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Sustainability as Seen Through the Lens of Salmon Aquaculture Sustainability Standards

Doctoral thesis

NTNU
Norwegian University of Science and Technology
Thesis for the Degree of
Philosophiae Doctor
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Department of Sociology and Political Science

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All models are wrong, but some are useful.

George Box

Certification can be useless.

Random post-it note found in the first book
I checked out from the NTNU Dragvoll
library after starting this project

Preface

This thesis is prepared for the degree of Doctor of Philosophy at the Department of Sociology and Political Science, under the Faculty of Social and Educational Sciences at the Norwegian University of Science and Technology (NTNU). The work was performed at Studio Apertura, NTNU Samfunnsforskning.

The study was done as part of the SustainFish project ("From global ideals to local realities: The foundations of sustainability"), which was funded by the Norwegian Research Council and led by Dr. Tonje Osmundsen at NTNU Samfunnsforskning (project number 254841).

The thesis is divided into two parts. The first is the thesis report, which provides a synthesis of the aim, background, and main contributions of the work, as well as discussions of overarching themes. The second part consists of five scientific papers, which comprise the main results of the conducted work.

I have included some puns, just for the halibut. Hopefully it will make for a more enjoyable read. Let's sea.

Acknowledgements

There are several people I would like to thank for their contribution to this thesis. Firstly, this study would not have been possible without our informants. Finding and taking the time out of a busy workday is not a given and I am truly grateful for your involvement and commitment.

My supervisors have been crucial throughout the doctoral period. Thank you to Jennifer L. Bailey (NTNU) for persistently speaking in the form of questions, opening my eyes to the infinite possibilities of research topics and perspectives to explore. And to Tonje Osmundsen (NTNU Samfunnsforskning), who has filled the formal roles of supervisor, project manager, and boss, as well as the more informal responsibilities of psychiatrist and life coach.

The completion of this thesis would not have been possible without my third and unofficial supervisor, Dr. Dad Amundsen, and his relentless wisdom and motivational Steinbeck quotes. Similarly, my mother has provided indispensable support, most importantly by reminding me, and my father, that there is more to life than just fish.

My colleagues at Studio Apertura have been of great help, both on an academic and personal level. I would also like to thank my more distant colleagues, the SustainFish project members, for fruitful collaboration and stimulating discussions. I would especially like to thank Frank Asche for scaring me into thinking that not finishing the PhD on time was in no way an option.

Finally, I am eternally grateful to those who have supported me from the outside of the PhD bubble, friends and family who have ensured my mental wellbeing through encouragement, flattery, and motivation. Most importantly, I would like to thank Tony Gonzalez, the captain of my cheerleading squad. You are a true inspiration with your endless championing and ridiculous amount of patience. Thank you for providing food for thought and for tummy.

Summary

This thesis was written as part of the SustainFish project, which was funded by the Norwegian Research Council (project number 254841). It explores the consequences of employing a technical understanding of certification and seeing sustainability as a technical outcome, in order to increase knowledge on how the aquaculture industry is, and should be, regulated. Specifically, this study maps the content of eight of the major sustainability standards for salmon aquaculture in Norway, Chile, and Scotland, generating a database with over 1900 sustainability indicators. Furthermore, it investigates the experiences of salmon aquaculture producers and auditors, providing insight into the actual workings of sustainability certification. Through document analysis, interviews, and fieldwork, this thesis examines the *impression* of sustainability that is created through the choice of content in these standards, the *implementation* of the standards, the *impact* of them, and the reciprocal influence between these 'phases' (the 3 I's) of the certification process. The findings are presented in five scientific papers.

The main contributions can be summarized as follows:

- The Wheel of Sustainability (WOS), a reference model for sustainable salmon aquaculture. In addition to being an important methodological contribution, this model serves as 1) a valid lexicon for the many issues related to improving the industry, 2) a tool for comparison of different improvement initiatives, and 3) a collaboration tool for identifying and addressing tradeoffs and other topics for consideration.
- In-depth understanding of how certification schemes concretize 'sustainability' through the indicators they choose to include (and exclude), and how the concept is further operationalized through the implementation of these indicators. This involves a comprehensive mapping of the indicators in some of the major sustainability standards (resulting in a database of over 1900 indicators), and investigation of how salmon aquaculture companies strive to comply with these indicators.

- Increased knowledge about how standard indicators are received, perceived, and achieved differently across different companies and sites. This speaks to the challenges of governing at a distance, as there is often a great range between 'standard' and 'reality' – between global ideals and local realities.
- Improved comprehension of what the behavioral dimension of certification effectiveness includes, through the development of specific content for the concept. The identified facilitators for behavioral change provide opportunities 1) for certification schemes to incorporate criteria that can better facilitate actual changes, 2) for salmon aquaculture companies to find ways in which to best achieve significant changes, and 3) for auditors to develop specific ways in which to assess companies on this dimension.
- Insight into some of the key challenges and implications of governing through standardized indicators. These findings contribute to an acknowledgement of the inherent limitations of 'governing at a distance' when employing a technical approach, as well as a proposal for a way forward.
- Suggestions on how to better utilize the potential that sustainability certification has for improving the industry. This primarily involves refocusing efforts towards continuous improvement, flexibility, and facilitation of learning and knowledge building through interaction between the governing system and the objects to-be-governed.

Based on the findings of the study, this thesis advances a fundamental change in how certification and indicators as governmental technologies are understood and utilized. This involves moving towards a recognition of 'sustainability' as a processual construction, with emphasis on relative rather than absolute improvement. Building on this, the primary theoretical contribution of this thesis is the advocacy for a shift from a technical to a social understanding of certification, which stresses the role of flexibility, negotiation, and reciprocal knowledge production in applying these tools. This shift entails treating certification as a *continuous* governance process, by both acknowledging and utilizing the reciprocal influence between the different 'phases' (the 3 I's) of the certification process.

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Tables and figures

1 Introduction

The objective of this thesis is to explore the consequences of treating sustainability as a technical outcome, investigating the specific case of sustainability standards for salmon aquaculture. With this, I seek to provide insight into the mechanisms of standardization as a means towards improving the industry, and with that contribute to a better utilization of sustainability certification. Drawing on a theoretical framework of certification, standardization, global and interactive governance, and neo-institutional literature, I approach these issues through three different perspectives: *impression*, *implementation*, and *impact* of sustainability standards[1]. By applying these perspectives (the 3 I's) in the context of each other, this thesis provides a portrayal of the important interplay between the vague concept of sustainability and the actions that are taken to 'achieve' it, concluding with a call to shift from a technical to a social understanding of certification.

1.1 Framing the issue

Sustainability has become one of the most commonly used and misused words of our time. Despite, or possibly because of, its proliferation, it is largely used in an entirely uncritical manner. Declarations stating that a country, or a county, or a company is working towards becoming sustainable are of no value if there is no consideration granted towards what this actually entails. The concept in itself serves little purpose if

[1] In this thesis, 'standard' refers to these documented agreements containing specified criteria in the form of indicators and requirements, which are developed by certification schemes. By demonstrating compliance with the necessary requirements, companies can obtain the scheme's certification (see Chap. 2.3 for more details).

not operationalized, which involves giving it specific content in the form of aims or actions. This chosen content, i.e. the concretization of the concept, will in turn influence what is associated with sustainability.

One way in which sustainability has been operationalized is through sustainability standards. These are private, market-based initiatives that are intended to encourage responsible practices and strengthened accountability through having companies comply with a set list of criteria, in exchange for a certificate. These schemes have become increasingly more common within many industries, including aquaculture. The aquaculture industry has long struggled with numerous challenges related to environmental impact, animal welfare, privatization of marine commons, etc., giving rise to criticism of being unsustainable. Sustainability standards have become a strategy to both improve the industry's practices and its reputation. There is, however, much concern as to the actual effects of these standards, as they employ a technocentric approach that aims to 'reach' sustainability through checklists of requirements.

1.2 Overall aim, research questions, and approach

The theoretical challenge that this thesis seeks to address is the fundamental limitations of treating sustainability as a technical outcome that can be 'reached' or 'accomplished', and the corresponding technical understanding of sustainability certification. Much of the certification literature is based on the premise that its potential for improvement lies primarily in the development of better indicators, resulting in the literature merely reproducing itself and the same knowledge comprehension. As is both argued and illustrated in this thesis, sustainability is not a static end-goal that can be achieved through compliance with set criteria. For that reason, I advocate for a shift away from this technical understanding of certification that is limited to an absolute conceptualization, and thereby simplification, of sustainability.

This study explores these issues through the case of sustainability standards for salmon aquaculture, focusing on the industries in Norway, Chile, and Scotland, and is centered around the following research questions:

Main research question:

RQ1: What are the consequences of employing a technical understanding of certification and seeing sustainability as a technical outcome, and how can increased knowledge about this move us towards a new conceptualization of certification as a mechanism for social change?

Sub-questions:

SQ1: What *impression* of sustainability is created through the choice of content in sustainability standards?

SQ2: How are sustainability standards *implemented* in salmon aquaculture companies?

SQ3: What *impact* does the adoption of sustainability standards have on the salmon aquaculture industry?

The first component of the main research question is addressed in the research papers, which are based around the three sub-questions. Observations pertaining to the second component are drawn from a synthesis of the findings in the research papers, and are presented in the thesis report. In order to best investigate these complex issues, I approach them through the perspectives of *impression, implementation,* and *impact* of sustainability standards (i.e. the 3 I's). Importantly, these are analytical categories, meaning that such a clear delineation between them merely serves a theoretical purpose. Both the research questions and papers are divided according to these three perspectives, so as to provide a comprehensive understanding of the processes at play, while also ensuring a more orderly presentation of the complex matters at hand.

'Impression' refers to how the meanings that sustainability is attributed can affect that which is done to 'achieve' it, and vice versa. This relates to the power of definition held by those that decide which indicators to include and exclude in e.g. sustainability standards. An unbalanced representation of interests in these decisions can have implications for the *impression* of sustainability that becomes prevalent, and can in turn affect agendas for action – what national authorities regulate, what civil society actors

demand, and what industries prioritize. The reason this perspective has been labeled *impression* is that it goes beyond the *definition* or *understanding* of sustainability, as it is not just a matter of what sustainability is said to involve. Impression concerns the ideas and feelings that are projected through both the stated and practiced definitions and substance of the concept.

'Implementation' refers to the different ways in which companies work to incorporate new procedures and practices into existing structures and routines. This perspective is interesting to explore because a study of just the set criteria of a regulatory initiative will only tell us something about hypotheticals. While the examination of the indicators of sustainability standards can provide valuable insight into the potential effects of sustainability certification, it is also necessary to investigate how these are *implemented* to understand the actual implications of these regulatory initiatives. Importantly, *implementation* is not just a matter of the initial adoption, but all processes involved in putting the standards into action. This not only concerns how companies work to comply with the criteria by e.g. changing or adding specific procedures, but other arenas where 'standard' meets 'reality', such as the audits where compliance is assessed.

'*Impact'* is purposely labeled using a very broad term. This is because this not only concerns the *effect* of sustainability certification, which is here understood as the question of whether they 'achieve' what they are intended to achieve. Using *effect* might also suggest that this only concerns whether companies reach the set targets, thereby ignoring the actual changes that are implemented within the companies. It would also be wrong to label this perspective as *consequences*, as this term has negative connotations, thereby implying the mere inclusion of downsides of sustainability certification. *Impact* includes not only intended effects or unintended consequences, but also potential implications for the industry as a whole, such as how the creators and assessors of these standards become a new source of expertise in the endeavor to improve the industry (see Chap. 6.3.1).

The 3 I's do not merely serve a purpose in individually shedding light on different 'phases' of the certification process. Seeing them in conjunction, they portray the reciprocal interplay between concept and action, which serves to both reveal the

consequences of treating sustainability as a technical outcome and provides insight into how sustainability and certification can be better understood and utilized.

1.3 Theoretical relevance

In ensuring theoretical relevance, it is imperative that new studies build on previous research, both by utilizing previous findings to inform one's own, and in identifying gaps in the literature to discover research opportunities. This thesis explores aspects of sustainability certification that have been largely neglected by previous research, such as the potential reach of existing sustainability indicators. However, it also examines issues that have already been studied, such as various dimensions of certification effectiveness, but by employing different and more in-depth strategies. Although in quite different manners, both these approaches build on previous research.

This thesis aims to serve as a contribution to the certification, standardization, and governance literature, by providing insight into the mechanisms of sustainability certification and 'governing at a distance' on a more general level. By exploring the consequences of treating sustainability as a technical outcome through sustainability standards, this thesis identifies strengths, problematic consequences, as well as issues to be aware of with this type of regulatory approach. This means that while the details presented here are case specific, I have sought to also identify and shed light on issues of more general relevance, i.e. relating the particular to more general concepts and ideas. This concerns issues such as the use of standardized indicators to govern a global industry with very different regulatory, geographical, and organizational contexts – both the indicators in themselves and how they are applied in actuality. Building on this, the primary theoretical contribution of this thesis is the demonstration of the need to shift from a technical to a social understanding of certification.

By delving into what certification effectiveness might involve within a social understanding of certification, this study also provides content to one of its less studied dimensions: the behavioral changes made within companies that become certified. This specification of the behavioral dimension provides an increased understanding of the many processes at play in the endeavor to make the industry more 'sustainable', relating

back to the importance of understanding the complexities of sustainability as a concept, a goal, and a strategy. This also speaks to the social and political relevance of the thesis, which is described in the next section.

Another contribution that is of both theoretical and social/political relevance is a reference model for sustainable salmon aquaculture, the Wheel of Sustainability, which has been developed as part of the SustainFish project. This model moves beyond the common three-dimension understanding of sustainability (see Chap. 2.1.1), providing specific content to the notion of 'sustainable salmon aquaculture'. For theoretical purposes, this model can serve to both educate and communicate, as it provides a holistic overview of the complexities of the many issues related to sustainability in salmon aquaculture production. The model can also be applied in a more practical (i.e. social and political) sense, as a tool for collaboration and improvement of the industry. Furthermore, the Wheel of Sustainability has been developed in such a way that it can easily be adapted to apply to other species of aquaculture, possibly even other industries.

1.4 Social and political relevance

The social and political value of this study lies in taking the vague and wide-spread concept of sustainability and seeing how it is being operationalized, and exploring the consequences of treating it as a technical outcome. This provides a knowledge base for understanding both what is actually being done, and what can and should be done. As regards to the chosen industry to study, aquaculture production is becoming increasingly important on a global level (Garlock et al., 2019). This thesis examines the *salmon* aquaculture industry specifically, which, while not being one of the major species in terms of production quantity, represents a significant share of the total production value globally (Asche et al., 2018). The salmon industry, as with aquaculture in general, has received massive criticism for not being regulated properly and for not being sustainable. Gaining more in-depth knowledge of how the industry is regulated is imperative, because improvement of the industry is premised on understanding these mechanisms. As is described in this thesis, regulatory initiatives are not merely

technical, meaning that the application of them will be influenced by the context within which they are implemented. Furthermore, they are not neutral, as they represent deliberations and decisions concerning which issues to address and which to disregard, thereby representing choices as to what an acceptable footprint (or 'food print') is (Béné et al., 2019).

As private sustainability certifications are becoming an increasingly important regulatory approach within aquaculture, they are an interesting case for studying these processes. The thesis provides an in-depth study of the impression of sustainability that these standards create and foster, how they are implemented, and their potential impact, both positive and negative, all of which can be of interest to the industry itself, national authorities, and NGOs. Importantly, the findings of this study are based on one specific case (sustainability standards) and industry (salmon aquaculture), and are not necessarily generalizable to a wider population (see Chap. 4 for explanation of case studies). However, they have been analyzed in the context of broader issues, meaning that they can shed light on the larger phenomena that are examined in this thesis. For instance, reflections on how to best realize the potential of sustainability certification can have a wider application, as this is a type of certification that exists for numerous industries and products, which can be assumed to face many of the same challenges as those for salmon aquaculture. Therefore, in this thesis, I sometimes refer to aquaculture in general or certification in general, as opposed to salmon production specifically.

Furthermore, while this is a study of *private* certification schemes, meaning that national regulations fall outside its primary scope, these are all part of a global governance regime for the industry. These schemes and their standards do not exist in isolation, as they are constantly positioning themselves in relation to national regulations and authorities. This means that national regulations must be seen as part of the context within which private certification schemes find themselves, suggesting that the findings of this study may speak to broader issues of both private and public governance initiatives.

1.5 The structure of the thesis

This thesis is presented in two parts: the thesis report and the scientific papers. The thesis report is structured as follows: Chapters 2 and 3 are in-depth depictions of relevant literature. The former delves into the theoretical background and key concepts, including sustainability, 'governing at a distance', private sustainability standards, and the sustainability of the salmon aquaculture industry. The latter explores the theoretical framework applied in this study, centered on the three perspectives *impression*, *implementation*, and *impact*. These chapters combined provide the necessary background to orient subsequent discussions. In Chapter 4, the research design and methods of this study are presented, concluding with important reflections on the scientific quality of the research. Chapter 5 contains a presentation of the scientific papers included in this thesis, five papers in total. This presentation also includes summaries of a conference and data paper that were written during the doctoral period. In Chapter 6, the findings are discussed in light of the theoretical framework, with focus on themes found across the papers and the main contributions of the thesis. In Chapter 7, I make some concluding remarks and provide suggestions for further research.

The appended scientific papers are listed in Table 2 (next page). Table 1, which is based on CRediT (Contributor Roles Taxonomy), shows my personal contribution in each of these papers. Importantly, much of this work was done in collaboration with co-authors (see Chap. 4.3 for details).

Table 1: Personal contribution in each paper

	Paper A	**Paper B**	**Paper C**	**Paper D**	**Paper E**
Conceptualization	X	X	X	X	X
Methodology	X		X	X	X
Formal analysis	X		X	X	X
Investigation	X	X	X	X	X
Writing - Original Draft			X	X	X
Writing - Review & Editing	X	X			

Table 2: Scientific papers of this thesis

	Title	Authors	Status
Paper A	The Operationalisation of Sustainability: Sustainable Aquaculture Production as Defined by Certification Schemes	Osmundsen, T. C., Amundsen, V. S., Alexander, K. A., Asche, F., Bailey, J. L., Finstad, B., Olsen, M. S., Hernandez, K., & Salgado, H.	Published
Paper B	'Social Stuff' and All That Jazz: Understanding the Residual Category of Social Sustainability	Alexander, K. A., Amundsen, V. S., & Osmundsen, T. C.	Published
Paper C	Virtually the Reality: Negotiating the Distance Between Standards and Local Realities When Certifying Sustainable Aquaculture	Amundsen, V. S., & Osmundsen, T. C.	Published
Paper D	Level Up or Game Over: The Implications of Levels of Impact in Certification Schemes for Salmon Aquaculture	Amundsen, V. S., Gauteplass, A. Å., & Bailey, J. L.	Published
Paper E	Becoming Certified, Becoming Sustainable? Improvements from Aquaculture Certification Schemes as Experienced by Those Certified.	Amundsen, V. S. & Osmundsen, T. C.	Published

2 Theoretical background and key concepts

It is argued in this thesis that the operationalization of sustainability through initiatives such as sustainability standards can have major implications, both for how sustainability is understood and for which measures are put into place to 'achieve' it. In order to explore the consequences of treating sustainability as a technical outcome, it is first necessary to delve into the key issues and areas of focus for this thesis, and with that provide the necessary background to better understand the many mechanisms at play. This section describes and discusses the concept of sustainability, the shift to governing global industries at a distance, private sustainability standards, and the sustainability of the salmon aquaculture industry. With this as a backdrop, the next chapter goes into detail on the operationalization of sustainability, and the complexities and implications of employing a technical understanding of sustainability and sustainability certification.

2.1 Sustainability

In today's society, there is increasing pressure to shift to more sustainable practices, which has been referred to as the 'sustainability transition' (Geels, 2011; Genus, 2016; Portney, 2015). This not only applies to specific industries, but is rather a general trend of higher expectations of accountability and transparency in major sectors. This pressure not only emanates from the general public, but also from governments, NGOs, investors, and consumers (Keeble et al., 2003). In many regards, sustainability has become the new norm, i.e. "a standard of appropriate behavior for actors with a given identity" (as summarized by Finnemore & Sikkink, 1998, p. 891). This especially pertains to food production, what Béné et al. (2019, p. 117) cleverly refer to as a newfound focus on the environmental 'food print'. Consequently, sustainability and

sustainable development are now nearly obligatory ingredients in organizations' strategies and mission statements, as well as governmental policies (Alexander et al., 2015; Meld. St. 16, 2014; Portney, 2015).

2.1.1 What is sustainability?

The definition of sustainable development most commonly referred to is from the Brundtland Commission Report: "development … [that] meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 44). Departing from this definition, Portney (2015, p. 4) elaborates:

> It is clear that, at its core, sustainability is a concept that focuses on the condition of Earth's biophysical environment, particularly with respect to the use and depletion of natural resources. It is not the same as environmental protection. It is not the same as conservation or preservation of natural resources. […] It is more about finding some sort of steady state so that Earth or some piece of it can support the human population and economic growth without ultimately threatening the health of humans, animals, and plants. The basic premise of sustainability is that Earth's resources cannot be used, depleted, and damaged indefinitely.

Similarly, Kuhlman & Farrington (2010) describe sustainability by referencing the noted quote by a Nigerian tribal chief, that "land belongs to a vast family of which many are dead, few are living and countless numbers are still unborn" (Dike, 1983, p. 855).

Another common way of explaining, or defining, the concept of sustainability is through the three dimensions: environmental, economic, and social sustainability, often visualized as the venn diagram, the nested model, or the three pillar model (see Figure 1). Not part of the Brundtland Commission Report, the triad was formulated as part of the United Nation's definition of sustainability in their Agenda for Development (United Nations, 1997), inspired by Elkington's (1997) triple bottom-line. Although sustainability is broken down into three components, Davidson (2011) and others argue that it is meant to be an integrated concept, with a necessary balancing of objectives in

all three areas. At its most basic, this means that tradeoffs among the dimensions are meant to be assumed. However, the separation of sustainability into three dimensions has been criticized for obscuring the many connections among the dimensions and their various aspects (Lehtonen, 2004). Other common criticisms of the three dimension model include the model's failure to illustrate the unavoidably conflicting objectives between the dimensions, the wrongful separation of social and economic aspects, and the implication that the dimensions should be seen as an issue of hierarchy (Kuhlman & Farrington, 2010; Lehtonen, 2004; Levett, 1998; Mauerhofer, 2008).

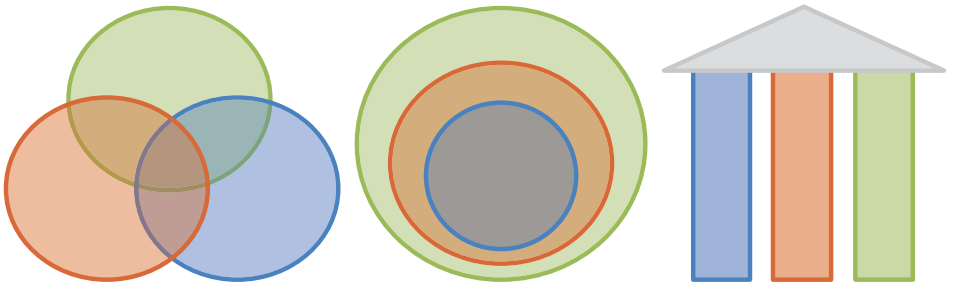

Figure 1: Different versions of the three-dimension model of sustainability (green for environmental, red for social, and blue for economic)

In response to the criticism, there have emerged other versions that are based on the three dimensions. For instance, in the quadruple bottom-line, the dimension of governance is added in addition to the three original dimensions (Alibašić, 2018). Others have added an institutional dimension to the three (Karlsen et al., 2013). One adaptation has made the three-dimension model three-dimensional, in order to include conflicting interests between the environmental, social, and economic dimensions (Mauerhofer, 2008). Nevertheless, despite the many criticisms, the three-dimension model is still the most commonly applied illustration of sustainability (Kuhlman & Farrington, 2010). In accordance with its critics, this thesis argues for a less simplistic portrayal and understanding of sustainability, which is further discussed in the following chapter.

Disputes regarding the sustainability concept not only concern how many dimensions there are to sustainability, but also the difficulties of saying what sustainability means with respect to any of them. A more practical and concrete operationalization of sustainability is the UN Sustainable Development Goals (SDGs) (United Nations, n.d.). The SDGs have proven valuable as they are the result of a many-year collaborative effort to actualize sustainability and sustainable development. They include 17 goals, where the final goal refers to the significance of partnerships in the endeavor towards sustainability, which speaks to the important issues of implementation and governance. The goals provide content to the vague concept of sustainability in order to facilitate action, while also demonstrating the multifaceted character of it. While not providing goals per se, it is a similar approach that has been applied in this study, but for salmon aquaculture specifically.

2.2 A shift in governance

Modern society is experiencing a shift in governance arrangements, which very much relates to the increased focus on complex global issues such as sustainability. This shift is rooted in neoliberalism, which Foucault describes as a condition for the development of modern capitalism, where political power is modeled on the market economy and marked-based mechanisms for regulation are encouraged (Eliassen, 2016; Foucault, 2007, 2008). This has led to the emergence of New Public Management, which represents a more performance-and-results-oriented government (Christensen & Laegreid, 2009; Turnhout et al., 2014). This shift has also involved that the traditional regulatory model, with the state as the key actor, is being challenged, moving towards decentralized power, wider participation, knowledge-based solutions, disciplinary apparatuses, and practices rather than institutions (Asdal, 2008; Foucault, 2008; Lindøe et al., 2018).

This is referred to as polycentric governance, or multi-actor governance, where private actors such as companies and activist organizations, and to some degree civil society, play a vital role in the governance of complex systems, such as marine space and aquaculture production (Abbott & Snidal, 2000; Groeneveld et al., 2017; Ostrom, 2010;

Vince & Haward, 2017). In the same vein, Thomann (2017) describes a broader understanding of regulation that has emerged, involving various hybrid constellations of the state, the market, and civil society actors. Cuyvers and De Meyer (2012, p. 126) describe this as a shift from 'international old governance' to 'transnational new governance':

> International old governance (IOG) characterized by intergovernmental organizations issuing fixed rules in a centralized and top-down manner is gradually being replaced by transnational new governance (TNG), which relies more on 'soft law' and orchestration of various configurations of public and private stakeholders as repositories of regulatory expertise. The reasons for this development are the distinct comparative advantages of TNG over IOG: TNG has the capacity to address regulatory issues in more diverse ways, which is important in increasingly complex and ever more rapidly shifting global production systems.

The concept of 'soft law' entails that these initiatives are not legally binding, as opposed to the hard law of government regulations. However, they can still be very effective as they carry with them various forms of sanctions (Busch, 2011). With soft law, it is an issue of assurance, i.e. enforcement through acquisition of documentation and other demonstrable evidence (Loconto, 2017). Importantly, the distinction between hard and soft law, or public and private regulations, is rarely clear, as many initiatives are hybrids or configurations of the two extremes (Abbott & Snidal, 2000; Challies, 2012; Kringen, 2018). This also concerns initiatives in which the state does not function as an active regulatory agent, but where the looming shadow of the state might serve as a threat of intervention, if the implemented initiatives do not achieve their purpose (Börzel & Risse, 2010; Thomann, 2017). Regardless of whether these types of initiatives depend on the looming shadow of the state to be effective, what this discussion illustrates is that we cannot explore private governance initiatives, such as sustainability certification, in isolation. While the role of the state is outside the scope of this thesis, it cannot be ignored as it represents a major part in the context within which these initiatives operate, suggesting a dynamic interaction and influence between the two (Groeneveld et al., 2017).

2.2.1 Governing at a distance

This shift in form of governance is founded on ‘governing at a distance’, a term borrowed by Rose and Miller (1992) with clear associations to Foucault (2007, 2008). As opposed to direct supervision, this represents an indirect form of governance, where individuals are shaped through discipline and education, rather than prohibition and penalty (Eliassen, 2016; Foucault, 2007). This relies on the creation of governable objects through elements of internal control, which entails that the subjects themselves become involved (Morris, 1998). This is in part accomplished through the act of inscription, which means having subjects document their actions and performance, records that are made available to external agents (Rose & Miller, 1992).

Using the acquisition of records as a means of regulation has been termed ‘informational governance’, or ‘governance-by-disclosure’ (Bailey et al., 2016; Gupta, 2008). This is what Foucault (2008) has coined the ‘conduct of conduct’, which Busch (2017, p. 5, *emphasis added*) summarizes as a shift “from the substantive to the formal, from assuring quality of food products among many other things to assuring the *assurance* of quality.” This is accomplished through what Foucault (2007) refers to as ‘technologies of power’, or governmental technologies, “the complex of mundane programmes, calculations, techniques, apparatuses, documents and procedures through which authorities seek to embody and give effect to governmental ambitions” (Rose & Miller, 1992, p. 175).

2.2.2 Governing through indicators

A common form of governmental technology is indicators, which can serve to construct governable entities through providing specific, quantifiable data. An indicator functions as a means to measure a particular attribute of a larger and more complex whole, which, when seen in relation to other indicators, can provide a clearer and more comprehensive picture. While some outcomes are possible to measure and monitor directly, indicators are employed as devices to get an indication of the condition of something by measuring something else that is easier to measure (Kongsvik et al., 2010). In other words, indicators are numerical measures that provide information and simplify

complex data, and in that way allow governing at a distance (Merry, 2011; Rydin, 2007). When employed in regulation, these measures must be standardized to create fair and transparent international comparison (Almklov et al., 2014; Merry, 2011).

The strength of indicators lies in that they are context transcending systems (Almklov et al., 2017). While words and reports carry meaning that is relatively local, standardized measures like indicators contribute to cross-contextual and international commensurability, aiding comparison of performance across different locations, thereby reducing transaction costs in a global economy (Busch, 2000, 2011; Rydin, 2007). Indicators are, therefore, a common approach for making sustainability, and the means of 'achieving' it, more tangible by providing measurement tools and parameters to regulate complex industries (Levett, 1998). The proliferation of sustainability indicators, both in public and private regulatory initiatives, can be traced back to a call for more comprehensive monitoring systems in the Agenda 21 document from the 1992 Earth Summit (Conference on Environment and Development, 1992; Milewski & Smith, 2019). According to Rydin (2007, p. 613), this proliferation "represents the interface of a continuing embedding of sustainable development as a legitimate focus of collective action and the increasing use of indicators across a range of policy areas."

Given the variety of roles that indicators can have, they should ideally satisfy criteria beyond the purely scientific, such as being easy to employ, interpret, and communicate, and be cost-effective. Indicators should ideally return a reliable report about the quality that is being measured (Dale & Beyeler, 2001). To summarize, «[e]veryone agrees that indicators should be (a) policy relevant, (b) resonant, (c) scientifically valid and (d) measurable (i.e. the necessary data are available)" (Levett, 1998, p. 291). When representing something as complex and intangible as 'sustainability', these universal criteria become especially difficult to meet. According to Rey-Valette et al. (2007, p. 9),

> [a]s sustainable development is inherently opposed to standardised solutions, procedures for elaborating sustainable development indicators must be varied and defined based on contexts and specific expectations regarding the functions they are to ensure.

However, due to the necessity for commensurability in dealing with such a vague 'condition', there is a prevailing preference for easily measurable, simplified sustainability indicators (Milewski & Smith, 2019; Rydin, 2007).

2.3 Private sustainability standards

A major source of sustainability indicators is private sustainability standards, which have become an increasingly important policy instrument, in salmon aquaculture and other major industries. These standards are developed by certification schemes, which are typically multi-stakeholder initiatives, meaning that they comprise a variety of actor constellations – NGOs, retailers, industry actors, etc. (Belton et al., 2010; Weitzman & Bailey, 2018). Being private, marked-based regulatory mechanisms, these standards are voluntary (i.e. soft law) and, to a large degree, directed by retailer and consumer choice (Challies, 2012; Tlusty & Tausig, 2015).

