15. Research-based innovation for sustainable development: the case of aquaculture

Matthew Coffay and Ragnar Tveterås

INTRODUCTION

There is growing consensus around the need for rapid decarbonization. This consensus is embodied in international agreements such as the EU Green Deal, where European countries (including Norway) have agreed to reduce CO_2 emissions 55 per cent by 2030. The scale and speed of this transition demands innovation across the public and private sectors: we must acquire knowledge quickly and diffuse it rapidly between research institutions, firms, policy-makers, non-governmental organizations (NGOs), and the general public. New knowledge production and innovation processes will not be linear, but rather iterative, with feedback between stakeholders integral for a successful transition. This way of thinking about innovation – as 'effectuated' rather than causal, making do with what is available rather than following recipes – has long been understood as central in entrepreneurial contexts (c.f. Sarasvathy, 2001), but it is especially salient when considering sustainability-focused innovation activities, where wicked problems and shifting targets make linear innovation approaches particularly problematic (Coffay et al., 2022).

This need for the rapid diffusion of knowledge raises important questions about the balance between research and innovation within business schools. Should universities broadly (and business schools in particular) shift resources away from research-based knowledge production and towards innovation activities that combine different types of knowledge into new technological, organizational, and policy solutions? In other words, is the problem we face less a problem of insufficient *quantity* of research-based knowledge, and more a problem of insufficient *combinatory utilization* of knowledge in the form of innovations? Of course, there is not a simple answer to this question across knowledge areas, technologies, and markets. But given the imperative to cut emissions 55 per cent by 2030, we would argue there is a need for new research strategies which can contribute to policies, business models, and technologies that can reduce emissions through strategic innovation and investment – and in the case of business schools, such strategies must deviate from the current siloed research paradigm.

Put simply, business schools are in need of a qualitative shift away from their current *modus operandi*. In principle, business schools can provide research-based knowledge in a range of green transition innovation areas facing the public and private sectors, from researchers in disciplines such as economics, finance, accounting, marketing, strategy, management, organization, and innovation research. However, for a variety of reasons, there is a disconnect between research activity on the one hand and the innovation needed for decarbonization on the other.

First, business schools often have a portfolio of research topics which may be of less relevance for the green transition. Even though all disciplines in a business school can contribute with relevant research knowledge to this transition, the research agenda within disciplines may overwhelmingly focus on issues not related to the green transition. Second, business school resource use and output are typically geared primarily towards knowledge production in the form of peer-reviewed research papers, rather than on innovation activities where researchers devote time to interaction with private and public sector organizations and contribution to their innovative output. This "research-relevance gap" has long been discussed in the management literature in terms of the relevance of business school research for managerial learning and firm performance (e.g., Kieser & Leiner, 2009; Starkey & Madan, 2001; Tranfield & Starkey, 1998). Our point here is that the same sort of problem also raises concerns for the relevance of business school research for solving practical sustainability challenges at the firm level. Third, business schools may have strategies and culture that lead to less cross-disciplinary collaboration with research disciplines outside business schools, e.g., natural sciences and engineering.

Further, existing incentive structures both at the institutional and the individual researcher level create barriers for connecting researcher activity with multi-stakeholder innovation projects. International rankings and business school accreditations focus on the output of peer-reviewed papers in defined sets of recognized journals (e.g., the ABS – Association of Business Schools – ranking). These rankings reward publication in a set of journals which often contain little sustainability content. Moreover, rankings may not reward cross-disciplinary research collaboration outside typical business school disciplines, as target journals for publication of new research from such collaborations may not be included (or may have a low ranking) in the journal ranking system of business schools. Resource use in innovation activities is often less rewarded than that in research activities. Business school innovation performance metrics are less developed than research performance metrics, and admittedly also challenging to construct, thereby incentivizing researchers to focus more on activities that lead to a higher output of research publications.

To sum up: in a world which needs a rapid green transition, business schools face significant institutional legacy costs and/or adjustment costs in the national academic sector to which they belong, at the international business school sector level, at individual business schools, and within research disciplines.

One contribution of this chapter is to use the case of aquaculture – a sector which must grapple with many environmental, social, and economic sustainability challenges, and which depends on new knowledge from many fields of research to meet these challenges – to shed light on the problems, dilemmas, and opportunities that business schools face in contributing to sustainable development. Universities in general (and, by extension, business schools) are understood as having three missions: education, research, and what Compagnucci and Spigarelli (2020) refer to as "contribution to society" (p. 1). In this chapter, we focus on the second and third missions, interpreting a "contribution to society" as researchers' engagement with a broader suite of stakeholders, including firms, policymakers, and civil society. We argue that given the sustainability challenges we face, business schools must reassess their research and innovation (R&I) strategies and activities in order to increase their contribution to a transition towards an economy with much lower carbon emissions and other environmental impacts.

