long term private user rights remains a delicate one, illustrating one of the differences between the public and private domains; how to deal with this in a social innovation setting?
- 3) While it is illustrated that marine space allocation for multiple sectors needs collaborative efforts based on trust – it is still unclear how collaboration between public and private actors can be improved. Under what conditions will potential enablers be motivated to take responsibilities and act according to social innovation and when are they hampered?
- 4) To what extent can formal and informal rules, norms and values be merged across institutional market settings and public sector contexts, and what new challenges emerge by such linking?
- 5) To what extent can social innovation be regarded a practical answer to balancing rather different incentives of EU Directives and Policies, and to promote sustainable growth, while taking care of biodiversity and poverty alleviation?

While in this article the focus has been on aquaculture in wind farms, the implications of Blue growth go far beyond. It is unclear how certain traditional groups can find ways to proceed, such as the small-scale fishery [46]. As for the fishery sector at large, the actual impacts may depend on future fish catches of immigration of new species due to climate change [47], and it is unclear what exact ecological deviations will follow [48]. If the future proceeds in taking into account the dynamics of socio-ecological systems [49], not only must inter-sectoral interaction be addressed properly [50], but also cross scale interaction (local, national global) [51] and stakeholder perspectives [52].

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