Companies can obtain a scheme's certificate by complying with the list of indicators and respective requirements that make up the specific standard. As described above, these indicators must be measurable, transferable, and comparable, allowing the same standard to be applied across different companies and countries. Although not the case for all types of sustainability certification, compliance is typically assessed by a third-party auditor (Hatanaka & Busch, 2008; Lindøe & Kringen, 2018; Loconto, 2017). According to Boyd and McNevin (2015, p. 303), "[t]his arrangement assures that there are no conflicts of interest among auditors who inspect facilities, entities that make the standards, and those who own or operate the facilities." An essential condition for third-party verification is that the auditors themselves are audited by accreditation bodies.

2.3.1 One goal, different approaches

While this thesis refers to 'sustainability standards', few certification schemes refer to their standards as such. 'Sustainability standard' is here used as a collective noun for standards that address issues pertaining to responsible production and product. Existing standards do, however, vary greatly. For one, different certification schemes operate

with distinct economic models, where some earn a profit and others do not. In regard to scope, Henson and Humphrey (2012) make the distinction between different horizontal and vertical scopes of standards. The former refers to the range of issues that are covered by a standard. Within seafood, some standards address wide-ranging matters of responsible production, while others limit their scope to topics such as food safety or animal welfare (Alfnes et al., 2018). Vertical scope refers to which segments of the value chain that are included as the units of certification. For instance, some aquaculture standards certify the production site or processing facility, while others certify entire companies through what is called 'chain of custody' (Bush & Roheim, 2019; Stanton, 2012).

Standards can also differ in the types of stakeholders that are included in the development process. For instance, some schemes include only industry actors, while others also include non-industry stakeholders such as environmental or human rights groups (Aguayo & Barriga, 2016). Another key difference is the object of certification. In the case at hand, certain standards are species-specific, while others concern aquaculture in general. Other differences include, as summarized by Boyd and McNevin (2015, p. 302): "[t]he procedures for developing standards, the rigor of standards, audit procedures, methods for selecting inspectors, requirements for compliance, and chain of custody and traceability of products from production facilities to consumers."

2.3.2 The proliferation of sustainability standards

While sustainability certification originated in agriculture, the increased focus on sustainability and accountability has led to a proliferation of standards in many different sectors, including forestry, food production, mining, and clothing (Busch, 2017; Challies, 2012; Derkx & Glasbergen, 2014). This also includes seafood, both for fisheries and aquaculture (Alfnes et al., 2018; Kalfagianni & Pattberg, 2013). One of the major certification schemes in seafood is the pioneering Marine Stewardship Council (MSC), inspired by Forest Stewardship Council (FSC), which was created through the collaboration of WWF and the major retailer Unilever (Gulbrandsen, 2009). Emerging from stakeholder activism, political consumerism, and a general increased attention to

sustainability, the 'sustainable seafood movement' has led to a higher demand for sustainable products (Aguayo & Barriga, 2016; Bush & Roheim, 2019; Konefal, 2013). This suggests an interesting turn, where multinationals are seen as part of the solution, as well as part of the problem (Vigneau et al., 2015). Furthermore, larger retailers committing to sustainability has been a major stimulus for the proliferation of these standards (Alfnes, 2017; Boyd & McNevin, 2015).

The potential of certification as a regulatory mechanism has also been recognized by the United Nations (Conference on Environment and Development, 1992). According to an FAO report on standards and certification in fisheries and aquaculture, public regulation of aquaculture alone does not achieve desired outcomes such as sustainability, and therefore needs to be supplemented by private certification schemes (Washington & Ababouch, 2011). Similarly, much of the seafood certification literature points to the perception that states have limited capacity to regulate the industry as a key explanation for the proliferation of these private standards (Bush, Belton, et al., 2013; Groeneveld et al., 2017; Konefal, 2013; Ponte et al., 2011; Vandergeest et al., 2015).

2.4 The sustainability of salmon aquaculture

Salmon aquaculture is an industry characterized by numerous challenges, many of which have become key targets for sustainability standards. Much of the trouble with improving the salmon aquaculture industry relates to the uncertainty surrounding its impacts (Osmundsen et al., 2017; Schlag, 2010). It is difficult to evaluate the full impact of the industry, as it requires many different methods and comprehensive data (Kaiser & Stead, 2002; Ytrestøyl et al., 2015). The difficulty of regulating salmon aquaculture is described by Osmundsen et al. (2017) as a 'wicked problem' (Rittel & Webber, 1973), which refers to the complexity and uncertainty pertaining to the industry's many externalities and how to best resolve these, underlining the need for more knowledge (Froehlich et al., 2018).

The many challenges of the industry have led to problems with public perception (Olsen & Osmundsen, 2017; Osmundsen & Olsen, 2017; Schlag, 2010). In Osmundsen & Olsen's (2017) study on the public debate in opinion pages, they found that salmon

aquaculture is a controversial topic that engages numerous actors, including industry, environmental groups, researchers, the media, and others. Many argue that negative public perception can have considerable effects on the industry, as conflicts are expensive and time-consuming, they can influence access to new sites and possibly regulatory conditions, and they can have direct effects on sales (Alexander et al., 2018; Olsen & Osmundsen, 2017; Tiller et al., 2017). Furthermore, the increased focus on sustainability has triggered a demand for more responsible practices, which in turn has led to major changes in the industry (Alexander et al., 2015; Tlusty, 2012).

To better understand the role of sustainability certification for salmon aquaculture and the way in which sustainability is operationalized within this setting, it is first necessary to explore the industry and its many complexities in more detail.

2.4.1 The salmon aquaculture industry

Aquaculture involves biological production of aquatic species, including finfish, shellfish, and aquatic plants, and can be traced back to 500 BCE. Globally, 598 different farmed species items have been recorded (FAO, 2018). The most common species are different types of carp and shrimp. There is limited aquaculture production in developed countries, one notable exception being Norway and its production of salmon (Garlock et al., 2019). Salmon aquaculture is commonly practiced in coastal waters in various forms of human-made structures, such as sea cages, with the primary phase occurring in freshwater. While having been experimented with since the 19th century, salmon aquaculture became a more significant global endeavor starting from the 1980s.

Norway was a major actor from the beginning, particularly in the farming of Atlantic salmon, but Scotland and Chile[2] soon became worthy contenders. During the 1980s, the production volume for farmed salmon in Norway doubled more than 15 times, in the period of just a decade (Phyne, 2010). Both due to the many restrictions on aquaculture activity in Norway and a desire to be closer to the market, many companies looked

[2] Facing the Pacific Ocean, Atlantic salmon is not native to Chile and was therefore imported and introduced as an alien species.

abroad for further expansion, investing in other key aquaculture nations such as Scotland and Chile (Hersoug, 2014; Liabø et al., 2007). As the production methods proved relatively simple, these were exported to other countries.

Foreign investment from the largest salmon producers brought with it intensified knowledge and technology transfer, strengthening the industry on a global level. For Scotland, the massive influx of foreign capital, combined with environmental advantages and a fast-growing market, made aquaculture the 'boom' industry of the 1980s (Coull, 1988; Lloyd & Livingstone, 1991). It became a particularly important industry for remote rural areas, such as the Highlands and Islands, which had been struggling with unemployment issues (Liabø et al., 2007). Similar to Scotland, the very profitable salmon aquaculture industry played an essential role in the Chilean 'economic miracle' during the 1980s, which brought the country out of a massive economic crisis (Barton & Fløysand, 2010).

Today, the aquaculture industry comprises 47 % of the total global fish production (FAO, 2018, p. 2), with farmed food fish production including 54.1 million tons of finfish (FAO, 2018, p. 5), and Atlantic salmon accounting for 4 % of total finfish production (FAO, 2018, p. 23). Although salmon has a somewhat low production volume compared to other species, it has a considerably higher production value (Asche et al., 2018; FAO, 2014). It is also important to acknowledge that its production methods have influenced the production of other species (Liabø et al., 2007). The salmon industry is experiencing substantial growth, with increase in production achieved through productivity improvements, general cost reduction, and innovation with regards to density of production animals (Asche et al., 2018; Christiansen & Jakobsen, 2017).

Salmon aquaculture is characterized by a sophisticated supply chain and production process, making it a highly successful species to produce (Anderson, 2002; Asche, 2008; Asche et al., 2013). There are, however, some reservations as to the potential growth in production in the future, mainly due to a limitation of available new sites (Asche et al., 2013). Since salmon aquaculture activity necessitates specific properties, such as being sheltered from extreme weather conditions while also having sufficient

water flow with a set range of water temperatures, the scarcity of suitable sites is a major issue in the governance of aquaculture (Mikkelsen et al., 2019; Solås et al., 2015).

2.4.2 Benefits and challenges of the salmon aquaculture industry

Fish is an important food product, providing benefits that are considered essential for human health, such as Omega-3 (Sprague et al., 2016). The growth of the aquaculture industry is, to a large degree, a result of the stagnation in fisheries. This suggests aquaculture playing an increasingly important role in regard to global food security (Beveridge et al., 2013; Smith et al., 2010). This, however, pertains less to salmon aquaculture, as it represents only a small portion of the total aquaculture production, and has a relatively high volume price (see Beveridge et al., 2013). Salmon is, nevertheless, a product that is exported in great quantities, making it an important industry globally.

A common issue with global food production is food safety, which involves knowing that consumption of a product will cause no harm to humans. This can pertain to bacteria and other pathogens, pollutants, chemicals, or allergens (Sapkota et al., 2008). Also, it is a matter of ensuring that the product actually is what it is advertised to be, for instance in terms of species. With salmon aquaculture products, a common food safety concern is the use of antibiotics to treat the fish for disease, which can, when consumed by humans, increase antibiotic resistance (Sapkota et al., 2008). While the use of antibiotics has gone significantly down in certain parts of the industry, this is still one of the more common criticisms of salmon aquaculture (Olaussen, 2018). With more food production occurring far from the site of consumption, requirements of traceability and transparency have becoming vital in the strive for food safety (Bailey et al., 2016). This has created particular pressure on retailers, who often become the center of blame in food scandals (Vandergeest et al., 2015).

In regard to environmental impact, studies show that, on certain criteria, aquaculture has a lower impact compared to other animal proteins. For instance, it has been shown that aquaculture has lower GHG emissions, as well as less need for cropland area for feed, which in turn can decrease pressure on agricultural land use (Froehlich et al., 2018; Pelletier et al., 2009). However, the aquaculture industry has also received much

criticism for its many negative environmental impacts. Aquaculture production, and salmon aquaculture specifically, has been criticized for being resource-intensive and generating many externalities, primarily environmental. As salmon is most commonly produced in open cages, the release of nutrients, chemicals, and pathogens into the surrounding environment is considered a major problem (Burridge et al., 2010). Furthermore, fish escaping from the cages can create risk of genetic interaction with wild salmon (Olaussen, 2018). Salmon aquaculture production can also pose risks to wild salmon and other local species just from occurring in their proximity, for instance through transfer of parasites and disease (Forseth et al., 2017; Thorstad & Finstad, 2018). The increase of salmon lice, affecting both the fish in the cages and the wild salmon, is often referred to as the industry's most consequential problem, so much so that it has become the primary indicator for regulating growth in Norwegian salmon aquaculture (Osmundsen, Olsen, et al., 2020; Thorstad & Finstad, 2018).

As with salmon lice, disease is a major problem in salmon production because the close proximity of cages can lead to rapid spread (Ellis et al., 2016; Graziano et al., 2018; Morton & Routledge, 2016). One of the most common is pancreas disease (PD), which is a viral disease with potentially high mortality rates (Pettersen et al., 2015). Infectious salmon anaemia (ISA) virus is another, which has caused major crises in the Norwegian, Scottish, and Chilean salmon industries. Starting in 1984, an outbreak of the ISA virus in the southwestern coast of Norway developed into an epidemic, the first outbreak of the virus in the Northern hemisphere (Alvial et al., 2012). Parallel to the crisis in Norway, the Scottish industry also suffered a disease outbreak, which nearly destroyed the industry (Graziano et al., 2018). In 2007, the Chilean salmon aquaculture industry suffered a massive hit caused by the proliferation of the ISA virus, as a consequence of Chile's lax regulations and inadequate disease control (Asche et al., 2009; Latta & Aguayo, 2012; Tecklin, 2016). It is important to note that while disease and parasites are a huge problem for animal welfare, it has been shown that the treatment of these can also be very harmful for the fish (Gismervik et al., 2019; Noble et al., 2018).

Feed is a controversial and complex topic of salmon aquaculture, warranting a separate section. Firstly, feed is the primary source of emissions from sites (Olaussen, 2018).

Another controversy is the source of feed. Traditionally, salmon feed is made of small pelagic fish. This practice has been subject to much criticism, as this fish could be used for human consumption, and is often sourced from developing countries (Schlag, 2010; Ytrestøyl et al., 2015). As a consequence of the criticism for irresponsible harvest of forage fish, the salmon aquaculture industry is seeing a shift from marine to plant ingredients (FAO, 2018). However, this has in turn triggered criticism for deforestation, as well as reduced nutritional value for the consumer (Pelletier et al., 2009; Sprague et al., 2016; Ytrestøyl et al., 2015). According to Pelletier et al. (2009), while impact of feed production will vary depending on ingredient, feed is regardless the biggest contributor to resource-use and emissions in the entire production process. This has led to an increasing pressure on the industry to find better alternatives, such as the use of trimmings (i.e. discards and by-products from processing) and new ingredients such as insects (Biancarosa et al., 2019; Ytrestøyl et al., 2015).

The effects of the salmon aquaculture industry on the local communities where production takes place are disputed. A major advantage of salmon aquaculture is that it can generate important ripple effects through sales, purchasing, and employment in the industry and supply industry (Andreassen & Robertsen, 2014). However, while the presence of a major industry can provide income and creation of jobs in rural areas (Ceballos et al., 2018), it is also a matter of the type of available jobs. Being a highly automated industry, salmon aquaculture does not create many direct jobs, and these are often unequally distributed, with more high-paying jobs typically being centralized (Bailey, 2014). Also, the issue of worker safety is significant, as on-site jobs are prone to injuries (Størkersen, 2012; Utne et al., 2017).

A major challenge with global industries, such as salmon aquaculture, is that due to distance between production and consumer, the local conditions of production areas are rarely questioned by consumers (Krause et al., 2015). Salmon aquaculture is often located in remote, rural communities, and there are concerns that the decrease in local ownership in the industry leaves limited benefits with the local community (Ceballos et al., 2018; Osmundsen et al., 2012). Possible consequences of the production on the local community include pressure on local infrastructure, intense work migration, as well as uneven distribution of benefits, with local communities receiving few benefits while

suffering the local environmental impacts of production (Krause et al., 2015; O'Ryan & Pereira, 2015).

Another issue for local communities is that suitable sites for salmon aquaculture are often subject to competition with other marine users. Salmon aquaculture is often criticized for taking up areas that have formerly been used for traditional and artisanal fishery, tourism, transport, and recreation, thus restricting these users' access to valued areas (Marshall, 2001; Osmundsen & Olsen, 2017; Ostrom, 1990; Primavera, 2006; Tecklin, 2016). As this usually pertains to rural areas, the issue of indigenous groups losing rights to marine space and resources is a major concern in many countries (Young & Matthews, 2010). The issue of space is an interesting topic in regard to salmon aquaculture (see Hersoug & Johnsen, 2012), as major changes are currently happening within the industry, with technology being developed to move production away from coastal areas, to both offshore and land-based sites. Much is still unknown about advantages and disadvantages of these new production methods, but both are claimed to solve some of the major issues of the salmon aquaculture industry.

2.4.3 Towards a 'sustainable' salmon aquaculture industry

Sustainability is a vague and comprehensive concept that must be operationalized to serve any actual purpose. In regard to the sustainability of major industries, such as the salmon aquaculture industry, there are several ongoing debates on how to 'achieve' sustainability and what this involves, such as the imperialism of the imposition of standards, and the difficult tradeoffs between centralized benefits and localized impacts. A recurring topic in an often polarized debate is the difficult balance between protecting the environment and developing an important global industry. According to Howarth (2006), the debate serves little purpose when the emphasis is on prohibiting all that is perceived as problematic, thus denying that development will always have a cost. Regulatory regimes should therefore, Howarth argues, strive to minimize the negative consequences rather than criminalize them, while ensuring that the costs do not outweigh the benefits. Ytrestøyl et al. (2015) similarly argue for the importance of balancing benefits and impacts, maximizing the former and minimizing the latter.

As illustrated in the previous section, there are numerous challenges that must be addressed in order to improve the salmon aquaculture industry. Improving the industry will necessarily involve tradeoffs (Bailey, 2014), as illustrated by the example of feed, where reducing marine ingredients as a response to criticism has led to concerns with using plant ingredients. Another example is the negative effects that disease treatment can have on the surrounding environment and wildlife (Olaussen, 2018), and on animal welfare (Gismervik et al., 2019). Tradeoffs also include the real-time considerations that need to be made on-site, such as operating personnel having to risk their personal safety to ensure the safety of the fish (Størkersen, 2012). Furthermore, tradeoffs are necessary due to the many different stakeholders involved, all with different interests and agendas, including aquaculture companies, local and national governments, local communities, consumers, environmental and social activist groups, and retailers. According to Howarth (2006), successful regulation of the industry necessitates the inclusion of all major stakeholders' interests, although these are far from coincident.

These many concerns illustrate the importance of a functioning regulatory regime that fully appreciates and tackles the complexity and controversies that characterize the industry (Osmundsen et al., 2017). Proper governance of the industry is imperative for a sustainable and prosperous continuation, ensuring that the benefits not only come to a fortunate few, while the environmental and social costs fall on those most vulnerable (FAO, 2018; Howarth, 2006; Peel & Lloyd, 2008). National regulations for marine aquaculture have increased along with the rapid development of the industry, especially with the growing focus on sustainability and accountability, albeit at a much slower pace (Glenn & White, 2007). Despite a growing focus on the importance of regulating salmon aquaculture and a continuing increase of knowledge about the industry, building an effective regulatory regime has proven difficult. In reference to the aquaculture industry in general, Krause et al. (2015) argue that this is related to a disconnect between science and policy. Further complicating the matter, many of the industry's negative impacts transcend geographical borders and territorial jurisdictions (Busuioc, 2016; van Waarden, 2012), thereby moving beyond the reach of national states (Ponte et al., 2011).

Although all three countries produce the same product with similar production methods, the industry has been regulated significantly differently in Norway, Chile, and Scotland. State involvement has been a perpetual factor in the Norwegian salmon aquaculture industry, something that was further amplified in the face of crisis (Alexander et al., 2015). From the onset of the industry, Norwegian authorities sought to obtain control of the key mechanisms of the industry, with the intent of avoiding that economic growth occurred at the expense of the resources' long-term production capabilities (Barton, 1997; Liabø et al., 2007). Similar to Norway, Scottish salmon aquaculture also received greater state attention as a consequence of periods of crisis. The industry experienced a major shift from self-regulation to state regulation, as private and voluntary arrangements to govern the sector proved insufficient. The transition was a result of emerging scientific evidence, pressure from environmentalist groups, a call for accountability, and a desire to facilitate local economy diversification (Peel & Lloyd, 2008). The Chilean industry's history, on the other hand, shows considerable private sector maneuverability and little state involvement, with the exception of matters of facilitating growth, promoting, and aiding the industry in times of crisis. Although the end of the Pinochet dictatorship in 1990 was followed by a greater focus on environmental protection and labor rights by the successive democratic administrations, the industry was given continued freedom to operate more or less autonomously, justified by its importance for the Chilean economy (Barton & Fløysand, 2010).

However different the chosen approaches, the difficulties of regulating the industry pertain to all three countries, and the rest of the industry. Due to its many roles – as an economic sector, a user of marine space, a user of renewable resources, a handler of animals, a food producer, an internationally traded commodity, and an activity that impacts natural systems – aquaculture, and salmon aquaculture, falls under several different legislations and regulatory agencies, all with different interests, priorities, and responsibilities (Alexander et al., 2015; Osmundsen et al., 2017). Also, the many conflicting interests of diverse stakeholders have played a major role in pulling the governance of salmon aquaculture in different directions, leading to continuous revisions and alterations of regulations. Salmon aquaculture is constantly evolving through the discovery of new solutions and even more new challenges, necessitating

that governments be as dynamic as the industry itself (Solås et al., 2015). New regulatory responses are initiated with different agendas and at different times, and are as such influenced by the contemporary demands of the industry, different stakeholders, and current issues and trends in the public debate (Hersoug et al., 2019; Peel & Lloyd, 2008).

These on-going revisions of policies have in many cases led to an ever-increasing complexity through the continuous layering of new regulations, described by Peel and Lloyd (2008, p. 366) as "the evolutionary and disjointed nature of the consequential governance regimes." Others have described these national regulatory frameworks as fragmented, intricate, and separated, with a particular emphasis on the challenges caused by the involvement of several different public authorities and agencies (Alexander et al., 2015; Liabø et al., 2007; Osmundsen et al., 2017; Read & Fernandes, 2003). Where one agency's authority and responsibility ends and the next begins is often not clear, leading to confusion and causing potential overlaps or oversights. Different agencies represent very distinctive interests and objectives, which often prove conflicting. These many challenges have raised doubts as to the capacity of the state to regulate complex industries, such as salmon aquaculture (Groeneveld et al., 2017; Ponte et al., 2011).

2.4.4 Certifying sustainable salmon aquaculture

Concerns regarding national governments' ability to regulate the salmon aquaculture industry are, to a large degree, founded on the fact that salmon aquaculture is a global industry that transcends national borders, with much of the production occurring in countries with somewhat lenient regulations (Vormedal & Gulbrandsen, 2018). In the shift to neoliberalism and transnational new governance (see Chap. 2.2), the inclusion of non-state actors, such as certification schemes, is said to provide some degree of global consistency and liability (Aarset & Jakobsen, 2009; Busch, 2017; Bush, Belton, et al., 2013). With larger distances between producers and consumers, sustainability standards also serve to foster a form of impersonal trust (Busch, 2011; Krause et al., 2015; Shapiro, 1987; Turnhout et al., 2014).

As the collective term denotes, the primary purpose of sustainability standards is making the industry more sustainable, safeguarding honest and safe operations and products through improved internal processes, enhanced traceability, and increased accountability. Sustainability standards are meant to give companies incentives to improve their practices (Bush & Oosterveer, 2015; Tikina & Innes, 2008; Tlusty, 2012). Certification also serves as a filter, i.e. a means to differentiate between 'good' and 'bad' companies, thereby influencing purchasing decisions of consumers (Busch, 2011; Gopal & Boopendranath, 2013). As previously illustrated, aquaculture is a controversial industry, which underlines the significance of identifying those producers that meet a higher standard of responsible practices (Alfnes et al., 2018; Roheim, 2008).

This is, to a large extent, accomplished through labeling, which provides consumers with information on certain product characteristics (Eden, 2008; Gupta, 2008; Roheim, 2008), "[enabling] consumers to 'see behind' the product itself" (Aasprong, 2012, p. 723). According to Busch (2011), certification can function as advice to consumers, thereby facilitating a form of impersonal trust. Sustainability certification is not only intended to convey information to consumers (business-to-consumer, B2C), but also to other companies (business-to-business, B2B), such as retailers (Aasprong, 2012; Boyd & McNevin, 2015).

2.4.4.1 Motivations

While the primary purpose of sustainability standards is increased accountability, companies that choose to become certified will have other motives beyond making the industry 'sustainable', on account of them being economic actors. This speaks to the idea behind marked-based mechanisms, which is to push the industry in a more responsible direction by providing companies with incentives produced through the market. Even commitments to safeguarding shared waters can be seen as a corporate motive, as salmon aquaculture companies are dependent on clean waters to operate (Vormedal & Gulbrandsen, 2018).

An important financial gain that can arise from certification is obtaining a price premium, which is based on the notion that consumers are willing to pay more for

products that are produced responsibly (Bronnmann & Asche, 2017; Roheim, 2008; Smith et al., 2010). Another potential financial gain is the competitive advantage that can follow the incorporation of sustainability-based strategies (Lloret, 2016). Also, eco-certification has been shown to reduce costs in the supply chain by impacting product longevity (Sogn-Grundvåg et al., 2019). Yet another financial gain that companies can attain through sustainability standards is market access, as certain markets and buyers demand specific certifications (Bush, Belton, et al., 2013). Access to new markets can also include niche markets for responsible products (Gopal & Boopendranath, 2013). According to Roheim (2008), it is a matter of balancing the costs and benefits of certification. Although she is referencing fisheries certification, most points mentioned can also be related to aquaculture:

> On the cost side, there are more than simply the costs of the certification process, but also the costs of any necessary changes to fishing and management practices that may be essential in order to meet the standards of the programme. […] On the benefit side, potential benefits to the fishery may be: increased market share at the expense of other noncertified competitors selling the same species; ability to sell one's fish to retailers who are under pressure from environmental organisations to remove 'unsustainable' fish from their store shelves – i.e. maintain access to the market; increased value for the product – i.e. the price premium; and long-term sustainability of the resource, leading to long-term sustainability of employment in the fishery and associated industries (Roheim, 2008, p. 53).

Another often cited motivation for obtaining sustainability certifications is risk mitigation, i.e. reducing hazards and risks to the environment, the fish, and to humans – both in regard to worker safety and food safety (Boyd & McNevin, 2015; Utne et al., 2017). With this follows also the reduction of liability and reputational risk, both for producers and retailers (Bronnmann & Asche, 2017; Busch, 2011; Vandergeest et al., 2015). This entails using certification as a means to counter negative publicity or pressure from NGOs (Boyd & McNevin, 2015; Bush, Belton, et al., 2013). Certification can, in other words, provide legitimacy and credibility to companies and the industry as

a whole, through increasing the trust of consumers and the general public (Bush, 2018; Gopal & Boopendranath, 2013; Groeneveld et al., 2017).

2.4.4.2 Challenges

As described in this chapter, regulating salmon aquaculture is challenging due to the wicked nature of the problems the industry faces, especially since many of them transcend borders and regulatory jurisdictions. Similarly, sustainability has been described as a wicked problem (Batie, 2008). These complex policy problems spawn new regulatory approaches (Busuioc, 2016), so that "we face a complex, interlocking collection of standards, each of which influence each other, and none of which are individually capable of ameliorating, let alone resolving the problem" (Busch, 2011, p. 11). What Busch points to here is the issue of legitimacy, the degree to which these standards are perceived as trustworthy, functional, and appropriate to solve the many challenges of the industry (Lindøe & Kringen, 2018). As the adoption of sustainability standards is voluntary, the schemes depend on strong legitimacy, since this can influence standard uptake and the authority that the schemes need to set rules (Aguayo & Barriga, 2016; Cashore, 2002; Ponte et al., 2011; van Waarden, 2012).

However, legitimacy can be difficult to achieve. Furthermore, gaining legitimacy can have negative effects on other aspects of a standard. This is illustrated by the major dilemma that certification schemes face in the development of standards, the difficult balance between stringency and market diffusion (Boyd & McNevin, 2015; Bush & Roheim, 2019). A too lenient standard will be considered less trustworthy, while a too stringent standard will have limited uptake. In the same vein, Bush, Toonen, et al. (2013) describe the dilemma of balancing accessibility, credibility, and continual improvement, labeling this 'the devil's triangle of certification'. Simply put, accessibility refers here to certification being available and obtainable for e.g. smaller actors or actors in developing countries, credibility relates to legitimacy and public recognition, and continual improvement is progress beyond compliance.

In addition, sustainability standards are dependent on market and consumer demand, again because they are voluntary (Roheim, 2008). Although these standards are

proliferating, both in terms of uptake and the number of standards, several studies point to limited awareness and demand for certified seafood (Bush, Toonen, et al., 2013; Vormedal & Gulbrandsen, 2018). This has proven especially true outside European and American markets (Bush, 2018; Kalfagianni & Pattberg, 2013). When discussing consumer demand, it is important to keep in mind that attitudes and values do not always coincide with behavior. This means that positive attitudes towards sustainable products, which is quite prevalent, does not necessarily translate into more responsible purchasing habits (Alfnes, 2017; Cashore, 2002; Portney, 2015).

Another major challenge related to consumers is that the proliferation of standards may cause consumers confusion and skepticism, ultimately reducing the credibility of sustainability standards in general (Boyd & McNevin, 2015; Washington & Ababouch, 2011). This confusion pertains not only to consumers, but to producers and retailers as well (FAO, 2018). An approach to deal with this confusion is benchmarking the many different standards, through meta-governance initiatives such as the Global Benchmark Tool developed by the Global Sustainable Seafood Initiative (GSSI) with FAO, and the International Social and Environmental Accreditation and Labelling Alliance (ISEAL) (Bush & Roheim, 2019; FAO, 2018). Still, some warn that the proliferation of meta-governance arrangements can lead to the same issues of confusion, just at a different level (Bush & Roheim, 2019; Samerwong et al., 2017).

3 Theoretical framework

In this chapter, earlier research is presented in order to shed light on the questions addressed in this thesis, as well as reveal gaps and understudied issues. The chapter is divided into the same perspectives as the research questions: impression, implementation, and impact. While much of the literature, and topics discussed, transcend the boundaries of the 3 I's, this simplified divide is here utilized to best explore the extensive literature on the many different aspects of the operationalization of sustainability.

3.1 Impression

The concept of sustainability has become a beacon for responsible and accountable development in today's society, having a signaling effect on local, national, and global policy decisions and civil society activism. This underscores the significance of exploring how this vague, yet tremendously influential, concept is actually understood, as the content it is given in turn shapes how it is acted upon. In this section, both the processes and implications of giving sustainability meaning are discussed, in order to shed light on the *impression* of sustainability. As previously described, impression refers to this reciprocal influence between the vague concept and actions taken to 'achieve' it (see Chap. 1.2).

3.1.1 The wave of sustainability

The impression of 'sustainability' and 'sustainable aquaculture'[3] that is created through and by sustainability standards is a matter of conceptualization. By giving these vague ideas content, concepts are formed and meaning is established (Busch, 2011; Hicks et al., 2016; Hox, 1997). The importance of exploring what these concepts have come to mean is accentuated by their proliferation. As described in Chap. 2.1, sustainability has permeated mission statements and official declarations of companies, organizations, and governments on all levels, giving the impression of a 'united' effort to work towards this common goal (Portney, 2015). The aquaculture, and salmon aquaculture, sector is of no exception, with both producers and regulators voicing the importance of making the industry sustainable (Howarth, 2006; Marine Harvest, 2009; Meld. St. 16, 2014).

Neo-institutionalist theory, and in particular Scandinavian neo-institutionalism, is a fruitful perspective for understanding the escalating commitments to sustainability, as it provides a good framework for explaining the impact of external forces on organizations (Ball & Craig, 2010). According to this body of theory, larger societal shifts influence the norms and conventions that serve as guidelines for behavior (Czarniawska & Joerges, 1996; Finnemore & Sikkink, 1998; Røvik, 1998), the current 'transition to sustainability' being a case in point (Geels, 2011; Smith, 2007). These shifts can be the result of smaller movements (or niches) created in opposition to the prevailing regime, causing 'regime tension', or pressures for regime transformation (Smith, 2007).

Following neo-institutionalist thought, the spread of ideas such as these is attributable to the structural conformity that occurs within communities of organizations (Czarniawska & Sevón, 1996; Røvik, 1998; Scott, 1995, 1998). Conforming to the pressures of implementing norms, such as sustainability, into the organization can be a result of both coercion and choice (Scott, 1998). On the one hand, it can be fueled by a need for external legitimacy, gained through the adoption of norms considered appropriate by the

[3] This chapter primarily refers to aquaculture, and not salmon aquaculture specifically, as the majority of the literature addresses the broader issue of 'sustainable aquaculture'. Nevertheless, the topics discussed here are equally relevant for salmon aquaculture.

organizational environment (Ashworth et al., 2007; Meyer & Rowan, 1977; Scott, 1995). On the other hand, it can be fueled by a desire for active identity management through the distancing from actors with which one does not want to be associated (Røvik, 1998).

Moore (2011) argues that the general acceptance of sustainability owes its success to the ambiguous language that characterizes its common definitions. The use of constructively ambiguous language when formulating sustainability agendas has allowed contrasting parties to come to what Moore describes as 'superficial consensus' (2011, p. 143), which has proven much more difficult to achieve with more detailed agreements (Abbott & Snidal, 2000). This echoes the premise of this thesis, which is centered on the powerful influence that 'sustainability' has, precisely because it is a vague and comprehensive concept. In the same vein, it is argued within Scandinavian neo-institutional theory that ideas must be simplified and abstracted in order to travel across time and space; in other words, they must become objectified (Czarniawska & Joerges, 1996; Czarniawska & Sevón, 2005).