Importantly, achieving the extensive transformations needed to cope with sustainability challenges implies the need for a two-way transfer of knowledge as part of this third mission: that is, not simply dissemination of knowledge from researchers to external stakeholders, but mutual learning and knowledge co-creation processes. Such integration of research and innovation shares much in common with widely recognized shifts in research knowledge production processes (Gibbons et al., 1994; Nowotny, 2000). This new approach to knowledge production (termed "Mode 2" to distinguish it from "'Mode 1", or traditional approaches to knowledge generation within research communities) involves much broader contexts of application, more transdisciplinarity, greater "heterogeneity of skills" amongst researchers, increased social accountability, and an applied focus: that is, knowledge generation for problem solving (Asheim, 2012; Gibbons, 2000, pp. 159–160).

Business school researchers are in a comparatively unique position (alongside researchers in a handful of other university departments and disciplines, e.g., engineering) to leverage a Mode 2 approach to knowledge production and bridge the gap between research on the one hand and real-world, sustainability-focused innovation on the other (Tranfield & Starkey, 1998). The transition towards a low carbon economy requires not only technological innovation, but also new sustainable business models, increased circularity in the broader economy, and innovative governmental policies and regulatory regimes. Further, these innovation areas are highly interrelated: for example, investment in new technological innovations that reduce climate gas emissions often depend on government regulations that give a license to produce and provide sufficient economic incentives, as well as business models which can both develop and implement these technologies profitably.

Sustainable business model innovation (SBMI) ("innovations that create significant positive and/or significantly reduced negative impacts for the environment and/or society, through changes in the way the organisation and its value-network create, deliver value and capture value (i.e. create economic value) or change their value propositions" (Bocken et al., 2014, p. 44) is increasingly important for firms that want to meet their sustainability goals (Coffay & Bocken, 2022). SBMI can make firms more resilient, reduce risk, improve competitive advantage, cut costs, and more (Bocken & Geradts, 2020; Bocken et al., 2014; Buliga et al., 2016; Choi & Wang, 2009; Coffay & Bocken, 2022; Porter & Kramer, 2011). However, firms attempting to develop new and sustainable business models struggle with what the literature calls the "design-implementation gap", insofar as these new business models either fail internally, out in the market, or somewhere in between (Geissdoerfer et al., 2018).

Meanwhile, governments face a number of challenges in developing policies and regulations for private and public sectors. These challenges include (1) balancing of economic, social, and environmental goals, embodied in the UN SDGs, (2) developing the knowledge base for new policies and regulations, and (3) monitoring and measurement issues.

This chapter will discuss how business researchers can contribute to both the development of firm-level sustainable business models as well as the development of new policies and regulations which facilitate the green economic transition. Empirically, we examine the interaction between the UiS Business School and the Norwegian aquaculture sector, where stakeholders include aquaculture value chain firms, government actors, researchers, and NGOs. We begin with a discussion of the sustainability challenges of salmon aquaculture in the second section of the chapter. In the third section, we examine interactions between the UiS Business School and the aquaculture sector. We show how many years of ongoing collaboration and mutual learning have led to the development of Green Platform, an ambitious, sustainability-focused, private-public innovation project in the aquaculture sector, which seeks to integrate research and innovation activity between public and private actors. We discuss this project and its contribution to the development of both a new regulatory framework as well as sustainable business models in the fourth section. Finally, we discuss lessons learned and the way forward in the last section of the chapter.