Through the colloquialization of sustainability, its definition has further broadened through 'concept stretching' (Pierson, 2004). The details as to what sustainability actually involves rarely go beyond the Brundtland Commission definition or the depiction of the three dimensions of environmental, economic, and social sustainability (Kuhlman & Farrington, 2010; see Chap. 2.1.1). Indeed, in academic literature the Brundtland Commission definition is often referenced to as case in point of the vague character of the concept, and the lack of a proper and tangible understanding of it (Davidson, 2011). Many argue that this shallow conceptualization has led to an uncritical use of the concept by private and public actors alike, with limited consideration as to what is actually meant by it (Ariffin, 2007; Custance & Hillier, 1998). Large industries, as well as national governments, have been criticized for issuing vague sustainability goals and objectives, with even vaguer strategies for accomplishing them. In Norway, for instance, uncritical claims of sustainability by brands has recently led to the interference of national authorities, seeking the prevention of such claims on the grounds that it is a misuse of the concept (Heen, 2019; Myklebost,

2019), thereby creating a sense of false security among consumers (Tlusty & Thorsen, 2017).

3.1.2 Constructing 'sustainability'

The indiscriminate use of sustainability underscores the necessity of operationalizing the concept to make it actionable and governable, a view that is voiced by much of the sustainability literature (Custance & Hillier, 1998; Davidson, 2011; Rydin, 2007). The operationalization of sustainability concerns the concretization of the concept, which involves both clarification and interpretation of it (Asdal, 2011; Røvik, 1998). Through the creation of a language of sustainability, content is provided, which enables elusive ambitions to be transformed into actions (Hansen & Salskov-Iversen, 2005). As described by Rose and Miller (1992) drawing on Foucault, language is performative in nature in that it conceptualizes ways of ruling, thereby shaping 'programs of government' that in turn make objects to-be-governed thinkable and actionable:

> programmes lay claim to a certain knowledge of the sphere or problem to be addressed […] Governing a sphere requires that it can be represented, depicted in a way which both grasps its truth and re-presents it in a form in which it can enter the sphere of conscious political calculation. The theories of the social sciences, of economics, of sociology and of psychology, thus provide a kind of intellectual machinery for government, in the form of procedures for rendering the world thinkable, taming its intractable reality by subjecting it to the disciplined analyses of thought (Rose & Miller, 1992, p. 182).

In other words, the impression created of the concept through the content it is given will, consequently, serve to guide collective efforts in attempting to 'achieve' it (Asdal, 2011).

Following the social constructivist school of thought (see Chap. 4.2 on research classifications), the operationalization of sustainability is here seen as the construction of sustainability. This is based on the assertion that sustainability is not an objective concept with a given denotation (Rydin, 2007; Tlusty & Thorsen, 2017). Just as 'nature' is produced by "an imbroglio of science, technology and politics […], rendering real

and visible, its object of intervention" (Asdal, 2008, p. 124), 'sustainability' is created by a multitude of actors with a multitude of interests, in the synergy of knowledge, expertise, and power (Havice & Iles, 2015; Rey-Valette et al., 2007). According to Levett (1998), the process of developing and choosing indicators to represent sustainability encapsulates how the concept is actually understood, as it reflects which issues related to sustainability are considered worth addressing, and which are not. Importantly, this understanding of sustainability is not static, as the concept is continuously given content, making it a *processual* construction. This underlines the importance of investigating existing sustainability indicators, in order to truly grasp how the concept is understood within a given context, in this case salmon aquaculture.

As discussed in Chap. 2.2.2, indicators can serve as a way of providing a concept, such as sustainability, with specific content, thereby constructing 'sustainability' through tools of standardizing, measuring, and ranking. The process of developing and selecting indicators is described as a way of demystifying vague and complex concepts, making them tangible and manipulable (Fyhn & Søraa, 2017; Larsen, 2017; Levett, 1998), providing "a transition from ambiguity to certainty; from theory to fact; and from complex variation and context to truthful, comparable numbers" (Merry, 2011, p. 88). The application of indicators, quantification, and a general obsession with categorizations is considered a quintessential aspect of modern life (Bowker & Star, 1999; Larsen & Røyrvik, 2017; Shore & Wright, 2015), what Turnhout et al. (2014) describe as the age of 'measurementality'.

It is important to keep in mind that the process of indicator development is a process of simplification. This simplification is described as one of the key advantages of utilizing indicators in the regulation of larger industries, as it reduces complexity and downplays local particularities (Busch, 2011; Merry, 2011). However, as Busch (2011) warns, indicators are often treated as true representations of reality, when they are in fact interpretations of big ideas that are difficult to measure directly, therefore only capturing a fragment of a complex reality. Similarly, Rydin (2007) underlines the normative character of indicators, arguing against their perceived neutrality. Merry (2011) advocates that indicators be seen for what they are meant to be an indication of, and not as something in themselves, exemplifying a major consequence of treating

sustainability as a technical outcome. This calls attention to the significance of the process of labeling indicators, and ensuring that they measure what they are intended to measure and what they are perceived to represent (Custance & Hillier, 1998; Merry, 2011).

Many have pointed to the difficulty of developing good indicators to measure sustainability, exactly due to its vague and wanting definitions (Custance & Hillier, 1998; Davidson, 2011; Rey-Valette et al., 2007). Furthermore, indicators addressing certain issues can have undesirable consequences for other issues (Lehtonen, 2004). Also, not all aspects of sustainability are necessarily measurable, causing a preference for issues that can easily be quantified (Milewski & Smith, 2019). In addition to the development and labeling of indicators, the *choice* of which indicators to represent a concept is significant because the criteria with which we measure sustainability will affect what is to be considered sustainable and what is not (Hatanaka & Busch, 2008). Illustrating this with the case of salmon aquaculture, Tlusty and Thorsen (2017) state that the sustainability of the farmed salmon as a product relative to other proteins will depend on what is measured, with comparison of greenhouse gas emissions, phosphorus emissions, or acidification all giving different results. As discussed in the previous chapter, there is much controversy as to what both 'sustainability' and 'sustainable aquaculture' actually is (Bush & Roheim, 2019; Genus, 2016), with definitions and goals varying with different stakeholders and their specific interests (Tlusty et al., 2012). According to Aasprong (2012, p. 723), "[t]he multitude of sometimes rivalling sustainability standards reflects power struggles, differences of emphasis and contesting notions of how sustainability can and should be codified in standards and certification schemes."

3.1.3 The power of definition

The origin of the word 'standard' is: "flag or other conspicuous object to serve as a rallying point for a military force" ("Standard," n.d.). This resonates with Foucault's understanding of power as manifested through indirect techniques of government, allowing subjects to be controlled at a distance (Eliassen, 2016; Foucault, 2007). In the

same vein, Busch (2011, p. 28) suggests the following definition of power: "the ability to set the rules that others must follow, or to set the range of categories from which they may choose." Following this perspective, the categories we employ and standards we adopt shape the structuring of how we perceive the world (Bowker & Star, 1999; Finnemore & Sikkink, 1998). This warrants more in-depth research on the attributed meanings of these categories and standards, through investigation of their actual content.

With regard to certification schemes, there is a limited number of concerns that each can address. This means that decisive priorities are set through the choice of which criteria to include in the standards (Levett, 1998). As a consequence, those involved in developing different standards play a key role in deciding how 'sustainable aquaculture' is understood (Busch, 2017; Havice & Iles, 2015). This relates to the power of expertise, which refers to the power certain actors can gain by obtaining rule-making authority through being given a legitimate voice, meaning that their decisions on which issues to include and exclude are assumed to represent expert knowledge (Brunsson & Jacobsson, 2005; Jacobsson, 2005). In the case of private sustainability standards, the power of expertise largely concerns who is invited into the process of developing the standard, and who within that group has an actual say. Busch (2017, p. 2) describes this fundamental dimension of the power of standards:

> [T]he inherited wisdom proceeds as if standards were merely epistemological categories by which we make sense out of an already pre-formed world; in contrast, the emerging challenge asserts that in addition to their epistemological character, standards are also ontological categories that bring worlds into being.

In other words, the selection of standards and indicators can alter or transform the concept they are meant to measure – constructing, producing, and changing reality by providing specific content to an ambiguous concept (Porter, 2001; Røyrvik, 2017). Through the choice of indicators, certain issues are attributed importance, while others are left out (Turnhout et al., 2014; Vandergeest et al., 2015; Vigneau et al., 2015). This power to frame the issue can in turn shape the public debate and influence the priorities

and actions of regulatory authorities (Finnemore & Sikkink, 1998; Hohnen & Hasle, 2011; Olsen & Osmundsen, 2017; Turnhout et al., 2014). As argued by much of the standardization literature, this implies that indicators are by no means neutral or merely technical, but rather value laden, as the choice of which indicators to include and which to exclude will necessarily reflect the interests of the specific decision-makers (Busch, 2011; Levett, 1998; Merry, 2011).

Yet, when norms or standards become institutionalized, they obtain a taken-for-granted character as they become embedded in the deep structures of the organizational environment (Geels, 2011; Meyer & Rowan, 1977; Røvik, 1998). With this naturalization follows a perception of standards and indicators as neutral, benign, and objective (Eden, 2008; Shore & Wright, 2015; Turnhout et al., 2014). Herein lie the dangers of naturalization, as the political aspect of defining these concepts is suppressed (Busch, 2011; Osmundsen, Olsen, et al., 2020). This is accomplished by downplaying any conflicts or disagreements that may have occurred during the development process, a strategy referred to as black-boxing (Asdal, 2008; Merry, 2011; Strassheim & Kettunen, 2014). In doing so, standard creators exclude the public from the uncertainties involved, reinforcing the impression of standards and their indicators as neutral and objective, rather than a result of negotiations. This illustrates the necessity of more research on what these standards actually include, and the consequences of prioritizing certain issues over others.

As the salmon aquaculture industry is experiencing an increase in polycentric and private governance, it is no longer just a matter of which issues the state prioritizes to address. Different stakeholders, such as producers, NGOs, and civil society, as well as the state, will necessarily have different interests and motivations when it comes to how an industry such as salmon aquaculture should be regulated (Lindøe & Kringen, 2018). With multi-stakeholder initiatives, like private sustainability standards, follow an expectation of the balancing of interests, but many do, however, point to clear power asymmetries taking place in these standard development processes (Havice & Iles, 2015; Ponte et al., 2011). This is in large part attributed to the resource-intensive and long-running nature of these processes, which means that not all actors will have the same opportunities for participation (Costa-Pierce & Page, 2013; Havice & Iles, 2015).

Busch (2017) and others (see e.g. Woods, 2007) claim that the current change in regulation, which relies more heavily on governance through private standards and initiatives, is characterized by democratic deficit, due to the accountability gap it creates. With the role of government diminished, the authority of definition is left with various actors. In the case at hand, Busch (2017) points to the power of the certification and accreditation organizations, those assigned to create and assess these standards. Merry (2011) argues that decision-making is granted those with expert knowledge, typically reserved those in the Global North. Konefal (2013) warns against the role that powerful individuals and firms have in defining sustainability. Bailey et al. (2016) stress the power of retailers in deciding what sustainability means, through deciding both which products and what information consumers have access to. While this points to the power of definition being distributed between several actors, the commonality among them is that they are all influential and high-powered. This underlines the importance of identifying those with the power to define, understanding how this power is exercised and which motivations and interests that fuel their actions.

3.1.4 The impression of sustainability and sustainable salmon aquaculture

As discussed in the previous chapter, sustainability is often spoken of in terms of the three dimensions: environmental, economic, and social. The three are often mentioned in the same breath to show that all bases are covered, giving the impression that these three dimensions all pull in the same direction. However, they carry with them contradictory needs and implications, necessitating tradeoffs between the three (Bailey, 2014; Custance & Hillier, 1998; Davidson, 2011). As Custance and Hillier (1998, p. 281) maintain, it is necessary to properly investigate the interrelationship between the dimensions in order to achieve a balance between the "maintenance of economic growth, protection of the environment and prudent use of natural resources, and social progress which recognizes the needs of everyone."

While sustainability is commonly referred to in terms of the equal importance of all three dimensions (as illustrated by the different pictorial expressions shown in Figure 1

in Chap. 2.1.1), the practiced understanding of sustainability rarely reflects this. What sustainability has come to mean through its application has been criticized mainly for the neglect of one or more dimensions. For instance, several scholars argue that fundamental social issues are given less focus, both in seafood and agri-food sector, and in general (Anderson et al., 2015; Challies, 2012; Hicks et al., 2016; Kittinger et al., 2017). Conversely, others warn against a neoliberal understanding of sustainability, which involves prioritizing the needs and wants of private businesses and equating the value of resources with its financial value (Davidson, 2011; Kazancigil, 2007). When looking at how sustainability is understood and applied for aquaculture, and salmon aquaculture specifically, there is a predominant emphasis on environmental sustainability, both in the industry, governments, research, and the media (Andreassen et al., 2016; Costa-Pierce & Page, 2013; Marine Harvest, 2009; Meld. St. 16, 2014; Olsen & Osmundsen, 2017). This tendency relates to how the major controversies of the industry have been concerned with its environmental impact (Schlag, 2010).

3.1.5 **Addressing the gaps - impression**

As discussed here, sustainability has purposely been defined using ambiguous language, in order to allow its widespread acceptance and use. However, this only intensifies the need to investigate how sustainability is operationalized and the implications of this. In response to the lacking overview of existing sustainability indicators, Papers A and B examine the content of some of the major sustainability standards for salmon aquaculture, the former on a general level and the latter with focus on social issues. In doing so, they provide insight into which issues that are addressed and which that are given less priority or completely disregarded. These findings can serve to shed light on the consequences of how sustainability is understood within this specific context, which relates to the power to frame the issue, the power to make rules, and the power to define 'sustainable aquaculture'. Furthermore, it is not just a matter of discovering which topics that are addressed, but also *how* they are addressed. In Paper B, we investigate the type of criteria following the indicators pertaining to social sustainability, exploring whether they actually serve to improve the industry in this domain.

3.2 Implementation

As described in Chap. 2.2.1, ‘governing at a distance’ refers to a form of governance that involves the decentralization of power, through ensembles of agents outside the state partaking in surveillance and control. A prerequisite of governing at a distance is, as previously mentioned, governmental technologies. Certification schemes and their standards and indicators can be understood as governmental technologies, as liberal tools of governance and indirect power, in that they perform an indirect supervisory role of monitoring and control (Henson & Humphrey, 2012; Ponte et al., 2011; Porter, 2013; Power, 2010). In other words, these standards can be seen as a way of implementing sustainability.

Recognizing sustainability standards as devices of control underscores the significance of the power to decide what is to be included and what is not (see Chap. 3.1.3), thereby confirming the importance of studying how sustainability is operationalized through these standards. However, it also demonstrates the necessity of not just exploring these standards’ output, but how they are actually implemented in organizations. As has been discussed, while standards emanate from the idea of objectivity, it is important to keep in mind that they are both made and managed by people. This suggests that different local realities will not necessarily ‘fit’ into a standardized template (Busch, 2011), underlining the significance of the implementation process.

3.2.1 Global ideals, local realities

Global industries, such as salmon aquaculture, are characterized by substantial differences in the way they operate, the challenges they face, and the way these challenges are met by their respective governing authorities (Howarth, 2006; see also Chap. 2.4.3). However, the tendency towards a global standardized governance regime has, to a large extent, left the effects of local historical, political, and cultural contexts underestimated and overlooked (Busch, 2014). Therefore, it is in the implementation of these standards, where ‘standard’ meets ‘reality’, that local adaptations are put into action.

In accord with this view, neo-institutional theory argues that the institutionalization of new norms and principles is constrained by the reinforcing deep structures of the organizational environment (Røvik, 1998; Smith, 2007). Furthermore, external ideas and practices must gain acceptance within the organization in order to take hold, i.e. achieve internal legitimacy (Røvik, 1998). This often entails creating variations in tune with how organizational members perceive their organizational identity, giving the external standards new meaning that corresponds with internal norms, practices, and rules (Hatch & Schultz, 2002). As this illustrates, organizations becoming certified cannot be considered passive adopters (Hwang & Suarez, 2005; Sahlin-Andersson, 1996).

Following this thought, Timmermans and Berg (1997) state that the universality that comes with standardization will necessarily materialize as different forms of local universality:

> Local universality emphasizes that universality always rests on real-time work, and emerges from localized processes of negotiations and pre-existing institutional, infrastructural, and material relations. 'Universality', here, has become a non-transcendental term – no longer implying a rupture with the 'local', but transforming and emerging in and through it (1997, p. 275).

Within the Scandinavian branch of neo-institutionalist theory, this process of adapting external rules and standards to local conditions is understood as a process of translation. This concept rests on the premise that it is not just a matter of organizations adopting or not adopting the principles of a standard (Vigneau et al., 2015), but rather how they *adapt* new principles and practices to their local context (Brunsson & Jacobsson, 2005; Czarniawska & Sevón, 1996; Røvik, 1998).

3.2.2 Governing through auditing

The audit process is a significant component when employing standards as a means to govern at a distance. This is because audits facilitate the accountability of autonomous subjects, thereby enabling decentralized control (Power, 2010; Shore & Wright, 2015). This makes the audit process a fruitful arena for exploring the implementation of this

form of governance, as it is an expression of where ‘standard’ meets ‘reality’. It is through the audit process that the materials that form the basis for assessment are accumulated and performance is evaluated, through the intermediary agent that is the auditor. Following this perspective, Cook et al. (2016) explain audits by employing Gupta’s (2008) concept of ‘governance-by-disclosure’, pointing to how audits are the means to generate information that is to be used in the regulation of the subjects.

Audits, though originating from the financial sector, are becoming increasingly prevalent in the assessment of other types of performance, such as sustainability (Cook et al., 2016; Tomlinson & Atkinson, 1987). Power (2010) describes the proliferation of auditing as an ‘audit explosion’, claiming that modern society has become an ‘audit society’ where everything is to be measured, ranked, and labeled, and performance is decided according to what is measured. Similarly, Shore and Wright (2015, p. 422) refer to an audit culture that has infiltrated modern life in a wholesale transformation, “where auditing has become a central organizing principle of society.” This change has reaped much criticism, in particular concerning the exclusion of important issues from the evaluation, due to an exclusive focus on that which is measurable and quantifiable, making actual behavior less important (Erlingsdóttir & Lindberg, 2005; Hohnen & Hasle, 2011; Merry, 2011). Furthermore, many point to a shift towards the auditing of qualities of systems rather than outcome (Jensen & Winthereik, 2017; Shore & Wright, 2015), what Power (2010) refers to as ‘policing of policing’, a play on Foucault’s ‘conduct of conduct’.

Inspired by Power, Jensen and Winthereik (2017) claim that having an audit society has led to ‘audit implosion’, in that auditors and auditees both become changed in the process through “mutually shaping interactions” (2017, p. 161). This relates to interactive governance theory and the issue of ‘governability’, as described by Jentoft and Chuenpagdee (2015). Applying the concept in the case of governance of small-scale fisheries, the authors describe the necessity of constructing both the governing system *and* the object ‘to-be-governed’ for any intervention to be successful. In other words, governability refers to both the capacity and quality of governance, and the subjects’ willingness to be governed, i.e. the outcome of the process of constructing both sides (Chuenpagdee & Jentoft, 2015; Jentoft & Chuenpagdee, 2015; Johnsen, 2017), making

governance a social process. The focus on interaction speaks to the complexity of both sides, the fluidity of governability, and the need to also include the voices of those working in different segments of the value chain and community members (Chuenpagdee & Jentoft, 2015; Jentoft & Chuenpagdee, 2015).

Jentoft and Johnsen (2015) link governability to Foucault's (2007) concept of governmentality, defining it as the continuously reproduced outcome of governing interactions. In these governing interactions, Jentoft and Johnsen (2015) highlight the importance of both the ability *and* inclination to adapt, referring to this as 'adaptamentality'. The concept of governmentality represents the shift in form of governance described in Chap. 2.2, allowing this complex form of power through the creation of governable objects (Asdal, 2011; Djama et al., 2011; Foucault, 2007). Adopting the perspective of these authors in how governmentality is understood and applied, this thesis explores the implementation of sustainability standards through employing the concepts *object 'to-be-governed'*, *governing system*, and *adaptamentality*.

3.2.2.1 The object 'to-be-governed'

While governability is originally applied to understanding public governance, the notion of mutual construction of the governing system and the object 'to-be-governed' can also shed light on the private governance of standards, and the mutually shaping interactions of audits. In regard to the object 'to-be-governed', the term 'adaptamentality' has clear parallels to what Busch (2011), Power (2010), and others describe as organizations changing to become more 'auditable'. This entails changes in organizational structures and practices to allow for external access and inspection, making them more performance-oriented. Two key elements for accomplishing this, which have become crucial components in sustainability standards, are traceability and transparency (Boyd & McNevin, 2015; Gopal & Boopendranath, 2013). *Traceability* concerns maintaining and presenting proper records and documentation, with the intent of ensuring safe food, responsible production and product movement, and responsible practices along the supply chain (Bush & Roheim, 2019; Costa-Pierce & Page, 2013; Groeneveld et al.,

2017). *Transparency* concerns the availability of information and accountability in regard to an industry's practices, for instance regarding work conditions of employees or environmental impact, i.e. 'governance-by-disclosure' (Gupta, 2008; see Chap. 2.2.1).

While adaptamentality is crucial in governing interactions, much of the audit and standardization literature voices concerns regarding the implications of the 'audit society' pressuring organizations to become more auditable. In reference to the dangers of naturalization of standards discussed in Chap. 3.1.3, the implications of an 'audit society' not only pertain to how performance is evaluated, but also how performance is seen and understood. With a preoccupation with issues that are measurable and quantifiable follows the risk of organizations shifting their focus of concern to that which is audited, resulting in the indicator becoming the focus rather than that of which it is meant to be an indication (Larsen, 2017; Shore & Wright, 2015). Power (2010, p. 95) describes this as the audit process becoming "a world to itself, self-referentially creating auditable images of performance." In other words, the map becomes the terrain. This substantiates the argument that no regulation tool can be seen as purely technical, but rather performative and political (Johnsen, 2017).

3.2.2.2 The governing system

The adaptamentality, i.e. both the ability *and* inclination to adapt, of the governing system in the case of sustainability standards is an interesting issue since much of the legitimacy of standards, as well as the auditors assessing them, is granted through the perception of their rigidity and objectivity (Jensen & Winthereik, 2017; Shapiro, 1987). Professional distance is seen as a key element of auditing. This is related to the naturalization of standards, where their taken-for-grantedness brings a sense of trustworthiness through the 'trust in numbers' (Porter, 2001). Cook et al.'s (2016) review of auditing literature shows a mainstream trend of uncritically evoking the norms of objectivity and neutrality as necessary for conducting a 'good' audit. This emphasis on objectivity and neutrality of both the standards and those assessing them complicates the need for adaptation and local translations. This dilemma is summarized

by Eden (2008, p. 1020) in terms of distance between auditor and auditee: “Absence from the field might support claims of independence, objectivity, and generalisability, but presence in the field might also support claims of authenticity, observation, and dedication.”

This quote illustrates the demanding role of the auditor, balancing the necessary interaction with those being audited with the need for legitimacy. Further complicating the matter, many argue that the sought-after neutrality is unattainable. Much of the standardization literature argues that measuring cannot be considered neutral or objective as it will necessarily involve decisions concerning what is to be measured and how these measurements are to be performed (Hatanaka, 2014; Turnhout et al., 2014). Similarly, Power (2010) maintains that the idea that audits are objective and that they are assessing objective facts is challenged by the fact that organizations change to become more auditable. He further explains that the issue of legitimacy and independence is a matter of distinguishing between *organizational* and *operational* independence of auditors, where the former refers to the formal arrangements of the audit, while the latter refers to the actual audit process. It is in regard to the latter that adaptation can occur, where the contact between auditor and auditee allows the translation of complex realities into simplified standards.

3.2.3 Auditor and auditee

Going beyond merely advocating for a more critical view on the neutrality of audits, Cook et al. (2016) further emphasize the significance of the interaction that occurs between the auditor and auditee. This concerns how the two parties shape both expectations and outcome by conceptualizing the audit, thereby constructing and reconstructing the norms of auditing. It is argued that this interaction can also be important for making the audit process an arena for learning, both for auditors and those being audited (Eden, 2008; Jensen & Winthereik, 2017). Similarly, Power (2010) points to the interactive potential of audits, referring to the negotiations that take place. This can concern topics such as specific demands in the standard, what constitutes compliance, and the auditor’s assessment (Eden, 2008; Scott, 1995). Although the

standards usually comprise very specific requirements, there is room for interpretation with regard to how compliance can be achieved in each local context (Aasprong, 2013). According to Kringen (2018), not only those adopting the standards must actively interpret the standard criteria, but also the auditors assessing compliance, supporting the argument that indicators are not, and cannot be, objective.

Jensen and Winthereik (2017) describe how the auditors they researched recognized how the interactional character of audits could provide possibilities for sharing of knowledge and suggestions, but that they, nevertheless, persistently argued for the necessity of maintaining a perception of objectivity and rigidity. However, the interactional character of audits is argued to be necessary, namely due to these standards being simplifications, indicating that they can never fully capture the complexities of reality (Eden, 2008). Despite a growing acknowledgement of its significance, there is limited research on what this interaction actually can and should involve (Eden, 2008 being a noteworthy exception). Precisely because different local contexts and conditions will not necessarily fit into the one global standardized template, the role of the auditor as an intermediary becomes especially important (Cook et al., 2016; Eden, 2008). In this regard, Braut and Øgar (2018) voice the importance of auditors' discretionary space, which involves the utilization of available knowledge to make measured judgements on the basis of specific situational conditions. This dictates some degree of flexibility and room for interpretation, which can be challenging with very specific requirements (Lindøe, 2018).

3.2.4 Addressing the gaps - implementation

While there has been much research on the workings of sustainability certification, there is little that addresses the arenas where 'standard' meets 'reality'. As argued in this section, there are many factors that influence how standards are implemented within companies, suggesting that these standardized means are in no way received in a purely standardized manner. This underlines the necessity of exploring what actually occurs when local realities are translated into standardized templates, framed by external expectations that these standards must be applied similarly across sites, companies, and

countries. Through speaking with aquaculture producers and auditors, as well as observing the actual audit process, the findings in Paper C shed light on these interactions, and the interpretations, negotiations, and compromises that take place. With this, the paper seeks to provide necessary insight into the complex dissonance between necessary adaptation and external expectations, thereby contributing to increased knowledge about the consequences of employing a technical understanding of certification.

3.3 Impact

Despite the proliferation of sustainability standards, there is much uncertainty as to their actual impact, both in terms of intentions and capacity (Boyd & McNevin, 2015; Hatanaka & Busch, 2008; Kalfagianni & Pattberg, 2013; Tlusty, 2012). On the discussion of this, it is crucial to keep in mind that impact is not an unambiguous concept. If one is to explore the impact of these standards, it is imperative to first explore what impact constitutes. As will be shown here, this involves much more than effectiveness, i.e. whether the standards accomplish their intended goals. Impact can involve a great number of issues, the weight given different issues often depending on the actors in question and their specific interests. For instance, industry actors, governments, and environmental groups will all have very different views on how the impact of sustainability standards should be assessed. Furthermore, unintended and unfavorable impacts must not be disregarded. In this section, several different aspects of sustainability standard impacts are discussed and key issues are identified, through the exploration of some of the main criticisms of these standards found in the certification literature.

3.3.1 Sustainability through standards

A common criticism of sustainability standards and similar initiatives is the allegation that they only serve as tools of ‘greenwashing’ or ‘window-dressing’ for a controversial industry, meant only to improve the image of the industry and not the industry itself (Kazancigil, 2007; Vigneau et al., 2015). This is premised on the idea that the

perception of responsible behavior is sufficient to legitimize a company or industry, and that companies obtain these certifications purely with the expectation that sustainability 'pays' (Challies, 2012; Power, 2010; Strathern, 2000). In this regard, it is argued that the 'sustainable seafood movement' has been captured by the market, meaning that the environment and social processes have been accorded a market value and thereby conceptualized as commodities (Konefal, 2013; Nyberg & Wright, 2013).

This criticism reflects a prevalent skepticism in the certification literature towards the actual potential of certification as a means towards improving food production, and specifically the aquaculture industry, demonstrating the necessity of more research on the topic. This skepticism concerns the technocentric character of standards and indicators, said to create a checkbox mentality where primarily trivial issues are addressed, rather than the actual problems of the industry (Boyd & McNevin, 2015; Busch, 2011). Furthermore, many criticize audits as a method of assessment for not providing adequate insight into the actual practices of an organization (Hatanaka & Busch, 2008; Strathern, 2000), in addition to creating unnecessary bureaucracy (Turnhout et al., 2014). Based on these and other concerns, many argue that certification must be considered one approach among many (Bush, Belton, et al., 2013; Vandergeest, 2007). Interaction and collaboration with national governments is deemed by some as essential for compensating for the limitations of private initiatives, such as these sustainability standards (Boyd & McNevin, 2015; Wouters et al., 2012).

3.3.1.1 Evaluating effectiveness

As sustainability standards have become such a major component in the regulation of many industries, including salmon aquaculture, this underlines the importance of evaluating their effectiveness, as well as researching their general impacts (Portney, 2015; Tlusty & Tausig, 2015). This has, however, proven challenging due to numerous reasons. For one, it is difficult to attribute improvements to one specific standard or initiative, as causality in such a complex context is problematic to establish (Challies, 2012; Cook et al., 2016). Another reason is that the question of improvement will

depend on a company's practices prior to becoming certified, which is seldom part of the evaluation (Tikina & Innes, 2008; Tlusty & Tausig, 2015).

There are many different manners in which standard effectiveness has been studied. For instance, Tlusty et al. (2016) assessed certification schemes for aquaculture, specifically the production of shrimp, along the dimensions of breadth and depth, the former denoting whether different factors where addressed in the standards and the latter how rigorously these factors were addressed. In a rather different manner, Kalfagianni and Pattberg (2013) evaluated various fisheries and aquaculture certifications according to five indicators: problem structure, comprehensiveness and stringency of standards, quality of audits, access of relevant societal actors to decision-making venues and procedures, and uptake of standards by relevant actors. Importantly, as Kalfagianni and Pattberg (2013) point out, by using the standards and other documents as basis for evaluation, these are studies of *potential* rather than *actual* effectiveness. There have also been conducted studies into the effectiveness of third-party auditing, which Cook et al. (2016) separate into two different types: the evaluation of whether audits are performed in an effective manner and whether the audits are affecting the change their standards claim to be changing.

Giving a more comprehensive overview of the many ways of evaluating standard impact, Tröster and Hiete's (2018) review of how success of certification schemes has previously been measured identifies the following success factors: stakeholder involvement, quality of the requirements, capacity building, quality of audits, context sensitivity, continuous improvement, transparency of the certification scheme, and communication to customers of the adopting entities. Furthermore, inspired by Young (1994) and Tikina and Innes (2008), Tröster and Hiete also identify four success dimensions: problem solving, behavioral effectiveness (behavioral changes in the organizations), process effectiveness (market diffusion), and constitutive effectiveness (acceptance by stakeholders). The complexity of potential standard impact is clearly demonstrated by the manifold indicators suggested here. Of the four, the behavioral dimension has been given the least amount of consideration, which reflects the output and technocentric fixation of these standards, as well as the challenges involved in evaluating the actual changes made within the certified organizations.

3.3.2 Criticism of sustainability standards' impact

While many point to advantages of certification (see Chap. 2.4.4.1), there is much skepticism in the certification literature as to sustainability standards' potential for achieving improvements. One such criticism is their scope, which is here understood as what is and what is not included in the standards. For instance, Bush, Belton, et al. (2013) claim that certification standards employ a narrow take on sustainability, in that they do not properly include important matters such as complex social issues. Kittinger et al. (2017) also call for a larger emphasis on social challenges of the seafood sector. Looking beyond just the content of the standards, Tlusty and Tausig (2015) criticize the scope of the standards by pointing to the limitations in what species are covered by the schemes, stating that it is mostly high-valued species and not those most commonly produced.

Another commonly cited criticism is the level of impact of certification. This is related to the unit of certification, and the issue of drawing the boundaries of what to include. Although certification is often issued at the site-level, the boundaries of a farm are not a given as they are, at least in the case of salmon production, typically based in an open environment. Because of this, local externalities of a site, e.g. water pollution, can have broader-reaching effects (Vandergeest, 2007). This begs the question of whether companies can be sustainable in themselves or if this is exclusively a national or global matter. Sustainability standards have been criticized for not addressing negative impacts beyond the site-level, such as the aggregate impacts of multiple farms in one location (Belton et al., 2010; Bush, 2018; Bush et al., 2019). Related to this is the issue of which parts of the value chain are included in the purview of the standards. According to Pelletier et al. (2009, p. 8730), it is imperative that the macroscale environmental impacts of salmon production are studied, which "requires consideration of the entirety of the interlinked series of industrial activities that comprise the salmon supply chain." In regard to aquaculture in general, Bush, Belton, et al. (2013) maintain that the production of feed is only included to a limited degree, while transportation and distribution are not included in any of the major schemes. Full life cycle analyses have been suggested to resolve this (Alfnes et al., 2018; Pelletier et al., 2009), however, these are very resource-intensive and difficult to achieve by existing methods.

Possible limitations of certification also concern the issue of who becomes certified. As discussed in Chap. 2.4.4.2, the fact that these private standards are voluntary gives rise to certain challenges. Initiatives that are optional to adopt, such as these standards, have been criticized for being less effective than mandatory programs (Portney, 2015). One explanation for this is that those seeking to obtain voluntary certifications are often demonstrating responsible practices before even attempting to become certified (Gulbrandsen, 2009; Tlusty, 2012). Furthermore, it has been shown that those sites and companies that are too far below the threshold of compliance will usually find certification beyond their means, thereby discouraging any attempt to become certified (Bush et al., 2019; Samerwong et al., 2020; Tlusty, 2012). This suggests that standard uptake cannot necessarily be equated with improvement of the industry.

A much-disputed criticism of sustainability standards is their potential for pushing companies to continuously improve. Continuous improvement is described as a basic tenet of certification, however, as these standards comprise indicators with specific criteria, many point to the lacking incentive for companies to exceed the set requirements (Bush & Oosterveer, 2015; Samerwong et al., 2018). Moreover, Tlusty (2012) points to the possibility that certification can impede innovation, due to the specific nature of the criteria and the detailed instructions on how to comply with them. Suggestions for how standards can facilitate continuous improvement, some of which are being practiced, include repeatedly updating standards with more stringent criteria, having multiple thresholds within a standard, and educational programs for those far below the threshold so that they can receive necessary aid to improve practices, and eventually become certified (Bush, 2016; Tlusty, 2012; Tlusty & Tausig, 2015). In the same vein, Bush et al. (2019) also advocate the emphasis of process over performance.

3.3.2.1 Unintended consequences

When discussing the impact of sustainability standards, it is imperative that unintended and unanticipated effects also be included (Gulbrandsen, 2009). One such possible effect is that the standards provide major corporate actors with the power to maintain the status quo (Challies, 2012). This relates to the criticism discussed in Chap. 3.1.4,

that market-based initiatives, such as these standards, serve a neoliberal understanding of sustainability. In this sense, sustainability standards become neoliberal tools that reinforce existing injustices by maintaining control over actors in developing countries (Bailey et al., 2016; Challies, 2012). Davidson (2011, p. 354) describes this in the context of the professed goals of sustainability, stating that:

> [t]he neoliberal and liberal approach with its emphasis on market mechanisms, such as supply and demand, as well as deregulation, free trade, globalization and, above all, profit and growth, discourages serious analysis of the interdependence of the dimensions of environment, society and the economy.

Furthermore, the neoliberal approach to governance leaves the question of who is accountable unanswered, as it opens up for numerous actors, both public and private, to govern large systems (Vince & Haward, 2017). Lindøe et al. (2018, p. 294) describe this as a 'regime without a face', referring to the lack of both center and periphery, with no overseeing actor and therefore no actors to pay the consequences for use and misuse of standards. This also applies to the issue of power of expertise (see Chap. 3.1.3), as there is limited to no accountability associated with which indicators are included and excluded in the standards (Jacobsson, 2005).

Also related to standards as neoliberal tools is the common criticism that sustainability standards can function as a barrier to trade. This is connected with the consequences of who has power of definition (see Chap. 3.1.3), as many of these standards are, despite being voluntary, becoming *de facto* mandatory (Stanton, 2012). This means that although these standards are not mandatory by law, the increasing demand for certified production and products means that more and more companies are dependent on becoming certified. Companies that do not have the capacity or ability to obtain certain certifications can thereby be excluded from important markets (Challies, 2012; Kringen, 2018). This especially pertains to smaller companies with fewer available resources, and companies in less developed countries, typically located in the global South (Bush, 2018; Challies, 2012; Gulbrandsen, 2009). The disadvantage of the latter group of companies lies in the lack of inclusion of non-western stakeholders in the development of these standards (Alfnes et al., 2018; Kalfagianni & Pattberg, 2013), while both

groups, often coinciding, are affected by how costly and resource-intensive the certification process often is (Boyd & McNevin, 2015; Bush, 2016; Henson & Humphrey, 2012).

The ever-increasing business side of certification is source to much concern in the certification literature, as this industry is becoming highly profitable and highly competitive (Hatanaka & Busch, 2008). Wouters et al. (2012) point to the proliferation of schemes, explaining that the big business of certification is causing companies to require multiple certifications, increasing the costs and other needed resources. Another consequence of the proliferation is the confusion it causes for consumers, as discussed in Chap. 2.4.4. In a progressively competitive market, credibility becomes increasingly important. Belton et al. (2010) stress the dangers of communicating a false message to consumers, giving the impression that the schemes accomplish more than they actually can. Tlusty and Thorsen (2017) protest the use of absolute claims of sustainability by certification schemes, maintaining that this provides consumers with a false sense of security, in addition to limiting further improvement. They argue that sustainability should not be considered an end-goal, but rather a type of behavior that fosters continuous improvement and innovation. In the same vein, Bush, Toonen, et al. (2013) suggest differentiating between degrees of sustainability as a way of avoiding the sustainable/non-sustainable dichotomy.

3.3.3 Institutionalizing principles of sustainability

As previously stated, when evaluating certification by exploring the content of the standards and other documents, this speaks to their *potential* impact. This is important to explore when discussing sustainability standards as a possible means towards improving salmon aquaculture, or any industry, because it signals potential achievements as well as the intrinsic limitations of certification. However, in order to understand the on-the-ground effectiveness of sustainability standards, it is necessary to also explore their institutional, or behavioral, effectiveness, something that has been largely disregarded in the literature (Kalfagianni & Pattberg, 2013; Tröster & Hiete, 2018). As argued within neo-institutional theory, actual organizational change requires

institutionalization of the new principles, a process constrained by the reinforcing deep structures described in Chap. 3.2.1 (Røvik, 1998; Smith, 2007). Therefore, the implementation of external standards will involve interpretation, translation, and adaptation.

For the institutionalization of new principles to take place, organizations must go beyond technical controls of outcome (e.g. quality and cost of products) to include procedural and structural changes (Scott, 1998). Røvik (1998) argues that a way of accomplishing this is by establishing new responsibilities, roles, and possibly departments in charge of that specific focus area, i.e. creating formal organization (Brunsson & Sahlin-Andersson, 2000). However, these types of structural changes have also been criticized for acting as a form of image management. According to Rydin (2007), properly embedding new principles in an organization is a matter of actively shaping the subjectivities of actors. Rydin further questions the possibility of achieving this with the principles of sustainable development, "because it lacks coherence, has no history of being successfully embedded in societal discourses, is not a carrier of power, and, indeed, implies conflicts with prevailing economic discourses" (2007, p. 619). In a similar vein, Nyberg and Wright (2013) argue that the implementation of 'sustainability' in organizations is subject to compromise, in which the meaning of the concept is changed to align with the financial interests of the companies. This relates back to the significance of what content a concept is given and how it is operationalized (see Chap. 3.1.2).

As this illustrates, the institutionalization of new norms and principles, such as sustainability, is not just a matter of ability, but also willingness (Oliver, 1991). This can, for instance, be related to the fact that major changes in an organization occur at the expense of both organizational efficiency and autonomy (Røvik, 1998). According to Oliver (1991, p. 159), whether an organization is willing to conform to external norms is

> bounded by organizational skepticism, political self-interest, and organizational control. Organizational questions about the legitimacy or validity of the institutional status quo, political self-interests among organizational actors that are at cross-purposes with

> institutional objectives, and organizational efforts to retain control over processes and outputs limit the willingness of organizations to conform to institutional requirements.

As organizations cannot be considered passive adopters of new standards (see Chap. 3.2.1), those that experience external pressure to become certified often employ strategies to mitigate the changes.

3.3.3.1 Strategic responses

When adopting new principles and practices, such as sustainability standards, organizational actors can respond in a variety of manners. Scott (1995, p. 132) argues that members of an organization can attempt to:

> reinterpret, manipulate, challenge, or defy the authoritative claims made on them. Organizations are creatures of their institutional environments, but most modern organizations are constituted as active players, not passive pawns.

In this regard, the employment of strategic responses must be seen as a significant part of the implementation of standards, as organizations do not necessarily engage in wholesale adoption of new practices and principles from external standards (Hwang & Suarez, 2005). As illustrated in Chap. 3.2.3, the negotiation of standard criteria and auditor assessments can be considered one such strategy.

In their paper on the spread of managerial practices in nonprofit organizations, Powell et al. (2005) outline a continuum of responsive types, from the enthusiastic adopter to the active resistor. Similarly, Oliver (1991) defines five types of strategic responses to institutional pressures: acquiescence, compromise, avoidance, defiance, and manipulation. Also in the same vein, Erlingsdóttir and Lindberg (2005) distinguish between *isomorphism* (translating new ideas into a dissociate ritual), *isopraxism* (transforming new ideas into new routines), and *isonymism* (applying the same names to other practices). What these authors illustrate is that an organization's response falls along a continuum of ideal types. At the one extreme, organizations can integrate external ideas with their internal systems, thereby fully facilitating organizational change and institutionalization of the standard principles (Kringen, 2018). At the other,

organizations can employ the strategy of 'decoupling' their formal structures and the day-by-day activities, creating disparity between policies and practice, as described in Meyer and Rowan's (1977) seminal paper on rationalized myths. Where specific organizations fall along this continuum is an empirical question, and must be treated as such (Scott, 1998).

3.3.4 **Addressing the gaps - impact**

As mentioned in Chap 3.1.5, in studies of sustainability standards, it is not just a matter of which topics that are addressed by the indicators, but what types of criteria that the companies must fulfill. Therefore, Paper D investigates what the specific indicators demand and the potential impact that these criteria may have on the industry as a whole. By exploring the standards' reach (i.e. level of impact), this study speaks to both their potential impact on improving the industry and provides insight into how their reach can be increased. Importantly, the fact that these findings relate to the *potential* impact of sustainability certification underlines the necessity of also going beyond the standards themselves in order to understand their actual impact. As has been argued in this chapter, there exists a prevalent notion that standardized means of regulation are neutral and that their output provides all we need to know in regulating complex systems and industries. Unfortunately, a similar conception has dominated much of the research on sustainability certification, limiting the focus to standards and their indicators, and largely ignoring that which occurs within the companies when new principles are to be implemented into existing procedures and practices. This is addressed in Paper E, where we explore the behavioral dimension of certification effectiveness.

4 Methodology and research design

Responding to gaps found in the literature, this thesis explores the consequences of treating sustainability as a technical outcome by investigating the *impression* (SQ1), *implementation* (SQ2), and *impact* (SQ3) of sustainability certification. This study tackles a complex phenomenon, warranting a multi-perspective approach with several data sources and methods. The data that forms the basis for this thesis consists of standard documents, interviews, and observations, which have been processed using thematic analysis, as well as the literature discussed in the two previous chapters. I was responsible for a significant share of the data collection, in close liaison with the project group.

The thesis takes an *empirically oriented*, *explanatory*, and *abductive single case study* approach, with the case being sustainability standards for salmon aquaculture production. *Empirically oriented* refers to the emphasis on the empirical data, as this is a study of a real-life phenomenon that has its roots in social interaction; something that is occurring and that can be changed. *Explanatory* investigation has traditionally been associated with quantitative hypothesis testing, but has developed a wider meaning that incorporates studies of influence, impact, and effects (Maxwell & Mittapalli, 2008), which applies to this study's investigation of the interrelation between sustainability and sustainability standards. *Abductive* inference is discussed in more detail in Chap. 4.2, but does, in short, involve that observations of sustainability standards and companies' adaptation to the certification regime are interpreted to identify overarching themes that speak to wider issues of sustainability certification (Sohlberg & Sohlberg, 2013). This study is a *case study* because it, as defined by Yin (2003, p. 13), "investigates a contemporary phenomenon within its real-life context." Although this study examines several sustainability standards, this thesis is a *single* case study in accordance with

Yin's definition, as the standards are parts of a larger whole, and therefore considered subunits of analysis rather than replications of similar cases.

Before the chapter delves into the specific research design of this study, it is first necessary to go further into detail on the author's ontological assumptions, epistemological presuppositions, and methodological commitments. The exploration of the research design's logic is described by Coffey and Atkinson (1996, p. 146) as 'retrospective reconstruction'. This process is important because research findings are never a simple reflection of 'reality', but influenced by the material at hand, research methods, and choice of theoretical framework (Sohlberg & Sohlberg, 2013, p. 106). For that reason, it is important to be explicit about one's background, academic positioning, and choices. Not only does this provide the necessary transparency for others to evaluate one's findings (Braun & Clarke, 2006), it also makes the researcher mindful of the implications that both conscious and subconscious choices have on the entire research process (Sohlberg & Sohlberg, 2013). Furthermore, awareness of the ideal research design allows a better understanding of the limitations of one's own design.

This chapter is, therefore, structured as follows: Firstly, the SustainFish project (the basis for the PhD scholarship) is described in more detail, as its focus, members, and goals set the premise for the study. Next, aspects of the philosophy of science are explored through various research classifications, with the author's choices specified and explained. This is followed by a description of the specific research design applied here, divided according to data collection and data analysis. Finally, scientific quality and the strengths and weaknesses of the chosen research design are discussed.

4.1 The SustainFish project

The research for this thesis has been conducted as part of the SustainFish project, which was funded by the Norwegian Research Council (project number 254841). The project began June 2016 and ended November 2019. It was led by Dr. Tonje Osmundsen at Studio Apertura, NTNU Samfunnsforskning. The project comprised an international group, with participants from Norway, Chile, Scotland, USA, and Colombia. The researchers in the project were affiliated with NTNU Samfunnsforskning, Norwegian

University of Science and Technology (NTNU), Norwegian Institute for Nature Research (NINA), University of Stavanger, University of Talca, and the Scottish Association for Marine Science (SAMS). The research group was interdisciplinary, with members from political science, anthropology, marine social science, economics, and biology, all with extensive research experience on topics related to aquaculture.

Interdisciplinary collaboration has been advocated by many, as it, when successful, can bring about profound discoveries and composite understandings of complex phenomena. As will be shown, the assortment of research disciplines in the SustainFish project was necessary in developing a comprehensive overview of issues relevant for sustainability in aquaculture. However, having such a diverse group also gave rise to certain challenges, as is common in these types of collaborations. For instance, we found that many of the key concepts relevant to the project are attributed different meanings within the different disciplines. As argued by Bailey et al. (2015) in their paper on the interdisciplinary CINTERA project, the creation of a common language is essential to communicate across disciplines. In the SustainFish project, this was done through the identification of reference points and formulation of shared definitions during several intensive workshops. The majority of the SustainFish project members had previous experience with international interdisciplinary projects, experience which proved invaluable for this project.

Briefly explained, the aim of the SustainFish project was to investigate standards and indicators for salmon aquaculture, with respect to sustainability, from scientific, policy, and industry perspectives. The specific case of private sustainability standards was a sensible choice, as they are becoming an increasingly important regulatory mechanism for the industry and represent a massive source of indicators (Alfnes et al., 2018). As discussed in Chap. 2.4.1, salmon does not constitute a very large portion of the total global aquaculture production, but is, however, a very successful industry in terms of production growth and value. As a field of investigation, salmon aquaculture is interesting because it is a growing global industry with countries of great variation in terms of geographical, regulatory, and institutional contexts. Furthermore, it is dependent on international trade, making it vulnerable and, thereby, susceptible to certification pressure.

With regard to specific countries, the project focused on the salmon aquaculture industry in Norway, Chile, and Scotland. The initial intent was to conduct a full comparative study, but this, however, proved difficult (see Chap. 4.4.1 for further details). The project group chose the three countries because they are three of the largest producers of Atlantic salmon. Furthermore, major production companies operate in all three countries, selling their products on the international market. Focusing on these three countries, thereby, allowed unique insight into the diversity that characterizes this global industry, and the intersection between global standards and local conditions in the implementation of these standards.

4.2 Research classifications

The question of *ontology*, i.e. what kinds of things that exist in the world, is usually seen as a matter of positivism versus constructivism. Although this is a too simplistic divide in a practical sense, it serves as a fruitful dichotomy for clarifying the logic of a chosen research design (Moses & Knutsen, 2007). Positivism is based on the notion of an absolute and observable truth to be found 'out there' and is typically associated with the natural sciences, while constructivism postulates multiple constructed realities (Moses & Knutsen, 2007; Tashakkori & Teddlie, 1998). Similar to positivism in that it emphasizes the divide between those that observe and the world that is observed, realism further includes less observable forces beyond the observable phenomena (Payne & Payne, 2004).

How we choose to see the world is a value choice, and different ontologies and philosophies offer different views on reality and on how knowledge can be obtained, along a continuum. In studying sustainability and sustainability certification, both social constructivism and critical realism could provide valuable insights, as both emphasize the subjectivity in construction of knowledge and the 'truth'. What primarily differentiates them is that critical realism concurrently stresses the existence of an external, physical world by which people are bounded (Taylor, 2018). Social constructivism is here considered a more fruitful perspective, as it better enables the exploration of sustainability as a *processual construction*. This entails an acceptance for

‘sustainability’ as a moving target, something that continuously changes and develops. Furthermore, critical realism’s premise of an external, physical world is here problematic due to the existence of many such ‘worlds’, both in time and space. However, preferencing social constructivism does not imply that I reject the existence of climate change and the many challenges in need of attention within aquaculture and other resource-intensive industries. Social constructivism does not deny the existence of a physical world, but rather places the focus on the experiences and perceptions of individuals through social interaction (Taylor, 2018). For the case at hand, there is a general consensus that moving an industry in ‘a more sustainable direction’ implies some form of improvement in terms of accountability and responsibility. However, what that improvement specifically involves is here understood as being determined through a process of constructing ‘sustainability’.

In this study, the social constructivist perspective is reflected in the research questions, as they pertain to how the specific content given to the vague concept of sustainability constructs a reality that, in turn, shapes understandings, priorities, and actions. Berger and Luckmann (1991) describe social constructivism through the dialectic relationship between man (the producer) and the social world (his product), and the processes of externalization, objectivation, and internalization. They maintain that society is a human product that is *externalized*, thereby achieving the perception of being *objective*, then *internalized* “by which the objectivated social world is retrojected into consciousness in the course of socialization” (1991, pp. 78–79). Following this view, this thesis seeks to explore the consequences of treating sustainability as a technical outcome by looking at the dialectic relationship between sustainability and sustainability standards: how sustainability as a concept is formed and how the understanding of it in return forms those applying it.

By not adhering to the idea of an objective ‘truth’, the social constructivist perspective presumes multiple worlds and multiple perceptions of phenomena. This is related to the *epistemology* (i.e. how we acquire knowledge about the world) of social constructivism, which is described by Moses and Knutsen (2007, p. 194) as follows: “Knowledge about the social world is always knowledge-in-context; it is socially situated and has social consequences. As a result, knowledge is always somebody’s knowledge.” As a

consequence of this, social constructivists often employ numerous tools and methods, and recognize and accept dissimilar or conflicting narratives found in the data (Moses & Knutsen, 2007). Accordingly, multiple sources of data and methods have been employed here, in a manner so as to discover the many perceptions, interpretations, and experiences, as will be further described in the next section.

While researchers are shaped by their ontological position, it is imperative that *methodological* choices are based on the research questions at hand and the logic used to pursue them. Qualitative and quantitative research methods are typically linked to different ontological positions, and are often seen as incompatible due to their differing epistemological and methodological principles (Flick, 2009). However, many scholars argue that the pronounced divide between quantitative and qualitative research is more of an ideological matter and that this is a simplified distinction (Coffey & Atkinson, 1996; Moses & Knutsen, 2007; Ragin, 2008; Yin, 2003). Case in point, while this study investigates documents and interview/observation transcripts, data sources that are traditionally associated with qualitative research, the analysis has combined the use of words and numbers to attain a thorough understanding of the data. As this illustrates, qualitative and quantitative research is not always easily distinguishable from each other, substantiating the point that this dichotomy is oversimplified.

With regard to analysis, a fundamental research classification is type of *inference*, most commonly divided into inductive versus deductive. Simply put, inductive reasoning is empirically driven, with generalizations being made based on observed occurrences. Deductive reasoning is hypothesis-driven, where conclusions are derived from general principles that are assumed to be true (Benton & Craib, 2001; Delanty & Strydom, 2003; Tjora, 2009). Both types of inferences have been criticized for being polarized and restrictive, suggesting that they do not contribute to generating new ideas – inductive because it relies on the continuous accumulation of observations, and deductive because it merely applies empirical research to test existing theories (Coffey & Atkinson, 1996). Coffey and Atkinson, therefore, advocate abductive inference, which is what is applied in this thesis. Abductive inference starts from the particular, but utilizes existing ideas and findings to relate this to new ideas and concepts. In the present case, there is considerable research that can help shed light on the consequences

of treating sustainability as a technical outcome, both on certification specifically and on themes such as standardization or global governance. By seeing the empirical evidence in the context of this existing knowledge, this study seeks to provide new insights into the implications of the content, application, and utilization of these standards.

4.3 Research design

Exploring the consequences of treating sustainability as a technical outcome through the specific case of sustainability certification does carry with it certain challenges. These are primarily related to the difficulties involved in exploring conceptual ideas, such as sustainability and governance. Furthermore, the case of sustainability certification encompasses a wide variety of standards, which can be perceived, received, and experienced very differently by different actors. Capturing the many facets of the research questions raised has, therefore, necessitated a carefully considered research design.

A common misconception is that research design simply involves choice of methods. It does, however, encompass research questions, key concepts, chosen theory, chosen methods, and research context, which are all closely interconnected. For that reason, research is an emergent and non-linear process, going back and forth to ensure that the data and analysis do in fact answer the questions asked (Coffey & Atkinson, 1996; Ragin, 2008; Tjora, 2009; Yin, 2003). This illustrates the necessity of letting the research questions lead one's choices, having a sound research design, and being transparent about the chosen design (Braun & Clarke, 2006; Mårtensson et al., 2016; Tashakkori & Teddlie, 1998; Yin, 2003).

As previously mentioned, the present study combines several sources of data and methods to create a comprehensive understanding of the issues at hand (see Table 3, next page). The specific process of integrating the different methods of data collection and subsequent analyses evolved throughout the course of the project, allowing for the needs of the research to dictate its course. Although this was a cyclical process, this

section discusses data collection and analysis separately, in order to give a clearer overview of the different elements of the research process.

Table 3: Data sources applied in each paper

		Content analysis of standards	Social analysis of standards	Level analysis of standards	Interviews	Observations
SQ1	Paper A	■				
	Paper B	■	■			
SQ2	Paper C	■			■	■
SQ3	Paper D	■		■		
	Paper E	■			■	■

4.3.1 Data collection

The three research sub-questions, summarized as the impression, implementation, and impact of sustainability standards, illustrate the wide span of this study's focus area. This is also reflected in the different sources of evidence collected, which have provided very different forms of input to the study. While all data sources have informed the main research question on the consequences of employing a technical understanding of certification and seeing sustainability as a technical outcome, Table 3 shows specifically which research sub-questions that are informed by each data source, with distinctions made between primary and secondary input. This is also further discussed in Chap. 4.3.2.

4.3.1.1 Sustainability standards

Eight sustainability standards from eight different certification schemes were included in this study, totaling 1916 indicators. These standards were primarily selected based on an investigation identifying those most prevalent in the Norwegian, Chilean, and Scottish salmon aquaculture industry – some in all three countries and some in just one

or two. We also sought to include a wide specter of *types* of standards, in regard to topics covered, unit of certification, and stakeholder inclusion (more details below). This was to ensure a comprehensive representation of standards, covering the production process from cradle to crate. A final criterion was that the standards had to be publicly available.

In their comprehensive review of labels for farmed seafood, Alfnes et al. (2018) distinguish between different types of standards: organic, animal welfare, fair trade, safety, traceability, geographic indication, company brands and private labels, and antibiotic-free. While this divide provides an effective illustration of the diversity of these standards, we choose to not follow such distinctions. As argued by Tröster and Hiete (2018), different standards address different issues pertaining to sustainability, not necessarily all. This means that standards can belong in several categories concurrently. It is important to keep in mind that sustainability is an all-encompassing concept, as illustrated by the countless issues addressed in the UN Sustainable Development Goals (see Chap. 2.1.1). The different standards cover much of what is generally incorporated into sustainability; these standards are, in other words, a part of the institutionalization of what is deemed 'responsible' inside a dominant paradigm of sustainability. As explained in Chap. 2.3.1, the standards in question are here all referred to as 'sustainability standards'. This entails the application of a broad understanding of sustainability, encompassing all topics described by Alfnes et al. (2018), and more. In doing so, sustainability is recognized and treated as a complex, integrated concept with divergent objectives and necessary tradeoffs, as advocated in Chap. 2.1.1.

Specific standards of this study

The certification scheme standards included in this study are listed in Table 4. While all eight are captured under the broad understanding of sustainability that is employed in this thesis, they have distinctive features that necessitate clarification. Although these standards are predominantly examined in unison, with findings speaking to general trends of sustainability certification rather than individual standards, a short presentation of each is still warranted. Based on the various differences between standards discussed

in Chap. 2.3.1, this section provides a summary of their overall aim (more details in Table 4, next page), object of certification, unit of certification, auditing requirements, stakeholders included in the development process, scope, and global reach. However, it bears mentioning that much of the information was difficult to ascertain and equate across the different standards, due to disorganized websites and limited consistency with regard to what information is available and how it is presented.

Aquaculture Stewardship Council (ASC) is a scheme that promotes the certification of environmentally and socially responsible seafood (ASC, 2019a). The chosen ASC standard concerns salmon production, with certificates given at the site-level. The certificates are valid for three years, but sites are audited annually. The ASC is renowned for its multi-stakeholder standard-setting processes, initiated by World Wide Fund for Nature, which have included non-industrial stakeholders such as environmental NGOs and scientists, in addition to producers, buyers, and retailers (Aguayo & Barriga, 2016; ASC, 2019b). The scope of the salmon standard includes compliance with national and local laws and regulations, habitat, biodiversity and ecosystem, health and genetic integrity of wild populations, responsible use of resources, managing disease and parasites responsibly, socially responsible development and operations, and community involvement. As per today, the scheme is adopted by companies in all three countries included in this study.

GLOBALG.A.P. primarily offers standards for responsible and ecologically sound agricultural production, but it also has a standard for aquaculture (GLOBALG.A.P., 2019). The standard covers the entire production chain, "from feed to fork", which also includes inputs like seedlings and feed (Boyd & McNevin, 2015; Kalfagianni & Pattberg, 2013). Although the GLOBALG.A.P. standard pertains to the company-level, only a select number of sites are audited annually. Only corporate actors, i.e. retailers and producers, were included in the standard's development process. The standard's scope includes legal compliance, food safety, workers' occupational health, safety and welfare, animal welfare, and environmental and ecological care. All three countries in this study have companies with this certification.

Table 4: Chosen certification schemes and standards

Certification scheme	Standard	Version[4]	Intent/ambition
Aquaculture Stewardship Council (ASC)	Salmon	v1.0	Minimize or eliminate the key negative environmental and social impacts of salmon farming, while permitting the industry to remain economically viable
GLOBALG.A.P.	Aquaculture/ GRASP	v5.0/v1.3	Economically, ecologically, socially and culturally responsible agriculture (and aquaculture)
Friend of the Sea (FOS)	Marine Aquaculture	v1.1	Conserve the marine environment while ensuring sustainable fish stocks for generations to come
International Featured Standards (IFS)	Food	v6.0	Quality assurance and food safety
BRC Global Standards (BRC)	Food Safety	v7.0	Food safety, quality and operational criteria in food manufacturing
Royal Society for the Prevention of Cruelty to Animals (RSPCA)	Farmed Atlantic Salmon	*09/2015*	Animal welfare, sustainability, traceability, biosecurity
Global Aquaculture Alliance (GAA)	BAP Salmon	v2.3	Food safety, social welfare, environmental, animal health and welfare
Scottish Salmon Producers' Organisation (SSPO)	Code of Good Practice - Seawater Lochs	*02/2015*	Balance between industry activities and regulatory detail or bureaucracy, assurance of quality, high minimum standard and continuous improvement

[4] Version number and/or date correspond with the name given the version by the certification schemes.

Friend of the Sea (FOS) is a seafood certification scheme that emphasizes the safeguarding of the marine environment (FOS, 2019). The specific standard included in this study is for marine aquaculture, and certification occurs at the site-level. Sites are audited every 18 months, with certificates being valid for three years. The scheme is an NGO-based project, with participation also from major retailers. The scope of the aquaculture standard includes impact on critical habitat, water quality, escapes, antifouling and growth hormones, social accountability, and carbon footprint. Companies in all three countries of this study have attained the FOS certificate.

International Featured Standards (IFS), originally International Food Standard, has various standards pertaining to global food safety and quality (IFS, 2019). The standard included in this study pertains to food processing facilities. These certificates are valid for one year. IFS standards are developed by retailers, industrial companies, and certification bodies. The scope of the IFS food standard includes senior management responsibility, quality and food safety management system, resource management, planning and production processes, measurements analysis and improvements, and food defense and external inspections. As per today, of the three countries focused on here, companies in Norway and Chile are certified according to this standard.

BRC Global Standards (BRC[5]) claims to be a global leading brand and consumer protection organization (BRCGS, 2019). Similarly to IFS, it has a food safety standard that pertains to food processing facilities. The frequency of audits depends on performance. BRC's standards are developed by retailers. The scope includes senior management commitment and continual improvement, food safety plan, food safety and quality management, site standards, product and process control, and personnel. Companies in all three countries of this study have adopted the BRC food safety standard.

Royal Society for the Prevention of Cruelty to Animals (RSPCA) focuses, as the name implies, on issues concerning animal welfare (RSPCA, 2018). The standard included in this study pertains to the rearing, handling, transport, and slaughter of farmed Atlantic

[5] BRC Global Standards became BRCGS after the research was conducted and is, therefore, referred to as BRC throughout this thesis.

salmon. Companies are subject to annual assessments, as well as unannounced audits. Stakeholders included in the development process are retailers, food companies, farming associated industries, veterinarians, and environmentalists. The scope includes management, animal health, husbandry practices, equipment, feed, environmental quality and impacts, transport, and slaughter. Of the three countries focused on here, Scotland is the only country with companies that have obtained this certificate.

Global Aquaculture Alliance (GAA) is an industry association that develops Best Aquaculture Practice (BAP) standards, promoting responsible aquaculture (BAP, 2019; GAA, 2019). The standard included in this study pertains to salmon farms, which are audited annually, when possible. The BAP standards are developed by aquaculture industry actors. The scope of the standard includes community property rights and regulatory compliance, community relations, worker safety and employee relations, sediment and water quality, fishmeal and fish oil conservation, control of escapees, predator and wildlife interactions, storage and disposal of farm supplies, animal health and welfare, biosecurity and disease management, control of potential food safety hazards, and traceability. Companies in Norway, Chile, and Scotland have attained this certification.