SUSTAINABILITY CHALLENGES IN AQUACULTURE

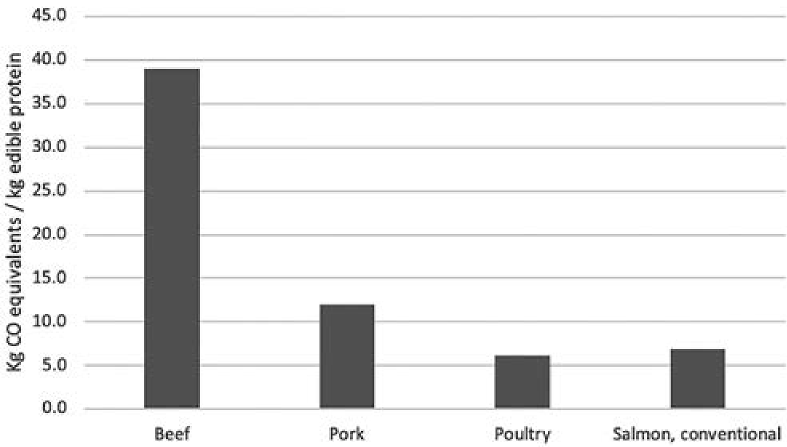
Food value chains, including aquaculture, face a number of sustainability challenges. Providing increasing volumes of healthy, nutritious food to a growing global population where many are still malnourished is one major challenge. Employment and income opportunities are also major concerns, as food value chains provide billions of jobs and the majority of employment in developing countries, particularly in rural communities (Townsend et al., 2017).

But food systems also face a range of environmental sustainability concerns, as value chains affect climate, biodiversity (of plants, insects, and animals), and human health. Food value chains represent one third of all human-made greenhouse gas emissions (Crippa et al., 2021). Around 70 per cent are from agriculture and land use or land-use change activities, while the remaining 30 per cent are from retail, transport, consumption, fuel production, waste management, industrial processes, and packaging. Climate footprints exhibit much variation across food products, with animal protein production having much higher emissions per gram of protein than cereals and nuts (Poore & Nemecek, 2018; Ritchie & Roser, 2020).

Among food sectors, aquaculture production has grown at a much faster rate than terrestrial animal production (Garlock et al., 2020). Globally, about 20.5 million people were employed in aquaculture in 2018, and farmgate sales value was USD 264 billion (FAO, 2020).

Aquaculture of fish and shrimp generally has lower greenhouse gas emissions per gram of protein than terrestrial animal protein production. However, there is much variation across species, production technologies, and regions (Poore & Nemecek, 2018; MacLeod et al., 2020). For salmon aquaculture in particular, the greenhouse gas emissions per kg of edible protein are around 20 per cent those of beef, 50 per cent those of pork, and comparable with poultry, as shown in Figure 15.1. From a global perspective, depending on the mix of species and technology involved, the growth of aquaculture protein production has the potential to lead to much smaller growth in greenhouse gas emissions than a similar increase in beef or pork protein.

Global aquaculture sectors also differ in terms of environmental footprints, including effects on biodiversity, eutrophication, water use (in freshwater aquaculture), and fish diseases (FAO, 2020). The environmental sustainability challenges are different across countries and species, and governments generally struggle with the design and implementation of policies that balance a range of environmental, economic, and social sustainability concerns, and



Sources: MacLeod et al., 2020; Poore & Nemecek, 2018; Winther et al., 2020.

Figure 15.1 Typical greenhouse gas emissions in CO_2 equivalents per kg edible protein

mitigate environmental impacts in particular (Abate et al., 2016; Osmundsen et al., 2017).

Salmon aquaculture is the biggest aquaculture sector in Organisation for Economic Co-operation and Development (OECD) countries, as measured by sales value, and in particular in Norway, Chile, the UK, Canada, Faroe Islands, and Iceland. In 2021 global production of Atlantic salmon was 2.9 million metric tonnes (MT), of which 1.5 million MT was produced in Norway, and 0.7 million MT in Chile. The Norwegian salmon export value in 2021 was 85 billion NOK (approx. 8.5 billion EUR).

As Norwegian salmon production has grown from around 100,000 MT in 1990 to 1.5 million MT today, the industry has experienced new sustainability challenges. The industry has gone through economic cycles, with periods of low and high profitability. It has also faced changing expectations from society on environmental impacts, fish welfare concerns, and the sharing of economic value added with society.

The Norwegian salmon aquaculture innovation system is arguably the most developed in the world. This is reflected in the labour skill structure and R&D employment in private and supporting public sectors, R&D expenditures, and intensity as measured by expenditures as a ratio of sales, output of peer-reviewed research papers, innovation rates, and productivity (Bergesen & Tveterås, 2019). Nevertheless, the salmon industry faces a range of environmental and biological challenges. Several biological and environmental externalities are present in aquaculture, and these provide the main rationale for government regulation of salmon aquaculture. The main biological and environmental problems in salmon aquaculture are sea lice (a parasite impacting both farmed and wild salmonids), fish diseases that lead to reduced fish welfare and higher mortality rates, and farmed salmon escapees which can interbreed with wild stocks (Grefsrud et al., 2021; Sommerset et al., 2021).

Managing and governing salmon aquaculture has been characterized as a 'wicked problem', due to uncertainty and lack of knowledge, changing challenges, lack of consensus, and problems that persist and rarely have final solutions (Osmundsen et al., 2017; Rittel & Webber, 1973). Globally, stringent regulation of aquaculture in developed countries has been identified as a possible cause of the slower aquaculture growth in Europe and North America compared to Asia (Abate et al., 2016).

Both national policy objectives and multilateral agreements have implications for the regulation of aquaculture. Together with other UN member countries, Norway has adopted the UN's 17 Sustainable Development Goals (SDGs). It is a challenging task to translate the SDGs into specific policies and regulations for aquaculture, as policymakers must weigh economic, social, and environmental considerations. The main Norwegian policy objectives for salmon aquaculture are expressed in the government's white paper to the Norwegian parliament (Meld. St.16, 2014–15). It states the government should (pp. 9–12):

- develop an industrial policy which contributes to maximum economic value creation;
- contribute to predictable and environmentally sustainable growth in aquaculture production of salmonids;
- employ environmental sustainability as the most important factor in regulating further growth in salmon aquaculture.

Sustainable growth of aquaculture requires a combination of knowledge inputs, including from biology, engineering, and the social sciences. Business schools with leading researchers in several social science disciplines have a potentially important role to play in balancing knowledge inputs across disciplines. While the natural and engineering sciences can make crucial contributions to biological and technological innovations which reduce seafood's environmental footprint, these disciplines do not provide all the analytical tools and knowledge required in the difficult balancing act between environmental, social, and economic sustainability concerns. Several necessary analytical tools are in the domain of business school research disciplines. Thus, business schools can make a crucial contribution to aquaculture policies, business management, and innovation. At the same time, knowledge input from business school researchers may be less useful if they do not collaborate with other research disciplines and acquire sufficient aquaculture-specific knowledge related to other disciplines by other means.

INTERACTIONS BETWEEN THE AQUACULTURE SECTOR AND UIS BUSINESS SCHOOL

This section discusses research and innovation-related interaction between industry stakeholders and business schools, using the Norwegian aquaculture sector and UiS Business School (and department of industrial economics) as an empirical case. In the Norwegian aquaculture innovation system (Figure 15.2), it can be argued that other research disciplines apart from those typically represented at business schools tend to dominate, such as fish biology, veterinary sciences, and marine sciences. Nevertheless, as shown by UiS researchers, business schools have a potentially important role to play in several areas, for example government policy and regulation design, business model innovation, market analysis, and product development. Also, in more technologically oriented innovation processes business schools can play a crucial role in, for example, management, planning, and economic analyses of different alternatives and difficult trade-offs.

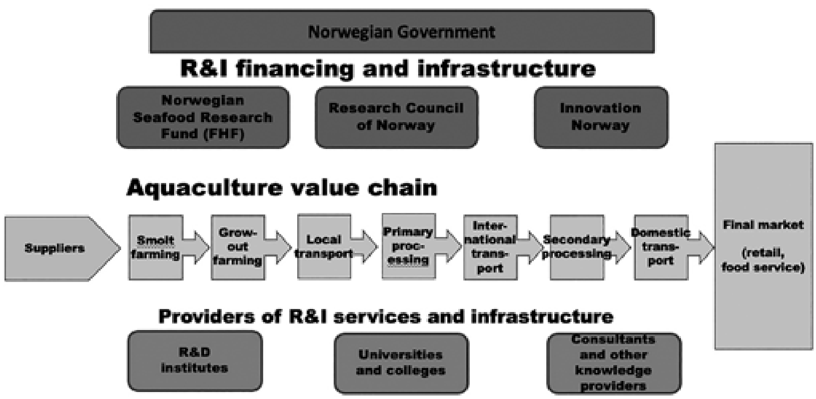
Business school researchers can contribute with knowledge to the public and private sector through several mechanisms, such as government- and private-sector-funded research and development projects, consulting, aquaculture cluster participation, and supervision of bachelor and master thesis projects. Researchers at the UiS Business School have over the last ten years interacted with the aquaculture innovation system through all these channels.