Scottish Salmon Producers Organization's (SSPO) standard, Code of Good Practice, is a standard aimed at providing good practices for aquaculture (COGP, 2019; SSPO, 2019). The specific section of the standard included in this study is for seawater lochs. All members of the SSPO must comply with the Code. Sites are audited annually. Being an association standard, the development process included the farm industry, in consultation with NGOs, environmental groups, angling groups, government, feed companies, fish processors, equipment suppliers, and supermarkets. The scope includes documents and training, food safety and consumer assurance, fish health and biosecurity, fish welfare and care, feed and feeding, and managing and protecting the environment. As it is a national standard, only companies in Scotland have adopted this standard.

4.3.1.2 Interviews

In order to gain insight into the perspectives and experiences of those becoming certified, we conducted 24 in-depth interviews. 22 of these were with major aquaculture production companies in Norway, Chile, and Scotland. Of these, ten companies were located in Norway, six in Chile, and only one in Scotland. The limited sample from Scotland was a result of challenges with obtaining access, i.e. finding companies that were willing to be interviewed. The interview guide was developed primarily by project members at NTNU Samfunnsforskning – Dr. Tonje Osmundsen, myself, and Marit Schei Olsen – with feedback from the rest of the project group. The interviews were conducted by those in the respective countries, in the local language. Most interviews were conducted in person, while a few had to be conducted over the telephone to limit travel costs.

Purposely, only companies with experience with sustainability certification were interviewed, as the scope of the study pertained to the respondents' perceptions of and opinions on the standards. Questions concerned their experience with the process of obtaining different certifications, its effects on the day-to-day work, the audit process, and the potential positive and negative outcomes of increasing demand for certification. The chosen interviewees all worked with certification in some regard, and included managing directors, quality directors, operational managers, environmental coordinators, and certification managers. We also made sure to interview companies of different sizes and geographical locations, to allow for the exploration of potential differences in experience with certification. Furthermore, we sought out both companies with years of experience with certification and companies that had only recently begun working towards becoming certified.

In addition to conducting interviews with aquaculture production companies, we also interviewed two auditors, one in Norway and one in Chile. This provided us with unique insight into the workings of sustainability standards, as auditors function as intermediaries between certification schemes and the companies attempting certification. The process in which the auditor assesses the company is a defining arena for the implementation of the standards, which is why interviews with auditors proved very fruitful. As both auditors that were interviewed had substantial international

experience within their field, they could also provide valuable insight into the potential impacts of sustainability standards and the trends of certification on a global scale. In addition to these interviews, we also conducted informal interviews (Briggs, 1986; Tjora, 2009) with three other auditors and several production company employees during the observational studies (see Chap. 4.3.1.3).

Each interview lasted approximately 1-1.5 hours. All interviews were semi-structured, meaning open conversations guided by specific topics of interest described in the interview guide (see Appendix I). The same guide was used for all interviews with aquaculture production companies. For the interviews with the auditors, we adapted this guide to fit their profession and experiences. By asking open questions and leaving room for digressions, informants could steer the conversation onto topics of particular interest to them, allowing unanticipated discoveries (Tjora, 2009; Yin, 2003). All interviews were, with permission from the informants, recorded, transcribed, and anonymized. Interviews in Norwegian and Spanish were subsequently translated into English by project members. As one always risks losing important subtleties in the process of translation, project members that spoke all three languages went through both original and translated transcripts to account for this.

4.3.1.3 Observational studies

In addition to interviews conducted by myself and others in the project, I conducted multi-sited observational studies of audits for three different sustainability standards, with the intent of gaining insight into the implementation and assessment phase of certification. The fieldwork took place at two different aquaculture production companies in Norway. The first audit was for the ASC standard, where one site was pursuing initial certification, while three other sites were up for recertification. The audit lasted five days, primarily taking place at the main office, but also included two site visits. A primary third-party auditor attended all five days, while an additional auditor joined for the visit to the site up for initial certification, to conduct interviews with the site employees. The second fieldwork took place at a combined audit for two food safety standards, IFS and BRC, at a processing facility up for recertification. The

audit lasted four days, of which I attended two. This audit also primarily took place at the main office, with a few inspections of the processing facility and surrounding area. One third-party auditor was present for the duration of the audit.

As per the request of the companies involved, recording devices were not used during the fieldwork. Diligent notes were taken throughout, which were subsequently transcribed and anonymized. Interaction with the attendees was limited during the audit sessions in order to not disturb or interfere with the process. During breaks, both company employees and auditors went into detail on issues that had been discussed, explaining the purpose of certain indicators, the types of documentation necessary for compliance, etc. As mentioned above, I also conducted informal interviews with auditors and company employees during longer breaks and in transit to and from sites. These interviews primarily pertained to their experiences with different standards and the process of becoming certified.

Although not very extensive, the fieldwork proved very fruitful, as has been shown to be the case with limited observational studies (Tjora, 2009, p. 20). The fieldwork was important in that it allowed for investigation of the practical implications of standards and indicators of sustainability. It provided insight into the mechanisms of the audit process, and a better understanding of the standard indicators and how these are operationalized. Furthermore, the observations provided valuable input to future interviews, particularly those with the auditors. They also served to corroborate findings from the interviews, allowing the exploration of the relationship between what informants say and what they do (Tjora, 2009).

4.3.2 Data analysis

As described above, research is not a linear process with distinct stages of hypothesizing, data collection, data analysis, and theorizing. This entails that analysis cannot be considered a distinct stage in itself, but rather something that occurs throughout (Braun & Clarke, 2006; Coffey & Atkinson, 1996). However, describing it separately is warranted for reasons of clarity, as well as because it allows one to properly delve into choices made and why. For the same reasons, the analysis of the

different types of data is described separately, despite having been conducted both separately and conjunctively.

When using several methods and sources of data, it is common to refer to the process of triangulation (Patton, 1987; Yin, 2003). As described by Patton (1987, p. 60), "[u]sing more than one data collection approach permits the evaluator to combine strengths and correct some of the deficiencies of any one source of data." Patton further explains that the different data must not necessarily coincide, and that triangulation can be used as a means to explore differences and possible explanations for their existence. Conversely, Coffey and Atkinson (1996) oppose the idea of triangulation because it suggests that numerous data sources or methods can be summed together to provide a single representation of the social world:

> We can use different analytic strategies in order to explore different facets of our data, explore different kinds of order in them, and construct different versions of the social world. That kind of variety does not imply that one simply can take the results from different analyses and stick them together like children's building blocks in order to create a single edifice (Coffey & Atkinson, 1996, p. 14).

In accordance with Coffey and Atkinson, multiple sources of data and methods have in this study been applied to generate insight into the complexity of sustainability and sustainability certification, exploring any dissonance or contradictions. As the phenomena studied here could be only partially covered by different measures, we did not apply multiple methods with the expectation of producing exact replications of findings. Rather, each piece of evidence provided insight into different aspects of, in this case, sustainability certification.

4.3.2.1 Thematic analysis

The overarching method of analysis applied in this thesis is thematic analysis, as described by Braun and Clarke (2006). It has proven fruitful in that it is a flexible approach that allows for multiple sources of data. As the name implies, it involves the identification and analysis of themes, or patterns, in one's data material. According to Braun and Clarke (2006, p. 82), a theme "captures something important about the data

in relation to the research question, and represents some level of patterned response or meaning within the data set." Importantly, Braun and Clarke stress that the idea of themes 'emerging' from the data is a misconception, because the identification of themes necessitates an active role of the researcher.

A strength of thematic analysis is that it can also be applied to the *interpretation* of the identified themes, the consideration of possible explanations and implications. This involves going beyond a semantic approach, which limits itself to explicit meanings, to a latent approach, where the researcher interprets the findings by exploring "the underlying ideas, assumptions, and conceptualizations" (Braun & Clarke, 2006, p. 84). Furthermore, thematic analysis allows both simplification and depth, as it serves to both organize a larger body of data *and* offer 'thick descriptions' (see Geertz, 2000) by providing space for context and the recognition of both similarities and differences in the data.

Braun and Clarke (2006, p. 87) provide a useful guide of thematic analysis, which consists of six phases:

1) Familiarizing yourself with your data
2) Generating initial codes
3) Searching for themes
4) Reviewing themes
5) Defining and naming themes
6) Producing the report

Applying these steps makes thematic analysis an exhaustive approach, and yet accessible. This approach was followed in this thesis, but, as supported by Braun and Clarke, not in a linear fashion. For instance, as will be shown, the defining and naming of themes often led to reviews and new searches for themes.

Analysis of standard documents

To obtain an in-depth understanding of existing standards, the indicators of the chosen sustainability standards were coded using N-VIVO, a data analysis computer software.

Coding entails the labeling of data based on the researchers' concepts, often beginning at a general level and then creating more detailed subcategories through the rereading of the data (Coffey & Atkinson, 1996). By creating a set hierarchy of nodes by which to code the indicators, we applied descriptive statistics to examine patterns and dispersion within the data, allowing us to "tack back and forth between the individual data and the general patterns" (Moses & Knutsen, 2007, p. 260). This method exemplifies the argument made in Chap. 4.2, that the distinction commonly made between qualitative and quantitative research is too simplified, as the approach applied here combines the analysis of words and numbers.

The coding of the standards' indicators was done according to both *content* (*general* and *social* topics) and *impact* level. Except for Paper B (social content analysis), I was primarily in charge of the coding work, with assistance and repeated feedback from project members and other co-authors. For all coding activities, the node hierarchy was developed parallel with the coding, repeatedly adapted to ensure that it accurately represented the data. With every modification of the node hierarchy, the indicators were recoded. The results were subsequently converted into charts and graphs to facilitate the identification of trends and patterns in the data. While each standard was coded separately, it is important to stress that these analyses are not intended as comparisons of standards. As described in Chap. 4.3.1.1, the different standards pertain to different segments of the production chain and focus on different challenges, meaning that a leveled comparison would neither be possible nor desirable. Nevertheless, we do refer to the specific findings of individual standards when discussing general trends, but merely with the intent of providing more in-depth explanations of the results.

The *content analysis* of the indicators was conducted by me, with assistance from project leader, Tonje Osmundsen, and repeated feedback from the entire research group (further details in Paper A). This specific coding activity had the purpose of examining which areas of sustainability that were addressed by the indicators in the various standards, and which areas that were neglected, primarily relevant to the *impression* of sustainability that is created by sustainability standards. Using the Circles of Sustainability as point of departure, a tool for creating sustainable cities and communities by James (2015), we developed a node hierarchy in the form of a reference

model for sustainable salmon aquaculture. As seen in Figure 2, our model, the Wheel of Sustainability (WOS), comprises four domains (economics, environment, governance, and culture), with seven subdomains per domain. The model was developed through an iterative process between project workshops and coding of standards, where the node hierarchy was continually refined to correspond with both the indicators and the key issues of sustainable salmon aquaculture, as identified by the project group. Each indicator was finally coded according to all relevant subdomains, as many pertain to more than just one issue of sustainability.

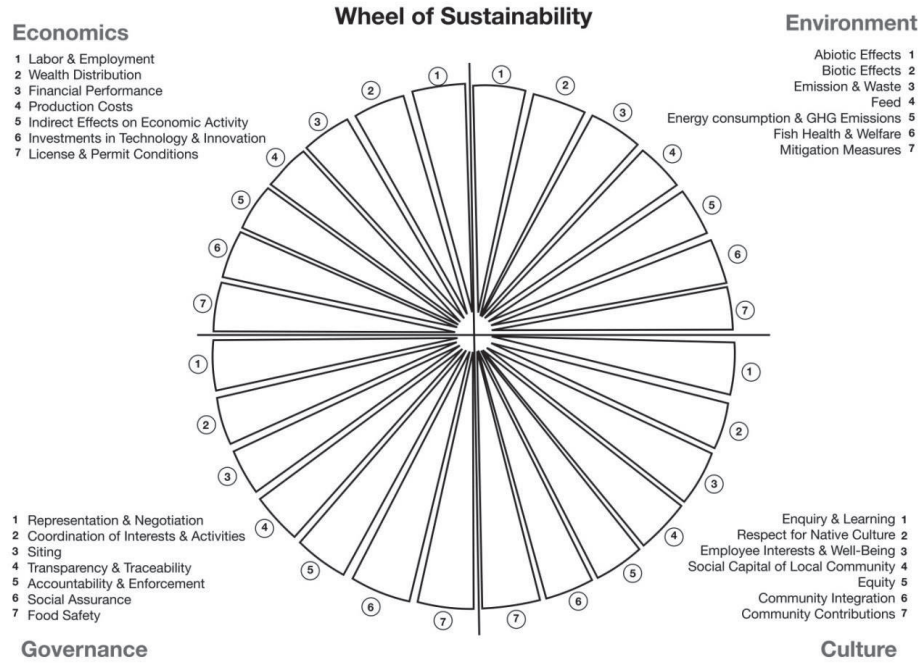

Figure 2: The Wheel of Sustainability with domains and subdomains

The *social content analysis* of the indicators was conducted by the lead author on this paper, Karen Alexander, with assistance and feedback from myself and Tonje Osmundsen (further details in Paper B). The intent of the coding activity was to explore the degree to which social sustainability is addressed by the sustainability standards, the

types of issues that are addressed, and how the schemes attempt to measure these issues. As with the general content analysis for Paper A, the findings here mainly relate to the *impression* of sustainability that is reflected in these standards. Based on a review of definitions for Corporate Social Responsibility (CSR), Triple Bottom-Line (TBL), and Social License to Operate (SLO), we developed a synthesized definition of social sustainability. Based on these and our definitions, we identified those subdomains from the WOS model relevant for social sustainability. The indicators within these subdomains were then recoded, first according to themes relating to each indicator's area of focus, and then according to the action required for each indicator.

The *impact level analysis* of the indicators was conducted by me, with assistance and feedback from Asle Gauteplass and Jennifer Bailey (further details in Paper D). This coding activity had the intent of exploring the criticism that sustainability standards do not address broader scale impacts, primarily relevant for the *impact* of these standards on improving the industry (see discussion in Chap. 3.3.2). The indicators were initially coded according to level of impact, but this proved difficult because it did not fully grasp the nuances of indicator levels. This resulted in a distinction being made between the level of *criteria* and the level of *targeted impact*. Level of criteria (see upper box in Figure 3, next page) refers to the level of the specific requirements, meaning where compliance occurs. Each indicator was coded as either 'site-level' (compliance occurring at the site or surrounding area), 'beyond site-level' (compliance occurring at the senior management level or with external parties, e.g. suppliers), or as both (compliance occurring both on and outside the site). Each indicator was then coded according to level of targeted impact (see lower box in Figure 3), which refers to the level of the issues addressed through the requirements. The indicators were here coded either as 'site-level' or 'beyond site-level', or both. Those indicators that were coded as 'beyond site-level' were given an additional clarification with either 'surrounding site' or 'broader'. For more detailed descriptions and examples, see Paper D.

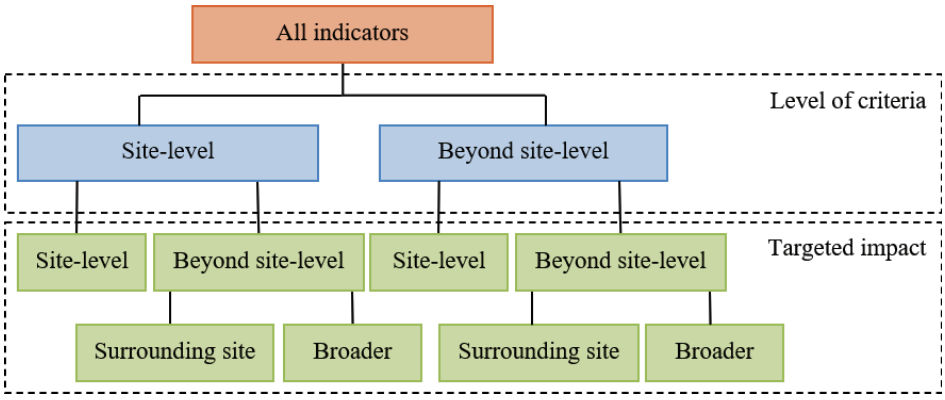

Figure 3: Coding tree for impact level analysis

Analysis of interview and observation transcripts

The coding of the transcripts from the interviews and observational studies was conducted in N-VIVO together with project leader, Tonje Osmundsen (further details in Papers C and E). The transcripts from interviews and the fieldwork were initially coded separately, but the themes and patterns from both were also analyzed together to examine any distinct similarities or discrepancies. The purpose of this analysis was to gain insight into the perceptions and experiences of those certified, in terms of the process of *implementation*, certification's effects on production, and its potential *impacts* and consequences. The coding involved the identification of themes and recurrent patterns in both the informants' statements and actions. As advocated by Braun and Clarke (2006), we avoided labeling the topics of questions asked during interviews as themes. In the initial coding sessions, we coded explicit topics discussed by the informants. These were then revisited in order to identify overarching themes found across informants' responses and actions. The identified themes were further developed during the writing process, which is further discussed in Chap. 4.3.2.3.

4.3.2.2 Theorizing

Theorizing is a vital aspect of research analysis, as it involves going beyond the data to develop new ideas and theories. As Coffey and Atkinson (1996, p. 154) correctly argue, "[m]ethods are not ends in themselves." They further state that:

> their interpretation goes well beyond the technical categorization and description of the data themselves. In significant ways, the real work of analysis and interpretation lies precisely in those intellectual operations that go beyond the data. Our important ideas are not 'in' the data, and however hard we work, we will not find those ideas simply by scrutinizing our data ever more obsessively (Coffey & Atkinson, 1996, pp. 154–155).

In this thesis, theorization of the data was conducted by going beyond the explicit meanings of informants and identifying overarching themes and patterns. By interpreting the data to discover possible explanations and implications, a latent and abductive approach was applied. For instance, explicit statements from the interviews were interpreted to understand the underlying processes in certification, like the incremental and ongoing changes made within the organizations. Doing so necessitated synthesis between the study's empirical data and existing literature. This further contributed to addressing the second part of the main research question, utilizing the findings to justify a new conceptualization of certification as a mechanism for social change.

4.3.2.3 Communication and presentation

According to Coffey and Atkinson (1996), writing out one's findings must be considered an analytical task, rather than merely a task of putting one's findings into words. This is because complexities of the phenomenon in question are often revealed in the writing process, as contradictions and discrepancies in the findings become apparent. As mentioned above, the position of this thesis is that numerous data sources and methods should be used to gain insight into the multiple representations of the social world, rather than use triangulation to understand one single representation. The process of writing this thesis, as well as the papers included, has been an important part of this endeavor.

Needless to say, a crucial aspect of formulating one's research is being able to communicate the findings in an understandable and intriguing fashion. Accomplishing this necessitates knowing one's audience (Coffey & Atkinson, 1996). In the present case, this involves using language that captures those with great proficiency in the topics at hand, while also not excluding those with little previous knowledge of the subject matter. Furthermore, as this thesis is empirically oriented, it is especially important that the findings are conveyed in a way that brings the reader closer to the empirical data (Tjora, 2009). Strategies for realizing this include the use of visual representations and direct excerpts from transcripts and standard documents.

4.4 Scientific quality of research

A fundamental part of the 'retrospective reconstruction' that is undertaken in this chapter is the evaluation of the scientific quality of the thesis. This involves exploring and communicating the strengths and weaknesses of the chosen research design, the potential implications of this, and important considerations that have been made. This endeavor is often considered problematical for social science research, as the most established quality criteria originate from the natural sciences.

In order to best evaluate the chosen research design, I here combine the multidisciplinary framework for quality evaluation by Mårtensson et al. (2016) with the quality criteria for case studies by Yin (2003). The framework of Mårtensson et al. is here applied as an overarching structure. It consists of four main criteria, or dimensions: *credible, contributory, communicable,* and *conforming*. Importantly, the authors underline that the significance given each criterion will depend on each specific research project. While certain criteria are unquestionably more pertinent in this thesis, they have all proven significant in some regard, which is why this framework was chosen. However, as will be seen by the length of the specific section, the *credible* dimension has been given the foremost emphasis. Yin's four criteria are here applied to provide an added understanding of how to evaluate the research quality for case studies, specifically. These include *construct validity, internal validity, external validity*, and *reliability*, bearing much resemblance to the well-established quality criteria for natural

sciences. Three of these criteria relate to Mårtensson et al.'s criteria *credible*, while one relates to *contributory*.

4.4.1 Credible

The first dimension of Mårtensson et al.'s framework, *credible*, is divided into the concepts *rigorous* (*internally valid, reliable,* and *contextual*)*, consistent, coherent,* and *transparent.* These topics relate to matters such as methodological choices, sources of evidence, and execution. Mårtensson et al. describe internal validity as whether one is measuring what one actually intends to measure. Bearing resemblance to Mårtensson et al.'s understanding of internal validity, Yin presents the criterion of *construct validity*. This involves ensuring that the right measures have been chosen, something that case studies are often criticized for not achieving because they do not use 'objective' judgements (Yin, 2003). According to Yin, an approach to strengthen the construct validity of one's research is using multiple sources of evidence, as has been done here.

In evaluating the measures applied in this study, it is important to consider the choice of which standards and informants that were included. These choices were, to a large degree, shaped by the project's focus on the salmon aquaculture industry in Norway, Chile, and Scotland specifically (see Chap. 4.3.1 for more details). The selection of other countries could potentially have produced different findings, but we believe that this specific combination, three countries with quite distinct geographical, regulatory, and institutional contexts, has provided an in-depth and far-reaching understanding of sustainability certification. Ideally, we would have attained access to more than one company in Scotland, as well as access to conduct fieldwork outside of Norway. As mentioned in the introduction of the chapter, this project was initially intended as a full comparative study, examining similarities and differences between the three countries. This did, however, prove difficult due to limited access, warranting a change in research approach.

Challenges with access is a common occurrence in social science research, particularly in organizational studies (Schwartzman, 1993). Our research is, nevertheless, to be considered credible, as it offers valuable findings with potential for informing policy.

While not being sufficient for a full comparative study, the available data does allow for several interesting comparisons, providing meaningful and important insights into some of the key differences across this global industry. However, the issues of access do warrant full disclosure, underlining the importance of transparency and honesty in research.

An important consideration to be made in regard to credibility of interview findings is the potential agendas or biases of informants, or their inclination towards answering what they think is expected of them by the interviewer or their organization (Tjora, 2009; Yin, 2003). Importantly, interviews do not provide objective answers, but rather the perceptions and experiences of those interviewed, which is what we focused on in our interviews. This in no way implies a lesser analytical value of interview findings, but it is something of which one must be aware and forthcoming. Furthermore, it underlines the importance of including contextual factors, as is advocated both for case studies (Yin, 2003) and thematic analysis (Braun & Clarke, 2006). According to Yin (2003), findings from interviews can be corroborated by using additional sources of data. In this study, interviews with aquaculture production companies and auditors were combined with observational studies, which served to provide input to additional questions to be asked during interviews and fieldwork, as well as comparison of findings in a joint analysis.

Another consideration when conducting interviews is the potential influence of the researcher. Briggs (1986, p. 22) argues that it is crucial to be aware of this because "the interview is itself a social interaction." This relates back to the issue of informants feeling inclined to answer 'correctly'. The potential influence of the researcher is just as relevant in observational studies, where the informants can become distracted or apprehensive by the researcher's presence (Schwartzman, 1993; Tjora, 2009). An important strategy for avoiding this in the current study was to ensure proper introductions with all attendees, as well as giving a short presentation about the project, my role and intentions for being there, and an explanation of our anonymization procedures. As previously mentioned, I also sought to restrict my influence by limiting any interaction with the informants during the audit sessions. Furthermore, my presence seemed less distractive as I did not use a recording device during the fieldwork. This did

not appear to be an issue during the interviews, as it was a different setting where it seemed to be more expected.

A potential weakness of the document analyses was that the coding work was primarily conducted by one researcher. However, several steps were taken to ensure the validity of the findings from these analyses. Firstly, those involved with each respective paper were all part of the discussions pertaining to node hierarchies and coding decisions. Furthermore, all were involved in the process of making the necessary changes after the initial coding sessions. For the content analysis coding, additional steps were taken to strengthen the validity, as this was the first coding activity and also more extensive than the successive analyses. For this coding activity, in addition to taking part in all discussions and constructing the node hierarchy, all SustainFish project members went through the indicators coded according to their domain of expertise. This elaborate process also allowed us to capitalize from the research group's extensive knowledge and experience. To ensure the relevance and robustness of the resulting model, it was presented at an international stakeholder workshop organized by the SustainFish project, with participants including professors, researchers, students, and consultants.

The final concept under the credible dimension is *reliability*. This refers to the idea that if the same study is repeated by another researcher, they would arrive at the same conclusions. This quality criterion is often said to not be applicable in social science research. Within anthropology, for instance, reliability in this sense does not apply, because the researcher is seen as his or her own research instrument (Spradley, 2016). Tjora (2009) has an interesting take on using the reliability criterion in qualitative research, stating that one should still question whether another researcher would arrive at the same conclusions, but that the answer does not necessarily have to be an unequivocal 'yes'. Rather, he argues that the researcher must be forthcoming about the context of the study, identifying factors concerning the specific researcher or specific informants that relate to the specific findings, as has been done in this chapter. According to Yin (2003, p. 37), "[t]he goal of reliability is to minimize the errors and biases in a study." A suggested strategy for accomplishing this, as has also been done in this project, is proper documentation of procedures in data collection and analysis.

4.4.2 Contributory

Mårtensson et al.'s second dimension, *contributory*, is divided into *original* (*idea, procedure,* and *result*), *relevant* (*relevant research idea, applicable result*, and *current idea*), and *generalizable*. The criterion of originality demands an exhaustive familiarity and understanding of existing research, in order to ensure that one's research questions build on existing knowledge and actual gaps in the literature. As reflected in the two preceding chapters, this thesis seeks to contribute to the literature on certification, sustainability, standardization, and 'governing at a distance'. The originality of this thesis lies primarily in the in-depth analysis of sustainability standards according to different topics. Furthermore, the combination of different sources of evidence and methods has provided unique insight into the workings of sustainability standards, as findings from interviews, observations, and document studies have been used to inform each other.

The relevance of the thesis, as discussed in Chap. 1.4, pertains not only to the specific topics explored here, but also the choice of industry in which to study these topics. Salmon aquaculture is a major industry that is continually developing, causing the emergence of new solutions and challenges. The issue of governing the industry is, therefore, of great importance and of key interest to stakeholders in both the public and private sphere. Sustainability has become one of the major buzzwords of today and is continually receiving increasing focus from the general public, national authorities, and major private actors. As was described in Chap. 3.1.1, the wide-spread preoccupation with sustainability has diluted the concept, which is why it is important to study the operationalization of it. As for certification, the relevance of this topic is demonstrated by its proliferation as a means to govern global industries and making them 'sustainable'.

Generalizability relates to Yin's quality criterion of *external validity*. Generalization of social science research is a matter of conceptual, or analytical, generalization, as opposed to the statistical generalizations of the natural sciences (Coffey & Atkinson, 1996; Tjora, 2009). It is still a matter of transcending the particular, which in this case involves speaking to issues beyond the specific standards and companies examined here. Yin (2003, p. 37) describes analytical generalization as "the investigator […]

striving to generalize a particular set of results to some broader theory." In the present study, this predominantly concerns standardization and governance theory, with emphasis on governing at a distance and the implications of doing so using global standards. Also, this thesis serves as a contribution to the certification literature, as it argues for a major shift in how certification is understood and utilized.

Importantly, the fact that case studies are not generalizable to larger populations does not suggest that the findings cannot prove relevant outside the particular case examined here. The study is intended to be applied, and has potential input for policy, as the results have the promise of informing both public and private decision-makers. Primarily, the findings in this thesis can speak to certification issues in general. Certain findings can be applicable to other salmon producing countries, as most of the standards examined here are also used in other countries. Furthermore, while this thesis specifically looks at sustainability standards for salmon aquaculture, certification is becoming more and more common within many other industries, which suggests that certain parallels can be drawn. When doing so, however, it is imperative that generalizations are not assumed, but rather that the particular findings are used to shed light on the larger phenomenon.

4.4.3 Communicable

The third dimension, *communicable*, is divided into *consumable* (*structured*, *understandable*, and *readable*), *accessible*, and *searchable*. This relates to what was discussed in Chap. 4.3.2.3, knowing one's audience as a writer and using illustrative tools such as visual representations and direct excerpts from the data material. In regard to research being accessible and searchable, all the published papers in this thesis are available as Open Access. Furthermore, the complete data material from the content analysis has been published as an Open Access data paper (Amundsen & Osmundsen, 2018), so that it can be used by others as a foundation for further research. This data material is also available in an open database on the SustainFish project website (https://sustainfish.wixsite.com/sustainfishproject/search-indicator-database), so that

any interested parties, e.g. researchers, policymakers, and industry actors, can benefit from this work.

4.4.4 Conforming

The final quality dimension in Mårtensson et al.'s framework is *conforming*, which is divided into *aligned with regulations*, *ethical* (*morally justifiable, open*, and *equal opportunities*), and *sustainable*. The issues that are most pertinent here are those related to the ethical criterion, some of which also relate to the research being aligned with regulations. The project was notified to the Norwegian Centre for Research Data and all interview and observation transcripts were anonymized, so as to comply with the national data management regulations. Also, the use of recording devices was only done with the consent from informants.

When conducting organizational research, there are also other important ethical considerations to be made. Firstly, is necessary to keep in mind that this is the informants' place of work, and many can, therefore, feel obliged or forced to partake in a research project. It is imperative that all informants are aware that participation is voluntary, which is something we explained both prior and during interviews and fieldwork. Participants were also informed about how to contact us if they wished to withdraw their involvement and data. Another consideration related to doing research in an organization is the fact that having an external party present, either to interview or observe, may be experienced as disruptive (Tjora, 2009). This was especially important to be aware of during the audit observations, as poor assessment results could have detrimental consequences for the companies. Furthermore, the fact that aquaculture is a controversial industry was something that warranted additional care, amplifying the importance of ethical handling of data, ensuring that individuals' and companies' identities remained anonymous (Yin, 2003).

5 Results - Presentation of papers

In this chapter, the five attached papers are presented, Papers A-E (Alexander et al., 2020; Amundsen et al., 2019; Amundsen & Osmundsen, 2019, 2020; Osmundsen et al., 2020). Two additional papers that were written during the doctoral period, a data paper and a conference paper, are also presented here (Amundsen & Osmundsen, 2018; Nilsen et al., 2018). These are, however, not included in the thesis. All papers speak to the main research question – what the consequences are of employing a technical understanding of certification and seeing sustainability as a technical outcome, and how increased knowledge about this can move us towards a new conceptualization of certification – which is further described and explored in the next chapter.

The chapter is divided according to the three overarching perspectives (the 3 I's): impression, implementation, and impact. Following each section, a short reflection on how the papers shed light on the relevant research question is presented, laying the foundation for the discussion in the subsequent chapter. To summarize, *impression* refers to what content 'sustainability' is given by the certification schemes, the significance of which lies in the ontological power of these standards (see Chap. 3.1), as their focus areas contribute to the common understanding of what sustainable aquaculture production involves. *Implementation* is here understood as how production companies work to comply with the standard criteria, and how compliance is assessed and negotiated. The *impact* of sustainability certification not only refers to their potential effectiveness in improving the aquaculture industry, but also their unintended implications.

Although the papers are grouped according to the 3 I's and their associated sub-questions, each paper touches on issues related to more than one of these perspectives. Table 5 illustrates how the 3 I's are very much interconnected. For instance, how a sustainability standard is implemented will have implications for its impact. Likewise, the impression of sustainability created by standards (i.e. which issues are and are not prioritized) will affect how the standards are implemented and thereby their potential impact on improving the industry. These interconnections are further discussed in this and the subsequent chapter.

Table 5: Which papers answer which research questions

	Impression SQ1	**Implementation SQ2**	**Impact SQ3**
Paper A			
Paper B			
Paper C			
Paper D			
Paper E			

5.1 Impression

SQ1: What *impression* of sustainability is created through the choice of content in sustainability standards?