An important aspect of the activities and interactions with stakeholders is the mutual learning between UiS Business School researchers and aquaculture stakeholders. Aquaculture is a dynamic sector, with continuous new innovations, emerging biological and environmental problems, and changing social tensions between industry and other stakeholders. Continuous dialogue and learning between stakeholders are critical to delivering timely and relevant knowledge to these complex ongoing processes. This should also be understood in the context of the UiS Business School's aim of providing "solution oriented social science" (Watts, 2017), including providing input to solving practical problems. For aquaculture – as for other sectors – distance and limited dialogue with stakeholders leads to the risk that researchers formulate research questions which are less relevant or timely and engage more in analyses of past rather than current challenges where society needs their knowledge input today.

Research on seafood and aquaculture economics, marketing, and management at the University of Stavanger began in the late 1990s. Researchers at the

UiS Business School and industrial economics department have been engaged in many research projects funded by the Research Council of Norway and the Norwegian Seafood Research Fund (FHF). These projects cover the whole aquaculture value chain from primary production to final consumers, and the aquaculture innovation system, as illustrated in Figure 15.2. The projects cover knowledge areas such as productivity, economic risk in aquaculture, value chain organization, international trade, consumer demand, government regulation, taxation, cluster economies, and innovation research. Projects have typically been organized as consortiums with several partner organizations, including other research institutions – often from other research disciplines (e.g., other social sciences, biology, engineering) – and often with private companies and public organizations being partners or members of projects' reference or steering groups to ensure stakeholder engagement in projects.

Research projects have contributed to publication of well over one hundred peer-reviewed research articles in international journals by UiS researchers since the late 1990s. Furthermore, knowledge has been shared through presentations to stakeholders at conferences, seminars, and meetings. Since 2000, more than one hundred articles have also been published in popular outlets such as newspapers and trade journals.



Source: Adapted from Bergesen & Tveterås, 2019.

Figure 15.2 Aquaculture value chain and innovation system

Co-author and UiS Business School faculty member Tveterås headed a government commission appointed by the Stoltenberg II government in 2013 which delivered a green paper report (NOU 2014:16) to the government. The NOU report draws on the UiS research group's work on seafood value chains and policies, and more general research on innovation processes. Several researchers at UiS – Asche, Roll, Øglend and Asheim – contributed as co-authors, with three reports to the commission which leveraged the group's research and have references to the research in the literature list (Asche et al., 2014; Digre et al., 2014; Winther et al., 2014). Recommendations have influenced changes in the trade of fish and the right of communities to receive and process fish, while further contributing to the political debate on additional changes in the regulation of industry structure. The report discusses innovation along the entire seafood value chain as a prerequisite for the competitiveness and growth of the Norwegian seafood sector, and stresses that government policies and regulations must provide sufficient scope for innovations. It states explicitly that innovation policy is much more than R&D policy since government regulations at different stages of value chains can influence the ability to innovate.

Researchers at the UiS Business School have also engaged with the seafood and aquaculture sector in various ways. The employer organization the Norwegian Seafood Federation (NSF) organizes the majority of companies in the aquaculture and seafood industry, altogether 700 companies. One of the authors of this chapter, Tveterås, led a steering group consisting mainly of industry executives in NSF's project "Seafood 2030", which developed a strategy for sustainable growth of the Norwegian aquaculture sector towards 2030 and proposed policies and regulations for the future. Reports from this project can be seen as representing a consensus among the heterogeneous member companies of NSF, as these represent a diversity of views on important issues, driven partly by geographic location, value chain position, and firm size (NSF, 2020, 2021). Through engagement with NSF, the UiS Business School contributed to a more explicit focus on environmental footprints, as well as the explicit use of concepts from microeconomics, in particular environmental economics. These concepts were used both to describe the environmental challenges of the industry and to develop proposals for policies and regulations in NSF reports (NSF, 2020, 2021).

Faculty members at the UiS Business School have also been engaged with private companies in consulting (e.g., in relation to investment projects), as company board members, and in domestic and international legal cases and litigation (e.g., as expert witnesses in court). These activities have provided new insights to researchers on several aspects of aquaculture value chains – including more or less tacit knowledge on economic, biological, technological, organizational, and legal issues – and have also helped inform their research and make it more relevant to society and stakeholders.

UiS Business School faculty members participate in public debates through presentations at conferences, opinion letters to newspapers, input to government processes, and consultations in the form of reports and consultation papers. Aquaculture and the seafood sector have stakeholders with different interests and perspectives on economic, social, and environmental issues. Debates and conflicts at both the local and the national levels have been an intrinsic feature of the sector. An example of this is a government process on taxation of salmon aquaculture companies, where researchers at UiS Business School received much critical media attention regarding their communication, independence, and analyses. This was largely driven by the fact that research project funding of UiS researchers was not reported on all occasions, for example, in opinion letters to newspapers. The government eventually designed a tax regime similar to recommendations from UiS researchers. But the process also provided valuable learning for UiS researchers on how to navigate in a politically contentious landscape.

Since its establishment in the early 2000s, UiS and its business school have been involved in the aquaculture cluster organization BluePlanet, a non-profit company co-owned by private companies and public organizations (county, municipalities, and UiS). BluePlanet established the cluster project Stiim Aqua Cluster, which now has over 170 members from across Norway, with the majority from the Stavanger region (see Figure 15.3, "Stiim Aqua Cluster member organizations"[1]). These range from small-scale entrepreneurs to large and multinational companies (e.g., Nutreco Skretting, AkvaGroup, Salmar, Mowi). UiS is represented on the board of BluePlanet and the steering group of Stiim Aqua Cluster, and researchers have been involved in a range of activities including workshops, conferences, and research and innovation projects.

Through Stiim Aqua Cluster, UiS Business School researchers have been engaged to lead and co-author reports that shed light on new opportunities and challenges for the aquaculture sector. These reports have been funded by private and public organizations, and the co-authors include several other research disciplines, such as biology, veterinary medicine, and law. In 2020 a report was published on offshore aquaculture which analysed environmental, biological, technological, and economic challenges, estimated potential future value creation and employment, and provided a roadmap for the development of offshore aquaculture (Tveterås et al., 2020). Another report on sea-based semi-closed aquaculture technologies (which have the potential to reduce environmental impacts and increase fish welfare significantly) was published in 2021 (Tveterås et al., 2021).

The collaboration with Stiim Aqua Cluster and its member organizations, including the multi-disciplinary projects mentioned previously, has contributed to the development of a large research and innovation project aimed at developing solutions for a new low emission offshore aquaculture value chain. We now turn to a discussion of this project, the design of which may provide important lessons for how industry and researchers can work together in the green transition.

Source: Stiim Aqua Cluster, 2022.[2]

Figure 15.3 Stiim Aqua Cluster member organizations

GREEN PLATFORM PROJECT

The research and innovation project "Low emission offshore aquaculture value chain" is a part of the Norwegian government's "Green Platform" program, with a total funding of 1.1 billion NOK (approx. 110 million EUR), where the main objective is to reduce climate gas emissions. At all stages in the new offshore aquaculture value chain, the project aims to provide new research-based knowledge and innovations that reduce energy consumption, provide low climate and environmental footprints, and offer the farmed salmon good living conditions, as illustrated in Figure 15.4, "Green platform project 'Low emission offshore aquaculture value chain'".[3] Proposed innovations include electrification of semi-closed inshore and large-scale offshore farms, new sea vessel concepts, a new green fish-feed, and digitalization and automation of farm operations. The project includes seven partner companies and ten partner research institutions, with a total budget of 185 million NOK (approx. 18 million EUR) which includes government co-funding of 93 million NOK.

The UiS Business School played a leading role in the initiation and development of the successful project application. Co-author Tveterås, a UiS Business School faculty member, has the overall project leadership, and business school researchers are engaged in several research and innovation activities in the project.[4]

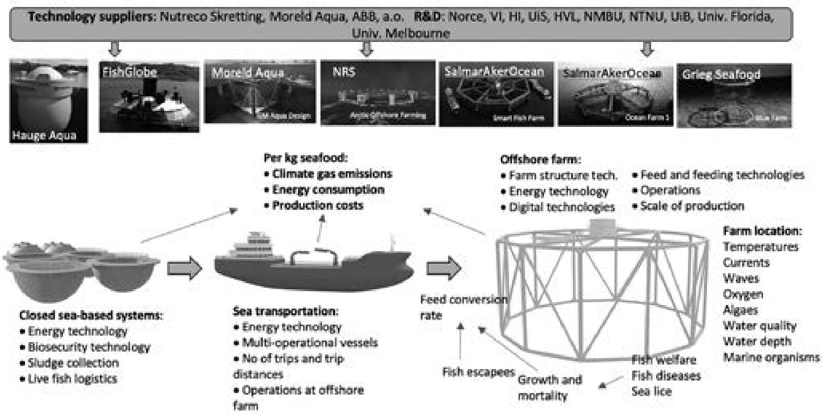


Figure 15.4 Green platform project "Low emission offshore aquaculture value chain"

The Green Platform project includes an organized dialogue arena – a "Responsible Innovation Lab" (RIL) – which brings together public and private actors with knowledge and expertise in the ocean space in general, and aquaculture in particular (Coffay et al., 2022). Conceptually informed by Responsible Research & Innovation (RRI), living labs, and effectuation theory, the RIL emphasizes sustainability-focused experimentation and knowledge co-creation between multiple stakeholders, including researchers, government, firms, public management organizations, and NGOs (see Figure 15.5, "Green Platform project 'Responsible innovation lab'"[5]). It serves as a dialogue arena where stakeholders can navigate dilemmas, identify emergent impact opportunities, and contribute to the responsible development of a regulatory regime for offshore aquaculture which balances economic, environmental, and social considerations.