5.1.1 Paper A

Osmundsen, T. C., Amundsen, V. S., Alexander, K. A., Asche, F., Bailey, J. L., Finstad, B., Olsen, M. S., Hernandez, K., & Salgado, H. (2020). The Operationalisation of Sustainability: Sustainable Aquaculture Production as Defined by Certification Schemes. *Global Environmental Change, 60,* 102025. https://doi.org/10.1016/j.gloenvcha.2019.102025

In this paper, a reference model for sustainable salmon aquaculture is presented and applied, the Wheel of Sustainability (WOS). This is an adaptation of the Circles of Sustainability model, developed by James (2015), which is used to assess cities and communities. The model was developed through a content analysis of the standard documents and repeated workshops with the project group, resulting in an overview of topics and issues to be addressed in making the salmon aquaculture industry 'sustainable'. These 28 topics are grouped according to four domains of social practice: economics, environment, governance, and culture.

Following James (2015, p. 44), social practice refers here to how we do things and how our practices can be reorganized. This speaks to why there is not a separate social domain, as the model emphasizes how all the elements are part of an integrated social whole with human activity being both grounded in and influencer of natural life; thereby making all these domains *social* domains. Denoting the domains as social is not to say that the social dimension of sustainability is of greater significance. These are four *domains of social practice* because they are all part of social life and human activity – systems that we exert influence on, systems that we can change. The WOS is not a hierarchical representation of sustainability that assigns importance or priority to

different challenges, but rather a model that accentuates the many, and sometimes conflicting, issues to consider.

The WOS was further applied to the coding of the 1916 indicators in the eight sustainability standards described in Chap. 4.3.1.1. Importantly, this was not a comparison of specific standards. Discovering which standards cover most aspects of sustainability does not speak to which standards are 'better', as specialized standards may be equally, possibly better, suited to improve the industry. The standards were therefore examined in unison, with the intent to explore the impression that is created of sustainability within the salmon aquaculture industry. We found an overwhelming concentration of environmental and governance indicators, where a large share of the latter serves to implement and legitimize the former. Issues related to economics and culture are largely ignored. The remarkable prioritization of environmental issues in these standards suggests a skewed and narrow operationalization of sustainability, which can, in turn, have implications for where efforts to improve the industry are, and are not, placed.

What this last point illustrates is that, while this paper primarily speaks to the *impression* of sustainability created by these standards, its findings also indicate potential implications for the *impact* of the standards. The fact that these sustainability standards function as ontological devices underscores the importance of scrutinizing their content and seeing the results in the context of the many issues to be addressed.

5.1.2 Paper B

Alexander, K. A., Amundsen, V. S., & Osmundsen, T. C. (2020). 'Social Stuff' and All That Jazz: Understanding the Residual Category of Social Sustainability. *Environmental Science & Policy, 112,* 61–68. https://doi.org/10.1016/j.envsci.2020.06.003

Based on the findings from the content analysis presented in Paper A, this paper delves into the indicators related to social sustainability. The 'social' indicators examined in this paper are those related to what the industry understands as social sustainability, what we have labeled the 'social stuff' in reference to how this was described in the

interviews we conducted. Based on definitions of Corporate Social Responsibility, Triple Bottom-Line, and Social License to Operate, we developed a synthesized working definition of social sustainability, where the private company is seen as an actor 'of and in society', with responsibilities emanating from being both an employer and a social player. Applying these definitions to the WOS model, we identified all the 'social' indicators in the eight standards. The relevant indicators were then coded according to theme and required action for compliance, in order to discover how social sustainability is operationalized through these standards.

The analysis identified 11 % of the 1916 indicators as relevant for social sustainability, with indicators primarily concerning the consequences that environmental impacts of aquaculture have for the local community, workers' rights, and health and safety. We also found that many of the indicators merely require compliance with national law/legal commitments. These findings combined are cause for speculation as to whether these sustainability standards truly address the main issues of social sustainability. Furthermore, we see that the vastness and vagueness of this 'social' category makes it unproductive in the endeavor to improve the aquaculture industry. The paper concludes by pointing to the unrealized potential for certification schemes in challenging and further developing our understanding of social sustainability, by incorporating indicators that drive private companies to move beyond the role of employer and economic agent.

As with Paper A, identifying the content of the sustainability standards speaks to the *impression* that they create of what sustainability and sustainable aquaculture involves. Firstly, the share of indicators in the standards that actually relate to social sustainability has implications for the industry's perception of its significance and urgency. While there appears to have been an increase in 'social' indicators within sustainability certifications, it is considered of much less importance than other challenges of the aquaculture industry. Secondly, the specific issues that are addressed by the standards play a key role in defining what is associated with social sustainability. In addition to impression, the findings of this paper also relate to the *impact* of sustainability certification, as they point to the potential consequences of how the 'social stuff' is, and is not, addressed in the standards.

5.1.3 Answering the research question SQ1 - impression

As both these papers argue, the content of major sustainability standards play a defining role in the general understanding of sustainability and what a 'sustainable salmon aquaculture industry' would look like. The environmental focus in the standards, described in Paper A, was also reflected in the interviews with production company employees, where questions asked about sustainability were often answered in terms of environmental issues. Similarly, the standards' limited, and somewhat shallow, inclusion of 'social stuff', described in Paper B, was reflected in how the informants spoke about these issues. As has been shown here, the impression that is created of sustainability is not just a matter of which issues that are addressed in the standards, but also *how* these issues are addressed, i.e. what the companies must do in order to achieve compliance.

5.2 Implementation

SQ2: How are sustainability standards *implemented* in salmon aquaculture companies?

5.2.1 Paper C

Amundsen, V. S., & Osmundsen, T. C. (2019). Virtually the Reality: Negotiating the Distance Between Standards and Local Realities When Certifying Sustainable Aquaculture. *Sustainability, 11(9),* 2603. https://doi.org/10.3390/su11092603

The point of departure for this paper is the common assumption that auditors and the audit process must be completely independent and objective to maintain their legitimacy. Auditors are, however, subject to the difficult task of both upholding the standard and considering the local context, seeing as standards are simplified representations that do not necessarily correspond with reality. This is especially true with global standards such as these sustainability certifications, where the same criteria

are applied across regions and countries. It is argued that while consistency is crucial for global certification to serve its purpose, the distance created by the focus on neutrality can impede understanding of local conditions, which necessitates proximity. To investigate this complicated balance, we attended audits for three different standards and conducted 24 in-depth interviews of aquaculture producers and auditors. The content analysis of indicators (see Chap. 5.1.1) also provided insight into the workings of standard assessment procedures.

Our findings confirm the important role that the auditor plays in the implementation and assessment of sustainability standards. While there in most cases are detailed descriptions on what constitutes compliance, the auditor must still make the final decisions and are accordingly held accountable for their judgements. Local practices of each company and site are translated to correspond with the standard's criteria, a process that is often realized through interaction between the auditor and those being audited. The extent of the interactional character of audits tends to be downplayed, both by auditors and producers, as this can reflect poorly on the perceived legitimacy of the process. However, we find that this interaction and communication supports the balancing of the concurrent need for distance and proximity, something that is contingent on the auditor having available means of discretion, as well as being experienced in the field. We argue that increased transparency concerning the value of interaction between auditor and auditee can provide better utilization of the knowledge and expertise of both auditors and producers, thereby facilitating much needed reciprocal knowledge production.

What this illustrates is that while the study of the audit process naturally relates mainly to the *implementation* of sustainability standards, it also speaks to the potential *impact* of the standards. It shows another facet of impact, not *whether* sustainability certification can improve the industry, but *how* it can best be utilized, in this case as instruments for learning. Furthermore, this paper provides insight into the consequences of applying the traditional notion of auditors and the audit process as independent and objective, which endorses the misconstrued technical idea of standards being true representations of 'reality'.

5.2.2 Answering the research question SQ2 - implementation

While there is only one paper in this thesis that primarily speaks to the perspective of *implementation*, as opposed to two for the others, Paper C presents several important aspects of how these standards are implemented. The choice of the audit process as the arena to explore standard implementation is founded in this thesis' occupation with the intersection of 'standard' and 'reality'. The translation and adaptation of the standard criteria to each local context occurs, to a large degree, in the interaction between auditor and auditee. The complexity of this process is here illustrated, where the enactment, rather than achievement, of objectivity and independence happens through the knowledge that the auditor possesses, the negotiations taking place between auditor and auditee, and the auditor's means of discretion.

5.3 Impact

SQ3: What *impact* does the adoption of sustainability standards have on the salmon aquaculture industry?

5.3.1 Paper D

Amundsen, V. S., Gauteplass, A. Å., & Bailey, J. L. (2019). Level Up or Game Over: The Implications of Levels of Impact in Certification Schemes for Salmon Aquaculture. *Aquaculture Economics & Management*, 1–17. https://doi.org/10.1080/13657305.2019.1632389

This paper explores the viability of the common criticism that sustainability certification does not, and cannot, address broader reaching externalities of aquaculture production, largely because they primarily certify on site or firm-level. By examining eight sustainability standards, utilizing both the *level of impact* and *content* analysis of the standard indicators, we sought to discover their potential for addressing challenges of

the industry beyond just local effects. We found that the indicators' level of criteria (i.e. the level of where compliance occurs) and level of targeted impact (i.e. the level of the issues addressed) rarely coincide, resulting in the indicators being coded according to both, in order to achieve a representative understanding of the indicators' potential reach. Importantly, as with Paper A, this is not meant as a comparison of specific standards, but rather a study that speaks to general trends in sustainability certification.

Consistent with much of the certification literature, we found that indicator criteria predominantly pertain to the site-level. However, by distinguishing between the level of compliance and the level of targeted impact, we found that the majority of the standard indicators address issues beyond site-level, including regional, national, and global. Using the content analysis of the indicators described in Paper A, we could further identify the groups of indicators that address broader scale impacts of aquaculture, and more importantly, indicators that address *multiple* levels of impact. In regard to the latter, two types of indicators were especially prominent: those ensuring traceability and those requesting coordination/sharing of information. The former allows insight into a wider segment of the value chain, for instance ensuring responsible feed production or a safe and healthy end-product. The latter especially pertains to producers and other actors in near proximity, often through various forms of area-based management. By adding these criteria, often through documentation requirements, numerous indicators with site-level compliance achieve a potential higher level of impact.

Through exploring the potential reach of sustainability certification, the findings of this paper primarily relate to the *impact* of sustainability standards. As many standards do in fact certify on site or firm-level, understanding the workings of existing multi-level indicators can contribute to maximizing the potential of sustainability certification. However, the findings also concern the *implementation* of the standards, as we distinguish between compliance and targeted impact of the indicators. The former, level of compliance, speaks to necessary actions to comply with the indicator requirements and how aquaculture producers work to achieve this. Furthermore, identifying the importance of traceability and coordination/sharing of information illustrates how the implementation and impact of sustainability standards are interconnected.

5.3.2 **Paper E**

Amundsen, V. S. & Osmundsen, T. C. (2020). Becoming Certified, Becoming Sustainable? Improvements from Aquaculture Certification Schemes as Experienced by Those Certified. *Marine Policy, 119.* https://doi.org/10.1016/j.marpol.2020.104097

In this paper, we explore how sustainability certification can serve as a means towards improving the aquaculture industry by focusing on the behavioral dimension of certification effectiveness, i.e. the behavioral changes that are made within certified organizations. This approach was motivated by one of the common criticisms of sustainability standards, that they only serve to improve the image of aquaculture companies through 'greenwashing' of the industry. According to this criticism, certified companies are not internalizing the responsible practices advocated by the certification schemes, thereby doing little to actually improve the industry. Furthermore, it is argued that in the format of sustainability standards, with set metrics that are applied globally, there is little incentive for the companies to continuously improve their practices.

Based on interviews and fieldwork, we found that producers are aware of the necessity of incorporating the principles and practices of the standards in the organization, and voice the importance of this. Many also describe how certification has caused inclusion of new focus areas, which in turn has led to more responsible practices, both environmentally and socially. Several respondents speak of major changes that have been made within the companies, which they see as essential steps towards improving the industry. Many of these changes are, however, related to documentation and reporting, which some experience as futile, especially since this also involves reporting on already existing procedures and practices. Furthermore, the certification demand that these companies experience, combined with the substantial resources associated with obtaining often numerous certifications, leads to many employing strategies to mitigate the pressure. These include things like negotiating compliance and sometimes even the terms of the standards, and decoupling the formal structure of organization with the actual day-to-day activities. Continuous improvement is also described as difficult to achieve.

The findings of this paper relate primarily to the *impact* of sustainability standards, arguing for the significance of the behavioral dimension of certification effectiveness. This is an understudied dimension, for which this paper has aimed to provide more content. This involves identifying key facilitators for behavioral change: to incorporate responsible practices as new routines, embrace new focus areas, implement structures promoting continuous improvement, make employees conscious of the importance of sustainability, and implement changes in the entire organization. Based on this, we argue that standards oriented towards flexibility and continuous improvement are better suited for promoting behavioral change. Also, the paper speaks to the *implementation* of these standards, because it sheds light on how companies work to obtain sustainability certifications.

5.3.3 **Answering the research question SQ3 - impact**

The two papers presented here touch upon quite different aspects of impact, with the intention of providing a more comprehensive picture of the matter. A commonality is that they both speak to the potential impact of certification, pointing to suggestions for how to maximize this potential. Paper D focuses on the potential reach of certification. An important element of this is the advancement of certification throughout the value chain of salmon production. Certain schemes require chain of custody, meaning that the complete production chain must be certified, including hatchery, nursery, and feed manufacturer. Other schemes specifically require certified feed suppliers, service providers, or smolt producers. Paper E concerns the potential and actual internalization of certification within the organizations, which has been proven essential for achieving any significant improvements.

Another aspect of certification impact that was merely referenced in Paper E, but which deserves a more explicit reference, is the significance of *who* becomes certified. For instance, findings from both interviews and fieldwork suggest that standard requirements often correspond comparatively better with the practices in Norway than in the other countries. According to several informants, this is because many of the standards are to a large degree rooted in the Norwegian salmon aquaculture industry and

Norwegian regulations. Furthermore, location of site is said to be of great importance, as differing geographical conditions affect things like seabed conditions, temperature, and disease exposure. In studies of the impact, both potential and actual, of sustainability certification, the issue of who can and does become certified must be part of the discussion.

5.4 Additional papers

Nilsen, M., Amundsen, V. S., & Olsen, M. S. (2018). Swimming in a Slurry of Schemes: Making Sense of Aquaculture Standards and Certification Schemes. In S. Haugen, A. Barros, C. van Gulijk, T. Kongsvik, & J. E. Vinnem (Eds.), *Safety and Reliability – Safe Societies in a Changing World* (pp. 3149–3156). London: Taylor & Francis Group.

In this conference paper, we explored why many sustainability standards differ in their declared focus areas, which served as a backdrop for subsequent studies in the project. This was done by examining five of the sustainability standards (ASC, GLOBALG.A.P., RSPCA, IFS, and GAA/BAP), categorizing them according to what we have labeled the 'three P's of certification': purpose, proprietorship, and process. These standards were chosen specifically because they represent a wide range within sustainability certification in regard to focus areas, motivation, and actors involved. We found distinct correlations between the three P's, while also providing detailed descriptions of the complexity that characterizes the different certification schemes. Furthermore, based on the findings, the paper argues that because of the necessary tradeoffs and political priorities involved in improving the aquaculture industry, the possibility for having just one all-encompassing standard is unlikely. This speaks to one of the major arguments of this thesis, that the many issues of sustainability do not pull in the same direction.

Amundsen, V. S., & Osmundsen, T. C. (2018). Sustainability Indicators for Salmon Aquaculture. *Data in Brief*. https://doi.org/10.1016/j.dib.2018.07.043

This data paper includes the material from the coding of indicators discussed in Paper A. By making the data and in-depth description of the method publicly available, we seek to both facilitate and encourage the utilization of our work for other researchers, policy-makers, and industry actors. The material can hopefully serve in the development of new indicators and improvement of salmon aquaculture regulation. As mentioned in Chap. 4.4.3, the data set is also available in an open and searchable database on the project website: https://sustainfish.wixsite.com/sustainfishproject/search-indicator-database.

6 Discussion

In this study, thematic analysis has been applied to multiple sources of data to explore the consequences of treating sustainability as a technical outcome and employing a technical understanding of certification (RQ1), focusing on the impression (SQ1), implementation (SQ2), and impact (SQ3) of sustainability standards in salmon aquaculture. As explained in Chap. 4.3.2.1, thematic analysis enables the identification and analysis of common themes in the data material. While certain themes have already been described in Chapter 5, this chapter seeks to go beyond the findings of the original papers by diving into patterns and themes identified across the papers, thereby providing additional insight into the complex issues at hand. As will be seen here, the data substantiates much of the previous research discussed in Chapters 2 and 3, but also expands on it in significant ways. Most notably, by shedding light on the many ramifications of employing a technical understanding of sustainability certification, the findings of this thesis demonstrate the need to move away from such an approach. Furthermore, by considering the limitations of a technical understanding against the identified challenges of governing at a distance and from there proposing a new direction, this chapter addresses the second part of the main research question: *how can increased knowledge about these consequences move us towards a new conceptualization of certification as a mechanism for social change*.

6.1 The challenges of governing at a distance

In today's neoliberal society, which represents a shift away from the traditional regulatory model to more indirect forms of governance (Foucault, 2008; Rose & Miller, 1992), private regulatory initiatives are playing a larger role in governing the salmon

aquaculture industry (Washington & Ababouch, 2011). This shift towards governing at a distance not only represents a shift in who regulates, but also a shift in power, in who decides and who defines the challenges to be dealt with, with private actors appropriating responsibilities that have formerly lied with the national state (Busch, 2017). This is what Lindøe et al. (2018) label a 'regime without a face', where the impersonal character of private initiatives, such as these certification schemes, provides limited accountability (Jacobsson, 2005), as discussed in Chap. 3.3.2.1.

While the topic of private sustainability certification versus national regulatory authorities is beyond the scope of this thesis, the findings do speak to the strengths and weaknesses of voluntary versus mandatory requirements. This relates to some of the key issues of governing at a distance, as many of the initiatives of decentralized power (e.g. sustainability certification) are private governance initiatives with no legal ramifications (Cuyvers and De Meyer, 2012). As previously described, aquaculture production is a global industry with challenges that go beyond the reach of national authorities. The shift away from state control to the involvement of more private actors and initiatives can, therefore, be seen largely as a response to the perceived lacking capacity of national regulators and regulations (Groeneveld et al., 2017). However, many of the challenges that national regulatory authorities face are exacerbated in the soft law (i.e. non-legally binding) of private governance. Governing within national borders involves the active attempt of authoritative bodies to make laws that are just and credible, but that also make sense across different locations and circumstances. Private regulatory initiatives face the same challenges, but to a larger extent, with standardized requirements that must be applicable across widely different contexts, often on a global scale.

The challenges associated with the application of standardized requirements stem from the fact that this approach builds on the idea of sustainability as a static end-goal. In global industries, however, companies and sites face diverse challenges that are determined by regulatory, geographical, and organizational differences. For instance, in the specific case of salmon aquaculture, different production sites will experience different types and degrees of exposure to disease, such as the Chilean salmon aquaculture industry's struggles with more bacterial diseases compared to e.g. Norway

(see Paper C). Importantly, the spread of disease not only varies across international borders, but across regions and even fjords, further complicating any standardized approach at regulation. As we have seen, differences such as these can have major implications for how companies must work to comply with a standard, but, more importantly, this can impact who actually *can* become certified.

While this example applies to animal husbandry and food production specifically, there are numerous examples that speak to the challenges of global standards in general. For instance, as discussed in Papers C and E, there are divergent perceptions and chosen approaches to comply with the standards' criteria, influenced by factors such as size and structure, location, geographical conditions, and existing practices. This is significant as these are intended to be *standardized* regulatory initiatives. Furthermore, as described in Paper C, different auditors may interpret requirements differently as indicators are the result of a process of simplification, a finding that contradicts the prevalent conception of objective standards and assessments. Another challenge with governing at a distance is that, as audits are performed by an external party, there is a preference towards criteria that can be assessed on a site-level using set metrics (see Papers B and D).

6.2 Employing a technical understanding of certification

These examples of challenges related to governing at a distance illustrate the fundamental limitations of treating sustainability as a technical outcome, and the corresponding technical understanding of sustainability certification. This approach reflects the neoliberal fixation with demonstrating progress through rational and quantifiable solutions (Turnhout et al., 2014), with market forces playing a predominant role in defining 'progress' (Nyberg & Wright, 2013). The use of indicators and audits as the main form of assessment further reinforces this technical understanding, as these rely heavily on the employment of traceability and documentation as governmental technologies.

While these tools provide the regulatory authority with the necessary material to assess compliance (i.e. governance-by-disclosure, see Chap. 2.2.1), there is dispute, both in the literature and among our informants, as to whether increased documentation actually

does serve to improve the aquaculture industry. Much of the standardization and audit literature criticizes how the 'audit society' of our time is advancing systems made for being audited, i.e. the implementation of changes that can be easily recognized and 'counted' in the audit process (Shore & Wright, 2015), usually related to documentation and reporting. In this study, several informants express annoyance with the time-consuming activity of documenting the 'real' job, while others emphasize the importance of proper reporting and traceability systems.

The encouragement of companies to become more 'auditable' has a major impact in shaping how 'sustainability' and 'sustainable aquaculture' is understood, as the notion of these as a technical and achievable outcome is reinforced by having the indicators themselves become the center of attention. A consequence of this technocentric approach, as argued by Tlusty (2010), is that set indicator requirements can remove any incentive to continuously improve one's practices. Another consequence is that, as discussed in Papers A and B, issues not included in the standards are lost to consideration – dropped as part of the core privileged meaning of 'sustainability'. In accordance with Bush, Belton, et al. (2013), who argue that certification schemes employ a narrow understanding of sustainability, we find that the environmental domain is largely prioritized over the others (see Paper A). Also, as illustrated in Paper B, the fact that a topic or issue is addressed does not necessarily mean that the standard exceeds existing legal requirements.

Related to this, another effect of treating sustainability as a technical outcome is the misconception of neutrality and the idea that these standards are true representations of reality, a result of the naturalization of standards (Porter, 2001; Shore & Wright, 2015; Turnhout et al., 2014). As shown in this study, there is often great disparity between 'standard' and 'reality'. For the companies, the internalization of new principles and practices into day-to-day activities necessitates translation and adaptation of the indicators and their respective requirements (see Papers C and E). However, due to the prevailing technical understanding of certification, the governing system must respond to external pressures of legitimacy that are based on misconstrued expectations of 'objectivity' and 'neutrality' (Cook et al., 2016; Jensen & Winthereik, 2017), thereby suppressing the necessary flexibility involved in the assessment process. As described

in Paper C, auditors are expected to utilize their professional expertise, while also setting aside their professional discipline to be loyal to the standard, creating a complex balancing act between the need for proximity and the need for neutrality. In line with much of the audit literature (e.g. Cook et al., 2016; Power, 2010), this paper demonstrates that the way in which audits are performed is in fact reinforcing the misconception that indicators are objective and can be measured 'neutrally'.

6.2.1 'Achieving' sustainability

While acknowledging the importance of objectification and constructive ambiguity in spreading the idea of sustainability (Moore, 2011), the simplified conceptualization of it feeds into the misconception of sustainability as a static end-goal. From this understanding of sustainability as a technical outcome emanates a checklist mentality, which steers efforts towards prioritizing compliance (see Papers C and E), predominantly on site-level (see Paper D), preferencing certain issues over others (see Papers A and B). Reflecting the views of Tlusty and Thorsen (2017) and Bush, Toonen, et al. (2013), this thesis seeks to bring to light the many ramifications of portraying sustainability in absolute terms, as something to be 'achieved'. For example, this can give the misleading impression that all necessary solutions are present, and that the only reason the problems are yet to be 'fixed' is resistance from the industry fearing the solutions at hand will occur at the expense of their financial performance. While it would be naïve to assume that economic agents, such as salmon aquaculture companies, do not have their bottom-line as a main priority, the challenges involved in improving the industry are much more complex and contentious (Osmundsen et al., 2017). As the discussion in Chap. 2.4.3 illustrates, there lacks a consensus as to what the best measures to improve the industry are, and, as this study further demonstrates, what 'sustainable salmon aquaculture' actually involves.

As previously described, improving the industry necessitates tradeoffs, such as ensuring the welfare of the fish at the expense of employee safety, or disease treatment having negative effects on the surrounding environment through emission of chemicals. An example of tradeoffs from the sustainability standards, which is also described in Paper

D, is the use of acoustic deterrent devices (ADDs) that aquaculture sites can install to keep predators away. While one standard requests that ADDs be used in order to safeguard the fish, another standard prohibits the use of them because they might cause pain to surrounding wildlife. As these examples demonstrate, ‘sustainability’ must be understood as a balancing act, with countless distinct needs and possible priorities. This is clearly demonstrated in Image 1, the result of an exercise from the stakeholder workshop described in Chap. 4.4.1. After having become acquainted with the WOS model, the participants were divided into groups and asked to sketch and present potential conflicts and tradeoffs between subdomains in the model. As seen here, there were several commonalities, as well as dissimilarities, among the links that the two groups identified. While these chaotic sketches illustrate the complexities involved in making salmon aquaculture ‘sustainable’, they also show how easy it was for the participants to identify potential conflicts and tradeoffs.

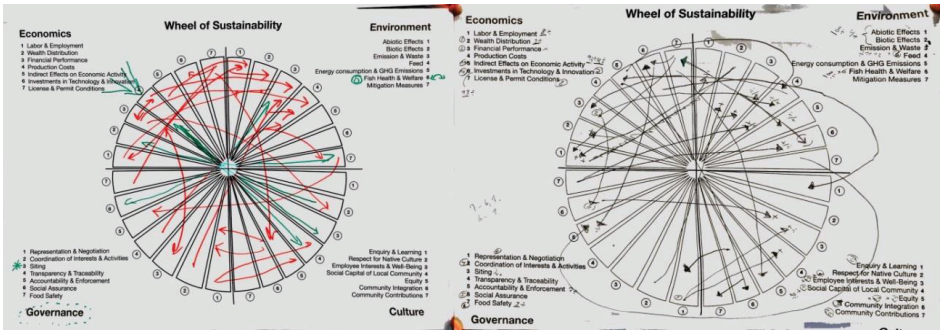

Image 1: Worksheets with identified tradeoffs, from stakeholder workshop

What is interesting about these tradeoffs, which was also echoed in the participants’ reflections, is the fleeting nature of them. As seen in Image 1, the potential links often included more than two subdomains, creating a network of situation-dependent linkages. The participants explained that it was impossible to speak about just tradeoffs, as it was more a matter of interrelations and interconnections, which could be both negatively and positively linked. One example illustrating the complexity was the link between financial performance, productions costs, and emission and waste. It was explained that these would traditionally have a negative link, but if there were a carbon

or nitrogen market, companies that performed better on emission would get alleviations from carbon or nitrogen tax, i.e. they would perform financially better because they were being more 'sustainable'.

What this illustrates is that the tradeoffs are context and situation-sensitive, meaning that it is not necessarily an issue of selecting to address one challenge over another, but rather making balanced prioritizations through careful considerations. The tradeoffs in this case are, in other words, rarely a matter of directly conflicting issues. With the exception of the example with ADDs, we found no directly conflicting indicators in the sustainability standards. In the interviews, when asked about conflicting indicators (either between national regulations or other standards), the informants only pointed to specific customer standards, i.e. standards created by specific buyers such as retailers, and not the certification schemes. The fact that the necessary tradeoffs are context and situation-sensitive speaks to the intricacy of the matters at hand, demonstrating that sustainability cannot be considered a technical outcome to be achieved through checklists of criteria.

The impression that the 'road to sustainability' is established and accessible is a result of black-boxing (Asdal, 2008). This not only applies to the standard development phase, where the conflicts involved in the process of selecting indicators and requirements are downplayed, but also to the audit process. While certain standards practice some degree of transparency, for instance by making the final audit reports publicly available, the process of translating local practices into a standardized template tends to be under-communicated (see Paper C). As has been discussed in this thesis, this is largely related to the issue of legitimacy, on which private (and voluntary) initiatives such as these schemes entirely depend. This is a self-reinforcing cycle, where continued suppression of the complexities involved in these processes strengthens the impression that reality is in fact simpler (Merry, 2011; Strassheim & Kettunen, 2014), which in turn increases the incentive to downplay any flexibility or comprises in the implementation process. For that reason, this thesis argues for the importance of honesty and transparency concerning the complexities involved in improving the industry, which necessitates moving away from a technical understanding of certification.

6.3 From a technical to a social understanding of certification

As these many limitations of employing a technical understanding of certification and sustainability illustrate, the conception of sustainability as a technical outcome to be achieved is continuously reinforced through how certification is understood and utilized. The flaws of a technical understanding are further demonstrated when seen through the 3 I's framework, as it becomes apparent that such an understanding provides no recognition of how these three 'phases' are interrelated. To reiterate, *impression* speaks to the implications of how sustainability is understood through what is included and excluded in the standards, and how this affects agendas for action, both public and private. *Implementation* provides insight into how standard requirements are perceived, received, and achieved differently across different contexts, thereby illustrating how the paths from concept to operationalization diverge. *Impact* relates to the prior, in that the many different contexts within which sustainability standards are implemented give rise to differing results and implications, signifying variation in how sustainability becomes operationalized.

The reciprocal influence between the 3 I's is illustrated by how all five papers speak to more than one perspective and sub-question (see Table 5 and paper summaries in Chapter 5). For instance, Paper A describes how the sustainability standards in question primarily address environmental issues, which speaks to the *impression* of sustainability they create, as well as implications for the *impact* of the standards as this leaves many other issues neglected or ignored. Similarly, Paper E focuses on the *impact* of certification in terms of the internalization of the schemes' practices and principles, which is very much related to how the production companies *implement* the standards within their organizations. Paper C shows how a technical approach to *implementation* in the audit process influences back on the *impression* of sustainability as a technical outcome. What these examples illustrate is the necessity of seeing certification as a continuous governance process, as something non-unidirectional and constantly negotiated. This entails a shift from a *technical* understanding to a *social* understanding of certification.

The use of 'social' recurs throughout this thesis as part of several different concepts, such as social sustainability, social challenges, social change, and 'social stuff'. Due to the numerous associations that accompany 'social', an unequivocal definition is neither feasible nor fruitful. However, these concepts build on a common understanding of it as something continuously created and negotiated by and among people through interaction, in response to and in interplay with shifting frameworks and physical worlds. Following this, a social understanding of certification, as advocated here, involves both acknowledging and utilizing the reciprocal influence between the 3 I's, with the possibility for continuous improvement both of the content of the standards, and in how they are adopted, adapted, and assessed.

A theoretical framework that has proven fruitful here is interactive governance theory (see Chap. 3.2.2), both in demonstrating the necessity of a social understanding of certification, and in exploring how this can serve to better utilize certification as a governance tool. While this perspective is primarily applied to understand state-citizen relationships, the concepts of governability and adaptamentality can shed light on the relationships and interactions between the certification (i.e. governing) system and the objects to-be-governed. Jentoft and Chuenpagdee (2015) describe governance as a *social* process, stating that governance systems must be responsive and considerate of local context. The key here is interaction, as governability demands the focus going beyond the role of the governing system, to also include the object to-be-governed and the interaction between them. In this lies the understanding of governability as something that is continuously changing, which corresponds with the reciprocal influence of the 3 I's and a social understanding of certification. Building on this allows us to explore how to better utilize certification as a governance tool.

6.3.1 Utilizing the potential of sustainability certification

Many argue that the inherent limitations of private certification schemes warrant a need for other types of initiatives (e.g. Bush, Belton, et al., 2013). While this view has definite merit, this thesis contends that there are ways in which to better utilize these standards by employing a social understanding of certification. Moving from a technical

to a social understanding allows us to not just become aware of the reciprocal influence between the 3 I's, but actively use this through interaction between the governing system and the object to-be-governed. The concept of adaptamentality (Jentoft & Johnsen, 2015) is especially useful here, because by referring to both the ability *and* inclination to adapt, it sheds light on why and how the actors involved must continuously contribute to make the system function. To explore this potential, this section tackles three key misconceptions that have emerged through the prevailing technical understanding of certification, using them to develop new insights and strategies. These misconceptions, all previously discussed in this thesis, include: 1) sustainability is an achievable goal, 2) the 'road to sustainability' is determined, and 3) sustainability standards are objective and can be assessed neutrally.

Sustainability as an achievable goal

Sustainability is commonly spoken of in absolute terms – by governments, industries, NGOs, and researchers alike. Tlusty and Thorsen (2017) rightly argue that labeling a certified product as 'sustainable' gives a false impression and thereby false sense of security, as 'sustainable' should cover much more than the scope of existing sustainability standards. Our findings point to an overwhelming environmental focus in these standards, omitting many key issues. While it is important to keep in mind that what 'sustainability' in salmon aquaculture 'becomes' ultimately depends on that which happens in a larger context, the ontological power of private sustainability standards should not be underestimated, as these are becoming increasingly important regulatory tools (Alfnes et al., 2018). Supporting this, we find that the results from the content analysis to a large extent echo the general discourse about and within the industry, with environmental issues eclipsing other key concerns from the goal that is 'sustainability'.

This thesis argues that the dichotomy of sustainable versus unsustainable should be avoided, advocating the social perspective of sustainability as a processual construction. This involves acknowledgement and acceptance of all that is unknown in regard to the complexities of 'sustainable salmon aquaculture', and being forthright about, and thereby allowing room for, deliberations and tradeoffs between necessary

prioritizations. This will allow for more suitable and accessible approaches and strategies that facilitate learning and knowledge building, through a focus on *continuous improvement*. Treating sustainability as a technical outcome supports the application of sustainability certifications as mere checklists, and not as something to be internalized in the organization. As described in Paper E, Elkjær (2004) argues that it is not sufficient for an individual to obtain some form of expertise for it to become organizational knowledge, as this necessitates reciprocal learning in interaction with others in the organization. As organizations are not passive adopters of new principles (Sahlin-Andersson, 1996), these must achieve internal legitimacy (Røvik, 1998) through a continuous learning and internalization process. By employing a social understanding of certification, this study provides insight into how schemes, auditors, and aquaculture companies can, and in certain cases already do, work towards new principles and practices becoming internalized, primarily through focusing on continuous improvement.

By way of illustration, there are development programs that help companies or sites that find themselves too far below the certification threshold to improve their practices, with the aim of eventually qualifying for certification. This is for example offered by Marine Stewardship Council (MSC), a major certification for fisheries, but can and should be implemented by more certification schemes to encourage those sites and companies with most potential for improvement. Sustainability standards can also function as tools for improvement for companies that *are* certified, if the certification process is treated more as a learning and development opportunity. This can be linked to the findings presented in Paper E, where we identify the implementation of structures that promote continuous improvement as a key facilitator for promoting behavioral changes within certified companies. This can include multiple criteria thresholds within a standard, frequent updates of the standards' criteria, or criteria asking for improvement rather than a set metric. Incorporating requirements of continuous improvement in sustainability standards can also be a way in which to assess actual improvements within an organization, and not just the quantifiable outputs typically associated with governing at a distance.

The 'road to sustainability' as determined

The prevailing perception that the 'road to sustainability' is established and accessible underlines the need for increased attention to the power of agenda setting (Brunsson & Jacobsson, 2005) – the power of being the one to define 'sustainability' and 'sustainable salmon aquaculture' (Busch, 2017; Havice & Iles, 2015). While the standard development processes and their specific power struggles and negotiations fall outside the scope of this study, their existence is very much present in our findings. In accordance with previous research, this primarily relates to unequal opportunities to become certified, most significantly related to where a company is located. According to Chilean and Scottish informants, the Norwegian salmon industry is systematically advantaged by certification schemes, for example through the required forms of measurements or restrictions on specific disease treatments. The informants attribute this to the fact that many of the standards are based on this specific national industry.

A social understanding of certification calls for continuous negotiation of the content, assessment, and administration of sustainability standards, relating back to the non-static nature of governability and the adaptamentality of both parties. As this approach dictates continuous dialogue and development of the concept of sustainability, it contradicts the notion of sustainability as a defined technical outcome. To illustrate, Paper D speaks to how the idea of 'sustainable aquaculture' can be expanded through broadening the reach of site-level standards, by 'lifting' the indicators' targeted impact through additional requirements related to traceability and coordination/sharing of information. With these multi-level indicators, certification schemes can ensure more responsible practices throughout the value chain, thereby widening the prevailing narrow understanding of sustainability.

However, the most central approach for ensuring the continuous development of the concept is through the inclusion of more voices, as also advocated in interactive governance theory (Chuenpagdee & Jentoft, 2015; Jentoft & Chuenpagdee, 2015). Due to the proliferation of sustainability certification, standard creators and auditors have emerged as new sources of expertise, the former by deciding which issues that are to be addressed (see Papers A and B) and the latter through their central role in shaping the implementation of standards (see Paper C). However, it is crucial that the knowledge of

other experts in the field, such as salmon aquaculture producers, is also accumulated and utilized. As has been discussed throughout this thesis, improving the industry requires the consideration of divergent needs and priorities, and the difficult act of balancing these. Although a governing system that unites all interests, with full consensus between different stakeholders, is extremely unlikely, the existence of these contrasting pulls is a way in which the many tradeoffs can be balanced. What is important here is the degree of *representation*, that the governing system ensures that all voices are heard and taken into account. Sharing of information and negotiation among more actors will facilitate reciprocal knowledge production to continuously raise the bar of 'sustainability' (see Paper C). The Wheel of Sustainability model may prove valuable in this regard, functioning as a collaboration tool that provides a common language and the potential for a holistic discussion.

Sustainability standards as objective

One of the major challenges of governing at a distance is the need to negotiate said distance. Importantly, this is not just a matter of negotiating physical (i.e. geographical) distance between the governing system and the object-to-be-governed, but also figurative distance: between the concept of sustainability and specific sustainability indicators, between set indicators and their application, between global ideals and local realities. It is through these processes that sustainability is operationalized, as the development, execution, and enforcement of the standards drive concretization and commitment. This complexity and processual nature of governing at a distance illustrates how standards and the assessment of them cannot be considered objective or neutral (Cook et al., 2016; Power, 2010), necessitating a social understanding of certification. This is reflected in Papers C and E, which demonstrate how companies experience a need for adaptation, compromise, and negotiation when the standard principles prove difficult to adopt as is.

This underlines the vital role of interaction between the governing system (both auditors and standard owners) and the object to-be-governed, and the need for flexibility in these interactions (Cook et al., 2016; Eden, 2008). This flexibility concerns the

adaptamentality of both parties, and can be enacted in many different forms. One example is the degree of rigidity of indicator requirements, as guidelines for how to achieve compliance are often quite specific. While some informants point to the predictability of such detailed instructions, others express frustration with the lack of leniency from auditors. Another way in which flexibility can be enacted is through how open the auditor is for communication and negotiation when the company disagrees with their assessment. This is not merely contingent on the auditor's willingness to negotiate, but also their afforded discretionary space. Followng Braut and Øgar (2018), this thesis argues for the importance of allowing and engaging an auditor's discretionary space, in order to facilitate the translation of local practices into a standardized, often global, never objective, template.

Furthermore, these interactions between those representing the governing system and the object to-be-governed is an arena for companies to learn better ways in which to comply with the standard, and in general improve their practices, as well as relay their knowledge and expertise, providing input on strategies and practical issues of implementation. This reciprocal learning production and exchange can play a crucial role in improving the industry, as there is so much that is still uncertain regarding the challenges of salmon aquaculture production and what the best solutions may be. While this knowledge transfer does occur to some degree, there needs to be wider acceptance of communication and negotiation taking place between auditor and auditee, if the industry is to fully capitalize on the immense knowledge of both. Therefore, this thesis advocates increased transparency concerning the human element of auditing, involving acknowledgement and acceptance of necessary discretionary means and trust in the expertise and knowledge of trained auditors.

7 Conclusion

The overall aim of this thesis has been to address the fundamental limitations of treating sustainability as a technical outcome that can be achieved, and the corresponding technical understanding of sustainability certification. By exploring the 3 I's (*impression*, *implementation,* and *impact*) of sustainability standards for the salmon aquaculture industry, the study has examined the important interplay between the vague concept of sustainability and the actions that are taken to 'achieve' it. Through the analysis of standard documents, interviews, and fieldwork, this study has produced five scientific papers and this thesis report. Many of the findings in this project confirm conclusions in previous research. However, basing the study around the 3 I's and the interrelation between them has added additional insights to sustainability certification as a means towards improving the salmon aquaculture industry.

The main contributions of this thesis can be summarized as follows:

- The Wheel of Sustainability (WOS), a reference model for sustainable salmon aquaculture. In addition to being an important methodological contribution, this model serves as 1) a valid lexicon for the many issues related to improving the industry, 2) a tool for comparison of different improvement initiatives, and 3) a collaboration tool for identifying and addressing tradeoffs and other topics for consideration.
- In-depth understanding of how certification schemes concretize 'sustainability' through the indicators they choose to include (and exclude), and how the concept is further operationalized through the implementation of these indicators. This involves a comprehensive mapping of the indicators in some of the major

sustainability standards (resulting in a database of over 1900 indicators), and investigation of how salmon aquaculture companies strive to comply with these indicators.

- Increased knowledge about how standard indicators are received, perceived, and achieved differently across different companies and sites. This speaks to the challenges of governing at a distance, as there is often a great range between 'standard' and 'reality' – between global ideals and local realities.
- Improved comprehension of what the behavioral dimension of certification effectiveness includes, through the development of specific content for the concept. The identified facilitators for behavioral change provide opportunities 1) for certification schemes to incorporate criteria that can better facilitate actual changes, 2) for salmon aquaculture companies to find ways in which to best achieve significant changes, and 3) for auditors to develop specific ways in which to assess companies on this dimension.
- Insight into some of the key challenges and implications of governing through standardized indicators. These findings contribute to an acknowledgement of the inherent limitations of 'governing at a distance' when employing a technical approach, as well as a proposal for a way forward.
- Suggestions on how to better utilize the potential that sustainability certification has for improving the industry. This primarily involves refocusing efforts towards continuous improvement, flexibility, and facilitation of learning and knowledge building through interaction between the governing system and the objects to-be-governed.

Based on the findings of the study, this thesis advances a fundamental change in how certification and indicators as governmental technologies are understood and utilized. This involves moving towards a recognition of 'sustainability' as a processual construction, with emphasis on relative rather than absolute improvement. Building on this, the primary theoretical contribution of this thesis is the advocacy for a shift from a technical to a social understanding of certification, which stresses the role of flexibility, negotiation, and reciprocal knowledge production in applying these tools. This shift entails treating certification as a *continuous* governance process, by both acknowledging

and utilizing the reciprocal influence between the different ‘phases’ (the 3 I’s) of the certification process. This involves not just allowing but promoting feedback processes, functioning as facilitators of both progress and correction.

While this study has looked at sustainability certification for salmon aquaculture, the theoretical contributions of its findings have the potential of going beyond this specific case. This does not imply that the findings can be assumed valid for other cases, but rather that they speak to larger issues of sustainability and governing at a distance. As suggested in the main research question, a new conceptualization of certification has the potential to institute this form of governance as a mechanism for social change. I argue that this new understanding of certification can and should shape the mainstream strive towards ‘sustainability’, as it speaks to the necessity of applying tools that allow for flexibility and continuous development. Furthermore, this conceptualization of certification provides insight into the motivations that need to be in place to inspire organizations, governments, and individuals when removing the idea of ‘sustainability as a set goal’, adding a new dimension to the understanding of governability and adaptamentality.

With regard to governing at a distance, these findings also contribute to the debate on universal characteristics of indicators, described in Chap. 2.2.2. The prevalent neoliberal mindset has fostered a preoccupation with indicators that are quantifiable, transferable, and commensurable. However, employing a social understanding of certification demonstrates the necessity of indicators that allow flexibility, facilitate organizational internalization, ensure continuous improvement, and promote learning. This will enable the application of indicators as governmental technologies to encourage progress and better capture the complexities of the conditions they are intended to measure. Furthermore, this will allow for more intangible issues to be addressed through indicators, such as social issues.

By bringing forth the interaction between the governing system and the object to-be-governed, this new conceptualization of certification can both grant and demand that actors assume more responsibility, with both certification schemes, auditors, and companies playing a larger role in pushing the common understanding of sustainability.

This also speaks to the issue of accountability, as it is not merely a matter of which actors assume different responsibilities, but also that these actors are held accountable by something more than an intangible and shifting market. It is imperative that the role of the state and its actual contribution is included in such discussions. As discussed in Chap. 2.3.2, private certification schemes emerged as a response to claims that states lack the capacity to regulate issues transcending national borders. This could suggest that the state has outlived its usefulness in this regard, and that other actors, e.g. NGOs, production companies, and certification schemes, must assume the responsibility of improving the industry. However, as argued in Chap. 2.2, private governance initiatives like sustainability certification cannot be seen in isolation, as the state is a major part of the context within which these standards operate. In that sense, it can be argued that the state is a prerequisite for private governance to be effective, if only as a looming shadow that ensures progression and accountability. As this debate falls outside the primary scope of this study, this thesis does not shed any immediate light on these momentous questions. However, the findings do support the important observation that neither national regulations nor private governance initiatives are static, and that they largely act in response to each other. By employing a social understanding of certification, these processes can be better understood and improved.

7.1 This thesis and beyond

Although the findings of this study clearly attest to the need for a social understanding of certification, potential ramifications of this transition do warrant consideration. For one, a key strength of governing through indicators is that decentralized control is made possible through governance-by-disclosure and commensurability. Employing a social understanding that emphasizes flexibility and negotiation runs the risk of losing these qualities. However, arguing for a shift in how we understand (and utilize) certification is not to suggest that we abandon all that represents the traditional understanding. It is a matter of *utilizing* the potential of certification, which entails taking advantage of the inherent useful qualities of governing through indicators, while also designing new qualities. While a social understanding of certification, as advocated here, does endorse

non-standardized ways of achieving compliance, with it follows also the opportunity to improve indicators and standards through reciprocal knowledge production.

Another important consideration is that certification is a market-based tool, therefore depending on companies seeing a value in obtaining them. Employing a social understanding would eliminate the use of absolute terms in reference to sustainability, thereby potentially removing the branding incentive for companies. Supporting the idea of treating sustainability as a static end-goal, many would argue that sustainability is either/or, and not a matter of degrees. While I can be inclined to agree with the semantical argument, I find it more pressing to support the position of sustainability as a processual construction, thereby moving away from the impression of sustainability as something to be achieved. This is not to suggest that simplified conceptualizations of complex concepts are futile or obsolete. Models, such as the common three-dimension visualization of sustainability or the WOS model presented in this thesis, are simplifications, but they are intended to be just that. Therefore, they must be understood and applied accordingly, i.e. we need to be clear on what these models do and do not tell us, and how they should and should not be used.

In drawing things to a close, I wish to reiterate the importance of critical reflections concerning the chosen research design and focus areas, which are discussed in detail in Chap. 4.4. As with any research project, this study could have taken many other directions. A different avenue that could have been interesting to pursue is the exploration of the development/selection process of standard indicators. Another approach could have been the inclusion of those working for the certification schemes, to gain insight into their experiences with sustainability standards. The interrelation between private sustainability initiatives and national regulations is yet another intriguing subject matter in need of more research, e.g. how these influence each other or how they can be better coordinated. These prospective focus areas, and the many more that exist, demonstrate the huge potential that lies within this exciting research area. When embarking on this journey, it is imperative to base one's decisions on that which has previously been done, standing on the shoulders of giants. Or, as we say in the SustainFish project, not reinventing the wheel (of sustainability).

References

Aarset, B., & Jakobsen, S.-E. (2009). Political Regulation and Radical Institutional Change: The Case of Aquaculture in Norway. *Marine Policy*, *33*(2), 280–287. https://doi.org/10.1016/j.marpol.2008.07.006

Aasprong, H. (2012). Recreating the Banana Grower: The Role of Private Certification Systems in the Windward Islands Banana Industry. *Culture Unbound: Journal of Current Cultural Research*, *4*(4), 721–745. https://doi.org/10.3384/cu.2000.1525.124721

Aasprong, H. (2013). Entangled Standardizing Networks: The Case of GLOBALGAP and Fairtrade in St Vincent's Banana Industry. *International Journal of Sociology of Agriculture and Food*, *20*(1), 91–108.

Abbott, K. W., & Snidal, D. (2000). Hard and Soft Law in International Governance. *International Organization*, *54*(3), 421–456. https://doi.org/10.1162/002081800551280

Aguayo, B. E. C., & Barriga, J. (2016). Behind Certification and Regulatory Processes: Contributions to a Political History of the Chilean Salmon Farming. *Global Environmental Change*, *39*, 81–90. https://doi.org/10.1016/j.gloenvcha.2016.04.005

Alexander, K. A., Amundsen, V. S., & Osmundsen, T. C. (2020). 'Social Stuff' and All That Jazz: Understanding the Residual Category of Social Sustainability. *Environmental Science & Policy, 112*, 61–68. https://doi.org/10.1016/j.envsci.2020.06.003

Alexander, K. A., Freeman, S., & Angel, D. L. (2018). Public Attitudes and Decision Making in Environmental Resource Planning—A Perception Gap.

Environmental Science & Policy, *80*, 38–43. https://doi.org/10.1016/j.envsci.2017.11.012

Alexander, K. A., Potts, T. P., Freeman, S., Israel, D., Johansen, J., Kletou, D., Meland, M., Pecorino, D., Rebours, C., Shorten, M., & Angel, D. L. (2015). The Implications of Aquaculture Policy and Regulation for the Development of integrated Multi-Trophic Aquaculture in Europe. *Aquaculture*, *443*, 16–23. https://doi.org/10.1016/j.aquaculture.2015.03.005

Alfnes, F. (2017). Selling Only Sustainable Seafood: Attitudes Toward Public Regulation and Retailer Policies. *Marine Policy*, *78*, 74–79. https://doi.org/10.1016/j.marpol.2017.01.012

Alfnes, F., Chen, X., & Rickertsen, K. (2018). Labeling Farmed Seafood: A Review. *Aquaculture Economics & Management*, *22*(1), 1–26. https://doi.org/10.1080/13657305.2017.1356398

Alibašić, H. (2018). *Sustainability and Resilience Planning for Local Governments: The Quadruple Bottom Line Strategy*. Springer.

Almklov, P. G., Rosness, R., & Størkersen, K. (2014). When Safety Science Meets the Practitioners: Does Safety Science Contribute to Marginalization of Practical Knowledge? *Safety Science*, *67*, 25–36. https://doi.org/10.1016/j.ssci.2013.08.025

Almklov, P. G., Ulset, G., & Røyrvik, J. (2017). Standardisering og måling i barnevernet. In T. Larsen & E. A. Røyrvik (Eds.), *Trangen til å telle. Objektivering, måling og standardisering som samfunnspraksis* (pp. 153–183). Scandinavian Academic Press.

Alvial, A., Kibenge, F., Forster, J., Burgos, J. M., Ibarra, R., & St-Hilaire, S. (2012). *The Recovery of the Chilean Salmon Industry: The ISA Crisis and Its Consequences and Lessons*. World Bank.

Amundsen, V. S., Gauteplass, A. Å., & Bailey, J. L. (2019). Level Up or Game Over: The Implications of Levels of Impact in Certification Schemes for Salmon Aquaculture. *Aquaculture Economics & Management*, 1–17. https://doi.org/10.1080/13657305.2019.1632389

Amundsen, V. S., & Osmundsen, T. C. (2018). Sustainability Indicators for Salmon Aquaculture. *Data in Brief*. https://doi.org/10.1016/j.dib.2018.07.043

Amundsen, V. S., & Osmundsen, T. C. (2019). Virtually the Reality: Negotiating the Distance Between Standards and Local Realities When Certifying Sustainable Aquaculture. *Sustainability*, *11*(9), 2603. https://doi.org/10.3390/su11092603

Amundsen, V. S., & Osmundsen, T. C. (2020). Becoming Certified, Becoming Sustainable? Improvements from Aquaculture Certification Schemes as Experienced by Those Certified. *Marine Policy, 119.* https://doi.org/10.1016/j.marpol.2020.104097

Anderson, J. L. (2002). Aquaculture and the Future: Why Fisheries Economists Should Care. *Marine Resource Economics*, *17*(2), 133–151. https://doi.org/10.1086/mre.17.2.42629357

Anderson, J. L., Anderson, C. M., Chu, J., Meredith, J., Asche, F., Sylvia, G., Smith, M. D., Anggraeni, D., Arthur, R., Guttormsen, A., McCluney, J. K., Ward, T., Akpalu, W., Eggert, H., Flores, J., Freeman, M. A., Holland, D. S., Knapp, G., Kobayashi, M., … Valderrama, D. (2015). The Fishery Performance Indicators:

A Management Tool for Triple Bottom Line Outcomes. *PLOS ONE*, *10*(5), e0122809. https://doi.org/10.1371/journal.pone.0122809

Andreassen, O., Karlsen, K. M., Robertsen, R., & Solås, A.-M. (2016). *Sustainability Barometer (In Norwegian: Bærekraftsbarometer)*. Nofima.

Andreassen, O., & Robertsen, R. (2014). *Nasjonale ringvirkninger av havbruksnæringen* (No. 49). Nofima.

Ariffin, Y. (2007). Developmental and Environmental Policies: Past Trends, Present Issues, Future Prospects. In P. de Senarclens & A. Kazancigil (Eds.), *Regulating Globalization—Critical Approaches to Global Governance* (pp. 205–248). United Nations University Press.

ASC. (2019a). *Certifying Environmentally and Socially Responsible Seafood—Aquaculture Stewardship Council*. Aquaculture Stewardship Council. https://www.asc-aqua.org/

ASC. (2019b). *History*. Aquaculture Stewardship Council. https://www.asc-aqua.org/about-us/history/

Asche, F. (2008). Farming the Sea. *Marine Resource Economics*, *23*(4), 527–547. https://doi.org/10.1086/mre.23.4.42629678

Asche, F., Cojocaru, A. L., & Roth, B. (2018). The Development of Large Scale Aquaculture Production: A Comparison of the Supply Chains for Chicken and Salmon. *Aquaculture*, *493*, 446–455. https://doi.org/10.1016/j.aquaculture.2016.10.031

Asche, F., Guttormsen, A. G., & Nielsen, R. (2013). Future Challenges for the Maturing Norwegian Salmon Aquaculture Industry: An Analysis of Total Factor

Productivity Change from 1996 to 2008. *Aquaculture*, *396–399*, 43–50. https://doi.org/10.1016/j.aquaculture.2013.02.015

Asche, F., Hansen, H., Tveterås, R., & Tveterås, S. (2009). The Salmon Disease Crisis in Chile. *Marine Resource Economics*. https://doi.org/10.5950/0738-1360-24.4.405

Asdal, K. (2008). Enacting Things Through Numbers: Taking Nature Into Account/ing. *Geoforum*, *39*(1), 123–132. https://doi.org/10.1016/j.geoforum.2006.11.004

Asdal, K. (2011). *Politikkens natur—Naturens politikk*. Universitetsforlaget.

Ashworth, R., Boyne, G., & Delbridge, R. (2007). Escape from the Iron Cage? Organizational Change and Isomorphic Pressures in the Public Sector. *Journal of Public Administration Research and Theory*, *19*(1), 165–187. https://doi.org/10.1093/jopart/mum038

Bailey, J. L. (2014). Looking for Sustainable Solutions in Salmon Aquaculture. *Etikk i Praksis - Nordic Journal of Applied Ethics*, *8*(1). https://doi.org/10.5324/eip.v8i1.1801

Bailey, J. L., Van Ardelan, M., Hernández, K., González, H., Iriarte, J., Olsen, L., Salgado, H., & Tiller, R. (2015). Interdisciplinarity as an Emergent Property: The Research Project "CINTERA" and the Study of Marine Eutrophication. *Sustainability*, *7*(7), 9118–9139. https://doi.org/10.3390/su7079118

Bailey, M., Bush, S. R., Miller, A., & Kochen, M. (2016). The Role of Traceability in Transforming Seafood Governance in the Global South. *Current Opinion in Environmental Sustainability*, *18*, 25–32. https://doi.org/10.1016/j.cosust.2015.06.004

Ball, A., & Craig, R. (2010). Using Neo-Institutionalism to Advance Social and Environmental Accounting. *Critical Perspectives on Accounting*, *21*(4), 283–293. https://doi.org/10.1016/j.cpa.2009.11.006

BAP. (2019). *Best Aquaculture Practices*. Best Aquaculture Practices Certification. https://www.bapcertification.org/

Barton, J. R. (1997). Environment, Sustainability and Regulation in Commercial Aquaculture: The Case of Chilean Salmonid Production. *Geoforum*, *28*(3–4), 313–328. https://doi.org/10.1016/S0016-7185(97)00013-4

Barton, J. R., & Fløysand, A. (2010). The Political Ecology of Chilean Salmon Aquaculture, 1982–2010: A Trajectory From Economic Development to Global Sustainability. *Global Environmental Change*, *20*(4), 739–752. https://doi.org/10.1016/j.gloenvcha.2010.04.001

Batie, S. S. (2008). Wicked Problems and Applied Economics. *American Journal of Agricultural Economics*, *90*(5), 1176–1191. https://doi.org/10.1111/j.1467-8276.2008.01202.x

Belton, B., Murray, F., Young, J., Telfer, T., & Little, D. C. (2010). Passing the Panda Standard: A TAD Off the Mark? *AMBIO*, *39*(1), 2–13. https://doi.org/10.1007/s13280-009-0009-4

Béné, C., Oosterveer, P., Lamotte, L., Brouwer, I. D., de Haan, S., Prager, S. D., Talsma, E. F., & Khoury, C. K. (2019). When Food Systems Meet Sustainability – Current Narratives and Implications for Actions. *World Development*, *113*, 116–130. https://doi.org/10.1016/j.worlddev.2018.08.011

Benton, T., & Craib, I. (2001). *Philosophy of Social Science: The Philosophical Foundations of Social Thought*. Palgrave.

Berger, P. L., & Luckmann, T. (1991). *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. Penguin.

Beveridge, M. C. M., Thilsted, S. H., Phillips, M. J., Metian, M., Troell, M., & Hall, S. J. (2013). Meeting the Food and Nutrition Needs of the Poor: The Role of Fish and the Opportunities and Challenges Emerging from the Rise of Aquaculture. *Journal of Fish Biology*, n/a-n/a. https://doi.org/10.1111/jfb.12187

Biancarosa, I., Sele, V., Belghit, I., Ørnsrud, R., Lock, E.-J., & Amlund, H. (2019). Replacing Fish Meal with Insect Meal in the Diet of Atlantic Salmon (Salmo Salar) Does Not Impact the Amount of Contaminants in the Feed and It Lowers Accumulation of Arsenic in the Fillet. *Food Additives & Contaminants: Part A*, *36*(8), 1191–1205. https://doi.org/10.1080/19440049.2019.1619938

Börzel, T. A., & Risse, T. (2010). Governance Without a State: Can It Work? *Regulation & Governance*, *4*(2), 113–134. https://doi.org/10.1111/j.1748-5991.2010.01076.x

Bowker, G. C., & Star, S. L. (1999). *Sorting Things Out: Classification and Its Consequences (Inside technology)*. MIT Press.

Boyd, C. E., & McNevin, A. A. (2015). *Aquaculture, Resource Use, and the Environment*. John Wiley & Sons, Inc.

Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braut, G. S., & Øgar, P. (2018). Skjønnsutøvelse og fortolkning. In P. H. Lindøe, J. Kringen, & G. S. Braut (Eds.), *Regulering og standardisering—Perspektiver og praksis* (pp. 107–117). Universitetsforlaget.

BRCGS. (2019). *About BRCGS*. BRCGS. https://www.brcgs.com/about/

Briggs, C. L. (1986). *Learning How to Ask: A Sociolinguistic Appraisal of the Role of the Interview in Social Science Research*. Cambridge University Press.

Bronnmann, J., & Asche, F. (2017). Sustainable Seafood from Aquaculture and Wild Fisheries: Insights From a Discrete Choice Experiment in Germany. *Ecological Economics*, *142*, 113–119. https://doi.org/10.1016/j.ecolecon.2017.06.005

Brunsson, N., & Jacobsson, B. (Eds.). (2005). *A World of Standards* (Reprinted). Oxford University Press.

Brunsson, N., & Sahlin-Andersson, K. (2000). Constructing Organizations: The Example of Public Sector Reform. *Organization Studies*, *21*(4), 721–746. https://doi.org/10.1177/0170840600214003

Burridge, L., Weis, J. S., Cabello, F., Pizarro, J., & Bostick, K. (2010). Chemical Use in Salmon Aquaculture: A Review of Current Practices and Possible Environmental Effects. *Aquaculture*, *306*(1–4), 7–23. https://doi.org/10.1016/j.aquaculture.2010.05.020

Busch, L. (2000). The Moral Economy of Grades and Standards. *Journal of Rural Studies*, *16*(3), 273–283. https://doi.org/10.1016/S0743-0167(99)00061-3

Busch, L. (2011). *Standards: Recipes for Reality*. MIT Press.

Busch, L. (2014). Governance in the Age of Global Markets: Challenges, Limits, and Consequences. *Agriculture and Human Values*, *31*(3), 513–523. https://doi.org/10.1007/s10460-014-9510-x

Busch, L. (2017). Standards and Their Problems: From Technical Specifications to World-Making. In *Transforming the Rural* (Vol. 24, pp. 97–114). Emerald Publishing Limited. https://doi.org/10.1108/S1057-192220170000024005

Bush, S. R. (2016). Reversing the Burden of Proof for Sustainable Aquaculture. *Solutions*, *7*(4), 27–30.

Bush, S. R. (2018). Understanding the Potential of Eco-Certification in Salmon and Shrimp Aquaculture Value Chains. *Aquaculture*, *493*, 376–383. https://doi.org/10.1016/j.aquaculture.2017.07.027

Bush, S. R., Belton, B., Hall, D., Vandergeest, P., Murray, F. J., Ponte, S., Oosterveer, P., Islam, M. S., Mol, A. P. J., Hatanaka, M., Kruijssen, F., Ha, T. T. T., Little, D. C., & Kusumawati, R. (2013). Certify Sustainable Aquaculture? *Science*, *341*(6150), 1067–1068. https://doi.org/10.1126/science.1237314

Bush, S. R., & Oosterveer, P. (2015). Vertically Differentiating Environmental Standards: The Case of the Marine Stewardship Council. *Sustainability*, *7*(2), 1861–1883. https://doi.org/10.3390/su7021861

Bush, S. R., Oosterveer, P., Bottema, M., Meuwissen, M., de Mey, Y., Chamsai, S., Lien, H. H., & Chadag, M. (2019). Inclusive Environmental Performance Through 'Beyond-Farm' Aquaculture Governance. *Current Opinion in Environmental Sustainability*, *41*, 49–55. https://doi.org/10.1016/j.cosust.2019.09.013

Bush, S. R., & Roheim, C. A. (2019). The Shifting Politics of Sustainable Seafood Consumerism. In M. Boström, M. Micheletti, & P. Oosterveer (Eds.), *The Oxford Handbook of Political Consumerism* (pp. 330–348). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190629038.013.16

Bush, S. R., Toonen, H., Oosterveer, P., & Mol, A. P. J. (2013). The 'Devils Triangle' of MSC Certification: Balancing Credibility, Accessibility and Continuous

Improvement. *Marine Policy*, *37*, 288–293. https://doi.org/10.1016/j.marpol.2012.05.011

Busuioc, E. M. (2016). Friend or Foe? Inter-Agency Cooperation, Organizational Reputation, and Turf. *Public Administration*, *94*(1), 40–56. https://doi.org/10.1111/padm.12160

Cashore, B. (2002). Legitimacy and the Privatization of Environmental Governance: How Non-State Market-Driven (NSMD) Governance Systems Gain Rule-Making Authority. *Governance*, *15*(4), 503–529. https://doi.org/10.1111/1468-0491.00199

Ceballos, A., Dresdner-Cid, J. D., & Quiroga-Suazo, M. Á. (2018). Does the Location of Salmon Farms Contribute to the Reduction of Poverty in Remote Coastal Areas? An Impact Assessment Using a Chilean Case Study. *Food Policy*, *75*, 68–79. https://doi.org/10.1016/j.foodpol.2018.01.009

Challies, E. (2012). The Limits to Voluntary Private Social Standards in Global Agri-Food System Governance. *International Journal of Sociology of Agriculture and Food*, *20*(2), 175–195.