Participation in the co-development of a regulatory regime which can facilitate and hasten the green transition presents a significant challenge for firms'

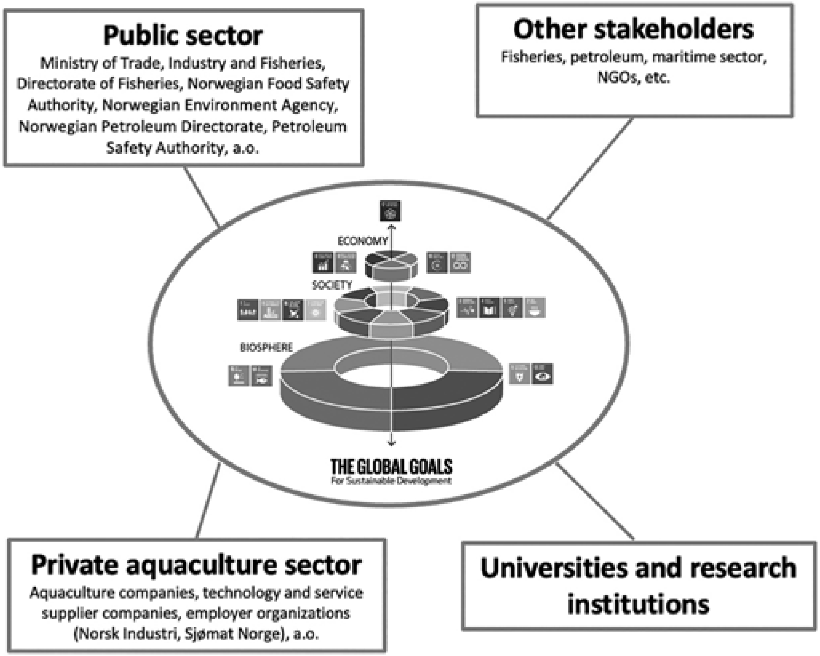


Figure 15.5 Green platform project's "Responsible innovation lab" here

existing business models. At the same time, policymakers and regulatory actors need input from firms, while firms in primary industries such as aquaculture need assurance that investment in sustainability-focused technologies and value chains can be made in anticipation of an emergent regulatory regime that will facilitate profitable production. Civil society must provide license for growth, which implies that new regulations should account for broader questions of social sustainability, equity, and fairness – something which is central to the mission of NGOs oriented towards environmental and social sustainability considerations as well as the broader public interest. Further, much of the technological, organizational, and policy innovation which should be accounted for in new regulatory frameworks must come from researchers with diverse backgrounds and knowledge bases, many of whom are unaccustomed to participating in regulatory development processes.

Through the design and operationalization of a Responsible Innovation Lab as well as large public–private cooperation projects such as Green Platform, business school researchers have the opportunity to bring together the above-mentioned stakeholders and facilitate the development of new policies and regulatory regimes. While this sort of activity may challenge business schools' existing research and innovation activities, we maintain that such a shift of orientation away from more traditional and siloed approaches to research and innovation is necessary in order to hasten the green economic transition.

Further, the development of a new low-emission offshore aquaculture value chain requires a serious rethinking of business models, driven by new technological and biological opportunities and risks, new economies of scale and vertical coordination along the value chain, and new expectations and requirements from customers and society on a range of sustainability concerns. Business school researchers can actively contribute to the development of new, sustainable business models by helping firms overcome the "design-implementation gap" discussed in the introduction to this chapter – that is, the gap which often emerges as firms struggle to design new sustainable business models and successfully implement them. One clear reason for the presence of this gap is a lack of tools which firms can leverage to engage in sustainable business model innovation (SBMI) (Coffay & Bocken, 2022; Geissdoerfer et al., 2018). While there are widely adopted tools for business model innovation *without* a sustainability focus, such as the Business Model Canvas (Osterwalder & Pigneur, 2010), a much smaller and less widely utilized collection of tools exists for SBMI. Of the tools that have emerged in recent years, many suffer from design and user experience problems, or were designed for highly specific contexts, and therefore present major challenges for broader use in multi-stakeholder sustainability-focused innovation projects.

Fortunately, business school researchers are increasingly turning their attention towards sustainable business model innovation and the development of tools which can aid firms in SBMI (Bocken et al., 2019; Pieroni et al., 2019). By continuing to develop, test, and leverage these types of tools, business school researchers can help firms overcome the design-implementation gap while further developing an important subfield of managerial research. Multi-stakeholder innovation projects such as Green Platform can be an effective arena for the development, testing, and leveraging of these sorts of tools. Several such tools are under development in connection with the project discussed here (Coffay et al., 2022; Coffay & Bocken, 2022), with the aim of making them broadly applicable to a wide range of innovation projects in different industry and policy contexts.

While the project is still under way (with a timeline from January 2022 to December 2024), at the time of writing, several lessons have so far been learned from the Green Platform project.

First, project participation gives access to tacit or costly knowledge on economic, technological, biological, environmental, and policy issues from business and research partners that would otherwise not have been obtained, and thus enables business school researchers to add more value by doing more relevant research and having more impact on innovation processes.

Further, there is clearly a role for the disciplines and skills that business school researchers bring to the project, as innovation challenges emerge along the offshore aquaculture value chain which require the analytical frameworks that are provided by the fields of strategy, finance, economics, and innovation. Often, innovation's challenges include the balancing of different sustainability concerns (economic, biological, and environmental), different technological alternatives with different cost structures and performance uncertainties, and organizational and regulatory concerns.

Additionally, the project has a high degree of internal complexity, risk, and conflict potential in several dimensions, where business school researchers can contribute to project management decisions with their analytical toolbox. It also requires much more time and cognitive resources in communication between partners and other activities than more conventional well-defined research projects which, particularly for junior researchers in a tenure-track process, can be viewed as costly. The project requires analytical contributions from business school researchers that can be very useful, but which are not always theoretically or methodologically "cutting edge" and may be difficult to use and adapt into peer-reviewed papers aimed at leading journals.

In sum, participation in the Green Platform project has provided the business school with an opportunity to make a significant impact on a green innovation process, but with an added cost for faculty members in the form of significant time resources allocated to activities that are not rewarded in the current incentive system of business schools.

LESSONS LEARNED AND THE WAY FORWARD

The green transition presents huge and complex challenges for society. In this chapter, we have proposed a path forward in which business schools contribute to the green transition by taking a more active role in innovation projects aimed at reducing environmental footprints. For the UiS Business School, interaction with aquaculture industry stakeholders – and, in particular, engagement in innovation-oriented projects – has provided valuable lessons on the pros and cons of following such a path.

For business schools, a shift of attention and resources towards innovation activities requires a critical discussion of current strategies and research culture. Innovation projects are typically more oriented towards cross-disciplinary knowledge exchange and interaction with other sectors, while typical business school research activities tend to have a narrower scope oriented towards disseminating knowledge through peer-reviewed academic journals. The institutional and individual incentives of business schools and their faculty members are often much better aligned with traditional research projects aiming for peer-reviewed publications, particularly when it comes to junior tenure-track faculty. Recognizing the career incentives of faculty members – particularly junior faculty, including their time and cognitive scarcity as they balance teaching requirements and aim for publications in leading field journals – is critical to assessing faculty members' ability to participate in innovation projects and creating new systems which incentivize such participation.

Business schools have limited human and financial resources with which to tackle their three missions of education, research, and contribution to society, where the primary and most resource-consuming mission is education. It remains an open question to what extent a business school can leverage its own limited resources through "smart" specialization in their innovation process collaboration with other institutions and firms. Doing so would involve a more developed understanding of which roles business school researchers should take in innovation processes, as well as the development of specialized capabilities (e.g., knowledge and expertise around sustainable business models and circular economy) within a business school related to the sectors and types of innovation activities it chooses to focus on.

NOTES

1. See https://stiimaquacluster.no/english.
2. See https://stiimaquacluster.no/blog/2022/03/23/klyngen-fortsetter-a-vokse/.
3. See https://gronnplattform.stiimaquacluster.no/english/.
4. Both authors of this chapter are engaged in the Green Platform project; Tveterås as overall project leader, and Coffay as researcher.
5. See https://gronnplattform.stiimaquacluster.no/english/.

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