Christensen, T., & Lægreid, P. (2009). Living in the Past? Change and Continuity in the Norwegian Central Civil Service. *Public Administration Review*, *69*(5), 951–961. https://doi.org/10.1111/j.1540-6210.2009.02044.x

Christiansen, E. A. N., & Jakobsen, S.-E. (2017). Diversity in Narratives to Green the Norwegian Salmon Farming Industry. *Marine Policy*, *75*, 156–164. https://doi.org/10.1016/j.marpol.2016.10.020

Chuenpagdee, R., & Jentoft, S. (2015). Exploring Challenges in Small-Scale Fisheries Governance. In S. Jentoft & R. Chuenpagdee (Eds.), *Interactive Governance for Small-Scale Fisheries* (Vol. 13, pp. 3–16). Springer International Publishing.

Coffey, A., & Atkinson, P. (1996). *Making Sense of Qualitative Data: Complementary Research Strategies*. Sage Publications.

COGP. (2019). *Code of Good Practice*. The Code of Good Practice. http://thecodeofgoodpractice.co.uk/

Conference on Environment and Development (Ed.). (1992). *Earth Summit Agenda 21: United Nations Programme of Action from Rio*. Department of Public Information, United Nations. https://www.dataplan.info/img_upload/7bdb1584e3_b8a53d337518d988763f8d/agenda21-earth-summitthe-united-nations-programme-of-action-from-rio_1.pdf

Cook, W., van Bommel, S., & Turnhout, E. (2016). Inside Environmental Auditing: Effectiveness, Objectivity, and Transparency. *Current Opinion in Environmental Sustainability*, *18*, 33–39. https://doi.org/10.1016/j.cosust.2015.07.016

Costa-Pierce, B. A., & Page, G. G. (2013). Sustainability Science in Aquaculture. In P. Christou, R. Savin, B. A. Costa-Pierce, I. Misztal, & C. B. A. Whitelaw (Eds.), *Sustainable Food Production* (pp. 206–222). Springer. https://doi.org/10.1007/978-1-4614-5797-8_175

Coull, J. R. (1988). Fish Farming in the Highlands and Islands: Boom Industry of the 1980s. *Scottish Geographical Magazine*, *104*(1), 4–13. https://doi.org/10.1080/00369228818736722

Custance, J., & Hillier, H. (1998). Statistical Issues in Developing Indicators of Sustainable Development. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *161*(3), 281–290. https://doi.org/10.1111/1467-985X.00108

Cuyvers, L., & De Meyer, T. (2012). Market-Driven Promotion of International Labour Standards in Southeast Asia: The Corporatization of Social Justice. In A. Marx, M. Maertens, J. Swinnen, & J. Wouters (Eds.), *Private Standards and Global Governance. Economic, Legal and Political Perspectives* (pp. 114–149). Edward Elgar Publishing Limited.

Czarniawska, B., & Joerges, B. (1996). Travels of Ideas. In B. Czarniawska & G. Sevón (Eds.), *Translating Organizational Change* (pp. 13–48). Walter de Gruyter.

Czarniawska, B., & Sevón, G. (Eds.). (1996). *Translating Organizational Change*. de Gruyter.

Czarniawska, B., & Sevón, G. (2005). Translation Is a Vehicle, Imitation Its Motor, and Fashion Sits at the Wheel. In B. Czarniawska & G. Sevón (Eds.), *Global Ideas: How Ideas, Objects and Practice Travel in the Global Economy* (pp. 7–12). Liber & Copenhagen Business School Press.

Dale, V. H., & Beyeler, S. C. (2001). Challenges in the Development and Use of Ecological Indicators. *Ecological Indicators*, *1*(1), 3–10. https://doi.org/10.1016/S1470-160X(01)00003-6

Davidson, K. M. (2011). Reporting Systems for Sustainability: What Are They Measuring? *Social Indicators Research*, *100*(2), 351–365. https://doi.org/10.1007/s11205-010-9634-3

Delanty, G., & Strydom, P. (Eds.). (2003). *Philosophies of Social Science: The Classic and Contemporary Readings*. Open University.

Derkx, B., & Glasbergen, P. (2014). Elaborating Global Private Meta-Governance: An Inventory in the Realm of Voluntary Sustainability Standards. *Global Environmental Change*, *27*, 41–50. https://doi.org/10.1016/j.gloenvcha.2014.04.016

Dike, A. A. (1983). Land Tenure System in Igboland. *Anthropos*, *Bd. 78*(H. 5./6.), 853–871.

Djama, M., Fouilleux, E., & Vagneron, I. (2011). Standard-Setting, Certifying and Benchmarking: A Governmentality Approach to Sustainability Standards in the Agro-Food Sector. In S. Ponte, P. Gibbon, & J. Vestergaard (Eds.), *Governing Through Standards: Origins, Drivers and Limitations*. Palgrave Macmillan.

Eden, S. (2008). Being Fieldworthy: Environmental Knowledge Practices and the Space of the Field in Forest Certification. *Environment and Planning D: Society and Space*, *26*(6), 1018–1035. https://doi.org/10.1068/d3208

Eliassen, K. O. (2016). *Foucaults begreper*. Scandinavian Academic Press.

Elkington, J. (1997). *Cannibals With Forks: The Triple Bottom Line of 21st Century Business*. Capstone.

Elkjær, B. (2004). Organizational Learning: The 'Third Way.' Management Learning, 35(4), 419–434. https://doi.org/10.1177/1350507604048271

Ellis, T., Turnbull, J. F., Knowles, T. G., Lines, J. A., & Auchterlonie, N. A. (2016). Trends During Development of Scottish Salmon Farming: An Example of Sustainable Intensification? *Aquaculture*, *458*, 82–99. https://doi.org/10.1016/j.aquaculture.2016.02.012

Erlingsdóttir, G., & Lindberg, K. (2005). Isomorphism, Isopraxism, and Isonymism: Complementary or Competing Processes? In B. Czarniawska & G. Sevón (Eds.), *Global Ideas: How Ideas, Objects and Practice Travel in the Global Economy* (pp. 47–70). Liber & Copenhagen Business School Press.

FAO. (2014). *The State of the World Fisheries and Aquaculture 2014: Opportunities and Challenges*. Food and Agriculture Organization of the United Nations.

FAO. (2018). *The State of World Fisheries and Aquaculture 2018—Meeting the Sustainable Development Goals*.

Finnemore, M., & Sikkink, K. (1998). International Norm Dynamics and Political Change. *International Organization*, *52*(4), 887–917. https://doi.org/10.1162/002081898550789

Flick, U. (2009). *An Introduction to Qualitative Research* (4th ed). Sage Publications.

Forseth, T., Barlaup, B. T., Finstad, B., Fiske, P., Gjøsæter, H., Falkegård, M., Hindar, A., Mo, T. A., Rikardsen, A. H., Thorstad, E. B., Vøllestad, L. A., & Wennevik, V. (2017). The Major Threats to Atlantic Salmon in Norway. *ICES Journal of Marine Science*, *74*(6), 1496–1513. https://doi.org/10.1093/icesjms/fsx020

FOS. (2019). *Certified Sustainable Seafood, Products & Services | Friend of the Sea*. Friend of the Sea. https://friendofthesea.org/

Foucault, M. (2007). *Security, Territory, Population: Lectures at the Collège de France, 1977-78* (M. Senellart, Ed.). Palgrave Macmillan : République Française.

Foucault, M. (2008). *The Birth of Biopolitics: Lectures at the Collège de France, 1978-79* (M. Senellart, Ed.). Palgrave Macmillan.

Froehlich, H. E., Runge, C. A., Gentry, R. R., Gaines, S. D., & Halpern, B. S. (2018). Comparative Terrestrial Feed and Land Use of an Aquaculture-Dominant World.

Proceedings of the National Academy of Sciences, *115*(20), 5295–5300. https://doi.org/10.1073/pnas.1801692115

Fyhn, H., & Søraa, R. A. (2017). Teknologisk produksjon av nærhet og avstand. Klimakrisa, virkemiddelapparatet og de tusen hjem. In T. Larsen & E. A. Røyrvik (Eds.), *Trangen til å telle. Objektivering, måling og standardisering som samfunnspraksis* (pp. 123–151). Scandinavian Academic Press.

GAA. (2019). *Global Aquaculture Alliance*. Global Aquaculture Alliance. https://www.aquaculturealliance.org/

Garlock, T., Asche, F., Anderson, J., Bjørndal, T., Kumar, G., Lorenzen, K., Ropicki, A., Smith, M. D., & Tveterås, R. (2019). A Global Blue Revolution: Aquaculture Growth Across Regions, Species, and Countries. *Reviews in Fisheries Science & Aquaculture*, 1–10. https://doi.org/10.1080/23308249.2019.1678111

Geels, F. W. (2011). The Multi-Level Perspective on Sustainability Transitions: Responses to Seven Criticisms. *Environmental Innovation and Societal Transitions*, *1*(1), 24–40. https://doi.org/10.1016/j.eist.2011.02.002

Geertz, C. (2000). *The Interpretation of Cultures*. Basic Books.

Genus, A. (2016). Sustainability Transitions: A Discourse-Institutional Perspective. In H. G. Brauch, Ú. O. Spring, J. Grin, & J. Scheffran (Eds.), *Hexagon Series on Human and Environmental Security and Peace* (Vol. 10, pp. 527–541). Springer International Publishing.

Gismervik, K., Gåsnes, S. K., Nielsen, K. V., & Mejdell, C. M. (2019). Fiskevelferd. In B. Hjeltnes, B. B. Jensen, G. Bornø, A. Haukaas, & C. S. Walde (Eds.), *Fiskehelserapporten 2018* (pp. 20–35). Veterinærinstituttet.

Glenn, H., & White, H. (2007). Legal Traditions, Environmental Awareness, and a Modern Industry: Comparative Legal Analysis and Marine Aquaculture. *Ocean Development & International Law*, *38*(1–2), 71–99. https://doi.org/10.1080/00908320601071389

GLOBALG.A.P. (2019). *GLOBALG.A.P.* GLOBALG.A.P. https://www.globalgap.org/uk_en/

Gopal, T. K. S., & Boopendranath, M. R. (2013). Seafood Ecolabelling. *Fishery Technology*, *50*, 1–10.

Graziano, M., Fox, C. J., Alexander, K. A., Pita, C., Heymans, J. J., Crumlish, M., Hughes, A., Ghanawi, J., & Cannella, L. (2018). Environmental and Socio-Political Shocks to the Seafood Sector: What Does This Mean for Resilience? Lessons from Two UK Case Studies, 1945–2016. *Marine Policy*, *87*, 301–313. https://doi.org/10.1016/j.marpol.2017.10.014

Groeneveld, R., Bush, S. R., & Bailey, M. (2017). Private Governance of Ocean Resources. In P. Nunes, L. Svensson, & A. Markandya (Eds.), *Handbook on the Economics and Management of Sustainable Oceans* (pp. 416–428). Edward Elgar Publishing. https://doi.org/10.4337/9781786430724

Gulbrandsen, L. H. (2009). The Emergence and Effectiveness of the Marine Stewardship Council. *Marine Policy*, *33*(4), 654–660. https://doi.org/10.1016/j.marpol.2009.01.002

Gupta, A. (2008). Transparency Under Scrutiny: Information Disclosure in Global Environmental Governance. *Global Environmental Politics*, *8*(2), 1–7. https://doi.org/10.1162/glep.2008.8.2.1

Hansen, H. K., & Salskov-Iversen, D. (2005). Globalizing Webs: Translation of Public Sector E-Modernization. In B. Czarniawska & G. Sevón (Eds.), *Global Ideas: How Ideas, Objects and Practice Travel in the Global Economy* (pp. 213–232). Liber & Copenhagen Business School Press.

Hatanaka, M. (2014). Standardized Food Governance? Reflections on the Potential and Limitations of Chemical-Free Shrimp. *Food Policy*, *45*, 138–145. https://doi.org/10.1016/j.foodpol.2013.04.013

Hatanaka, M., & Busch, L. (2008). Third-Party Certification in the Global Agrifood System: An Objective or Socially Mediated Governance Mechanism? *Sociologia Ruralis*, *48*(1), 73–91. https://doi.org/10.1111/j.1467-9523.2008.00453.x

Hatch, M. J., & Schultz, M. (2002). The Dynamics of Organizational Identity. *Human Relations*, *55*(8), 989–1018. https://doi.org/10.1177/0018726702055008181

Havice, E., & Iles, A. (2015). Shaping the Aquaculture Sustainability Assemblage: Revealing the Rule-Making Behind the Rules. *Geoforum*, *58*, 27–37. https://doi.org/10.1016/j.geoforum.2014.10.008

Heen, R. D. (2019, July 21). - Ukritisk bruk av ordet bærekraft kan få negative konsekvenser for næringen. *Fiskeribladet*. https://fiskeribladet.no/nyheter/?artikkel=68052&utm_source=Nyhetsbrev+Fiskeribladet+NEW+2018&utm_campaign=48ad0a8010-mandag22.+juli+-+2019&utm_medium=email&utm_term=0_89ed5eac24-48ad0a8010-215649797

Henson, S., & Humphrey, J. (2012). Private Standards in Global Agri-Food Chains. In A. Marx, M. Maertens, J. Swinnen, & J. Wouters (Eds.), *Private Standards and*

Global Governance. Economic, Legal and Political Perspectives (pp. 98–113). Edward Elgar Publishing Limited.

Hersoug, B. (2014). Borte fra, men hjemme best? In E. Hovland, D. Møller, A. Haaland, N. Kolle, B. Hersoug, & G. Nævdal (Eds.), *Over den leiken ville ha rå—Norsk havbruksnærings historie* (pp. 315–351). Fagbokforlaget.

Hersoug, B., & Johnsen, J. P. (2012). *Kampen om plass på kysten: Interesser og utviklingstrekk i kystsoneplanleggingen*. Universitetsforlaget.

Hersoug, B., Mikkelsen, E., & Karlsen, K. M. (2019). "Great Expectations" – Allocating Licenses With Special Requirements in Norwegian Salmon Farming. *Marine Policy*, *100*, 152–162. https://doi.org/10.1016/j.marpol.2018.11.019

Hicks, C. C., Levine, A., Agrawal, A., Basurto, X., Breslow, S. J., Carothers, C., Charnley, S., Coulthard, S., Dolsak, N., Donatuto, J., Garcia-Quijano, C., Mascia, M. B., Norman, K., Poe, M. R., Satterfield, T., St. Martin, K., & Levin, P. S. (2016). Engage Key Social Concepts for Sustainability. *Science*, *352*(6281), 38–40. https://doi.org/10.1126/science.aad4977

Hohnen, P., & Hasle, P. (2011). Making Work Environment Auditable – A 'Critical Case' Study of Certified Occupational Health and Safety Management Systems in Denmark. *Safety Science*, *49*(7), 1022–1029. https://doi.org/10.1016/j.ssci.2010.12.005

Howarth, W. (2006). Global Challenges in the Regulation of Aquaculture. In *VanderZwaag, D.L. & Chao, G. eds. Aquaculture Law and Policy: Towards Principled Access and Operations* (pp. 13–36). Routledge.

Hox, J. J. (1997). From Theoretical Concept to Survey Question. In L. Lyberg, P. Biemer, M. Collins, E. De Leeuw, C. Dippo, N. Schwarz, & D. Trewin (Eds.), *Survey Measurement and Process Quality* (pp. 47–69). John Wiley & Sons, Ltd.

Hwang, H., & Suarez, D. (2005). Lost and Found in the Translation of Strategic Plans and Websites. In B. Czarniawska & G. Sevón (Eds.), *Global Ideas: How Ideas, Objects and Practice Travel in the Global Economy* (pp. 71–93). Liber & Copenhagen Business School Press.

IFS. (2019). *IFS Database—Home*. IFS Certification. https://www.ifs-certification.com/index.php/en/

Jacobsson, B. (2005). Standardization and Expert Knowledge. In N. Brunsson & B. Jacobsson (Eds.), *A World of Standards* (Reprinted, pp. 40–49). Oxford University Press.

James, P. (2015). *Urban Sustainability in Theory and Practice: Circles of Sustainability*. Routledge, Taylor & Francis Group.

Jensen, C. B., & Winthereik, B. R. (2017). Audit Loops and Audit Implosion. In A. Lebner (Ed.), *Redescribing Relations, Strathernian Conversations on Ethnography, Knowledge and Politics* (pp. 155–181). Berghahn Books.

Jentoft, S., & Chuenpagdee, R. (2015). Assessing Governability of Small-Scale Fisheries. In S. Jentoft & R. Chuenpagdee (Eds.), *Interactive Governance for Small-Scale Fisheries* (Vol. 13, pp. 17–35). Springer International Publishing. https://doi.org/10.1007/978-3-319-17034-3_36

Jentoft, S., & Johnsen, J. P. (2015). The Dynamics of Small-Scale Fisheries in Norway: From Adaptamentality to Governability. In S. Jentoft & R. Chuenpagdee (Eds.), *Interactive Governance for Small-Scale Fisheries* (Vol. 13, pp. 705–723).

Springer International Publishing. https://doi.org/10.1007/978-3-319-17034-3_36

Johnsen, J. P. (2017). Creating Political Spaces at Sea – Governmentalisation and Governability in Norwegian Fisheries. *Maritime Studies*, *16*(1). https://doi.org/10.1186/s40152-017-0071-7

Kaiser, M., & Stead, S. (2002). Uncertainties and Values in European Aquaculture: Communication, Management and Policy Issues in Times of "Changing Public Perceptions." *Aquaculture International*, *10*(6), 469–490. https://doi.org/10.1023/A:1023963326201

Kalfagianni, A., & Pattberg, P. (2013). Fishing in Muddy Waters: Exploring the Conditions for Effective Governance of Fisheries and Aquaculture. *Marine Policy*, *38*, 124–132. https://doi.org/10.1016/j.marpol.2012.05.028

Karlsen, K. M., Andreassen, O., & Dreyer, B. (2013). *Illustrasjon av bærekraftig utvikling*. Nofima.

Kazancigil, A. (2007). The Significance of Statehood in Global Governance. In P. de Senarclens & A. Kazancigil (Eds.), *Regulating Globalization—Critical Approaches to Global Governance* (pp. 37–68). United Nations University Press.

Keeble, J. J., Topiol, S., & Berkeley, S. (2003). Using Indicators to Measure Sustainability Performance at a Corporate and Project Level. *Journal of Business Ethics*, *44*(2), 149–158. https://doi.org/10.1023/A:1023343614973

Kittinger, J. N., Teh, L. C. L., Allison, E. H., Bennett, N. J., Crowder, L. B., Finkbeiner, E. M., Hicks, C., Scarton, C. G., Nakamura, K., Ota, Y., Young, J., Alifano, A., Apel, A., Arbib, A., Bishop, L., Boyle, M., Cisneros-Montemayor, A. M.,

Hunter, P., Le Cornu, E., … Wilhelm, T. ’Aulani. (2017). Committing to Socially Responsible Seafood. *Science*, *356*(6341), 912–913. https://doi.org/10.1126/science.aam9969

Konefal, J. (2013). Environmental Movements, Market-Based Approaches, and Neoliberalization: A Case Study of the Sustainable Seafood Movement. *Organization & Environment*, *26*(3), 336–352. https://doi.org/10.1177/1086026612467982

Kongsvik, T., Almklov, P., & Fenstad, J. (2010). Organisational Safety Indicators: Some Conceptual Considerations and a Supplementary Qualitative Approach. *Safety Science*, *48*(10), 1402–1411. https://doi.org/10.1016/j.ssci.2010.05.016

Krause, G., Brugere, C., Diedrich, A., Ebeling, M. W., Ferse, S. C. A., Mikkelsen, E., Pérez Agúndez, J. A., Stead, S. M., Stybel, N., & Troell, M. (2015). A Revolution Without People? Closing the People–Policy Gap in Aquaculture Development. *Aquaculture*, *447*, 44–55. https://doi.org/10.1016/j.aquaculture.2015.02.009

Kringen, J. (2018). Regulering, standardisering, normering: Terminologi, typologier og egenskaper. In P. H. Lindøe, J. Kringen, & G. S. Braut (Eds.), *Regulering og standardisering—Perspektiver og praksis* (pp. 27–49). Universitetsforlaget.

Kuhlman, T., & Farrington, J. (2010). What is Sustainability? *Sustainability*, *2*(11), 3436–3448. https://doi.org/10.3390/su2113436

Larsen, T. (2017). Når virkeligheten flytter på seg. Instrumentalitet, estetikk og livsverden i vår tid. In *Trangen til å telle. Objektivering, måling og standardisering som samfunnspraksis* (pp. 265–307). Scandinavian Academic Press.

Larsen, T., & Røyrvik, E. A. (Eds.). (2017). *Trangen til å telle. Objektivering, måling og standardisering som samfunnspraksis*. Scandinavian Academic Press.

Latta, A., & Aguayo, B. E. C. (2012). Testing the Limits: Neoliberal Ecologies from Pinochet to Bachelet. *Latin American Perspectives*, *39*(4), 163–180. https://doi.org/10.1177/0094582X12439050

Lehtonen, M. (2004). The Environmental–Social Interface of Sustainable Development: Capabilities, Social Capital, Institutions. *Ecological Economics*, *49*(2), 199–214. https://doi.org/10.1016/j.ecolecon.2004.03.019

Levett, R. (1998). Sustainability Indicators-Integrating Quality of Life and Environmental Protection. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *161*(3), 291–302. https://doi.org/10.1111/1467-985X.00109

Liabø, L., Nystøyl, R., Pettersen, I., & Vang, T. A. (2007). *Rammebetingelser og konkurranseevne for akvakultur: En sammenligning mellom Chile, Skottland og Norge (Industrial Policies for Aquaculture: A Comparative Study*. SeMM (Senter for matpolitikk og marked), NILF (Norsk institutt for landbruksøkonomisk forskning).

Lindøe, P. H. (2018). Faglig forsvarlighet og brannsikkerhet for risikoutsatte grupper. In P. H. Lindøe, J. Kringen, & G. S. Braut (Eds.), *Regulering og standardisering—Perspektiver og praksis* (pp. 163–184). Universitetsforlaget.

Lindøe, P. H., & Kringen, J. (2018). Standarder og standardiseringsprosesser. In P. H. Lindøe, J. Kringen, & G. S. Braut (Eds.), *Regulering og standardisering—Perspektiver og praksis* (pp. 67–87). Universitetsforlaget.

Lindøe, P. H., Kringen, J., & Braut, G. S. (Eds.). (2018). *Regulering og standardisering—Perspektiver og praksis*. Universitetsforlaget.

Lloret, A. (2016). Modeling Corporate Sustainability Strategy. *Journal of Business Research*, *69*(2), 418–425. https://doi.org/10.1016/j.jbusres.2015.06.047

Lloyd, M. G., & Livingstone, L. (1991). Marine Fish Farming, Planning Policy and the Environment. *Scottish Geographical Magazine*, *107*(1), 52–57. https://doi.org/10.1080/00369229118736807

Loconto, A. M. (2017). Models of Assurance: Diversity and Standardization of Modes of Intermediation. *The ANNALS of the American Academy of Political and Social Science*, *670*(1), 112–132. https://doi.org/10.1177/0002716217692517

Marine Harvest. (2009). *Annual Report 2008*.

Marshall, J. (2001). Landlords, Leaseholders & Sweat Equity: Changing Property Regimes in Aquaculture. *Marine Policy*, *25*(5), 335–352. https://doi.org/10.1016/S0308-597X(01)00020-3

Mauerhofer, V. (2008). 3-D Sustainability: An Approach for Priority Setting in Situation of Conflicting Interests Towards a Sustainable Development. *Ecological Economics*, *64*(3), 496–506. https://doi.org/10.1016/j.ecolecon.2007.09.011

Maxwell, J. A., & Mittapalli, K. (2008). Explanatory Research. In L. Given, *The SAGE Encyclopedia of Qualitative Research Methods*. SAGE Publications, Inc. https://doi.org/10.4135/9781412963909.n164

Meld. St. 16. (2014). *Forutsigbar og miljømessig bærekraftig vekst i norsk laks- og ørretoppdrett.* Det Kongelige Nærings- og Fiskeridepartementet.

Merry, S. E. (2011). Measuring the World: Indicators, Human Rights, and Global Governance. *Current Anthropology*, *52*(S3), S83–S95. https://doi.org/10.1086/657241

Meyer, J. W., & Rowan, B. (1977). Institutionalized Organizations: Formal Structure as Myth and Ceremony. *American Journal of Sociology*, *83*(2), 340–363. https://doi.org/10.1086/226550

Mikkelsen, E., Karlsen, K. M., & Osmundsen, T. C. (2019). *Endringer i arealplanlegging av sjøområder? Mulig betydning for havbruk* (No. 11). Nofima.

Milewski, I., & Smith, R. E. (2019). Sustainable Aquaculture in Canada: Lost in Translation. *Marine Policy*, *107*, 103571. https://doi.org/10.1016/j.marpol.2019.103571

Moore, F. C. (2011). Toppling the Tripod: Sustainable Development, Constructive Ambiguity and the Environmental Challenge. *Consilience: The Journal of Sustainable Development*, *5*, 141–150. https://doi.org/10.7916/D8668CW6

Morris, L. (1998). Governing at a Distance: The Elaboration of Controls in British Immigration. *International Migration Review*, *32*(4), 949. https://doi.org/10.2307/2547667

Morton, A., & Routledge, R. (2016). Risk and Precaution: Salmon Farming. *Marine Policy*, *74*, 205–212. https://doi.org/10.1016/j.marpol.2016.09.022

Moses, J. W., & Knutsen, T. L. (2007). *Ways of Knowing: Competing Methodologies and Methods in Social and Political Research*. Palgrave Macmillan.

Myklebost, I. T. (2019, July 6). *Forbrukertilsynet: – H&M driver ulovlig miljømarkedsføring*. NRK. https://www.nrk.no/troms/forbrukertilsynet-refser-h_m-for-ulovlig-miljomarkedsforing-1.14578730

Mårtensson, P., Fors, U., Wallin, S.-B., Zander, U., & Nilsson, G. H. (2016). Evaluating Research: A Multidisciplinary Approach to Assessing Research Practice and Quality. *Research Policy*, *45*(3), 593–603. https://doi.org/10.1016/j.respol.2015.11.009

Nilsen, M., Amundsen, V. S., & Olsen, M. S. (2018). Swimming in a Slurry of Schemes: Making Sense of Aquaculture Standards and Certification Schemes. In S. Haugen, A. Barros, C. van Gulijk, T. Kongsvik, & J. E. Vinnem (Eds.), *Safety and Reliability – Safe Societies in a Changing World* (pp. 3149–3156). Taylor & Francis Group.

Noble, C., Gismervik, K., Iversen, M. H., Kolarevic, J., Nilsson, J., Stien, L. H., & Turnbull, J. F. (2018). *Welfare Indicators for Farmed Atlantic Salmon: Tools for Assessing Fish Welfare*. Nofima.

Nyberg, D., & Wright, C. (2013). Corporate Corruption of the Environment: Sustainability as a Process of Compromise. *The British Journal of Sociology*, *64*(3), 405–424. https://doi.org/10.1111/1468-4446.12025

Olaussen, J. O. (2018). Environmental Problems and Regulation in the Aquaculture Industry. Insights from Norway. *Marine Policy*, *98*, 158–163. https://doi.org/10.1016/j.marpol.2018.08.005

Oliver, C. (1991). Strategic Responses to Institutional Processes. *The Academy of Management Review*, *16*(1), 145. https://doi.org/10.2307/258610

Olsen, M. S., & Osmundsen, T. C. (2017). Media Framing of Aquaculture. *Marine Policy*, *76*, 19–27. https://doi.org/10.1016/j.marpol.2016.11.013

O'Ryan, R., & Pereira, M. (2015). Participatory Indicators of Sustainability for the Salmon Industry: The Case of Chile. *Marine Policy*, *51*, 322–330. https://doi.org/10.1016/j.marpol.2014.09.010

Osmundsen, T.C., Amundsen, V. S., Alexander, K. A., Asche, F., Bailey, J., Finstad, B., Olsen, M. S., Hernández, K., & Salgado, H. (2020). The Operationalisation of Sustainability: Sustainable Aquaculture Production as Defined by Certification Schemes. *Global Environmental Change*, *60*, 102025. https://doi.org/10.1016/j.gloenvcha.2019.102025

Osmundsen, T. C., Olsen, M. S., & Thorvaldsen, T. (2020). The Making of a Louse—Constructing Governmental Technology for Sustainable Aquaculture. *Environmental Science & Policy*, *104*, 121–128. https://doi.org/10.1016/j.envsci.2019.12.002

Osmundsen, T. C., Almklov, P., & Tveterås, R. (2017). Fish Farmers and Regulators Coping with the Wickedness of Aquaculture. *Aquaculture Economics & Management*, 1–21. https://doi.org/10.1080/13657305.2017.1262476

Osmundsen, T. C., & Olsen, M. S. (2017). The Imperishable Controversy over Aquaculture. *Marine Policy*, *76*, 136–142. https://doi.org/10.1016/j.marpol.2016.11.022

Osmundsen, T. C., Størkersen, K. V., & Fenstad, J. (2012). I storm og stille—Havbruksbedriften som næringsaktør og politisk aktivist i norsk kystsoneforvaltning. In *Kampen om plass på kysten: Interesser og utviklingstrekk i kystsoneplanleggingen*. Universitetsforlaget.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.

Ostrom, E. (2010). Beyond Markets and States: Polycentric Governance of Complex Economic Systems. *American Economic Review*, *100*(3), 641–672. https://doi.org/10.1257/aer.100.3.641

Patton, M. Q. (1987). *How to Use Qualitative Methods in Evaluation*. Sage Publications.

Payne, G., & Payne, J. (2004). *Key Concepts in Social Research*. SAGE Publications, Ltd. https://doi.org/10.4135/9781849209397

Peel, D., & Lloyd, M. G. (2008). Governance and Planning Policy in the Marine Environment: Regulating Aquaculture in Scotland. *The Geographical Journal*, *174*(4), 361–373.

Pelletier, N., Tyedmers, P., Sonesson, U., Scholz, A., Ziegler, F., Flysjo, A., Kruse, S., Cancino, B., & Silverman, H. (2009). Not All Salmon Are Created Equal: Life Cycle Assessment (LCA) of Global Salmon Farming Systems. *Environmental Science & Technology*, *43*(23), 8730–8736. https://doi.org/10.1021/es9010114

Pettersen, J. M., Osmundsen, T. C., Aunsmo, A., Mardones, F. O., & Rich, K. M. (2015). Controlling Emerging Infectious Diseases in Salmon Aquaculture. *Revue Scientifique et Technique de l'OIE*, *34*(3), 923–938. https://doi.org/10.20506/rst.34.3.2406

Phyne, J. (2010). A Comparative Political Economy of Rural Capitalism: Salmon Aquaculture in Norway, Chile and Ireland. *Acta Sociologica*, *53*(2), 160–180. https://doi.org/10.1177/0001699310365632

Pierson, P. (2004). *Politics in Time: History, Institutions, and Social Analysis*. Princeton University Press. http://public.eblib.com/choice/publicfullrecord.aspx?p=768545

Ponte, S., Gibbon, P., & Vestergaard, J. (Eds.). (2011). *Governing Through Standards: Origins, Drivers and Limitations*. Palgrave Macmillan.

Porter, T. M. (2001). *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton University Press. http://public.eblib.com/choice/publicfullrecord.aspx?p=581641

Porter, T. M. (2013). Funny Numbers. *Culture Unbound: Journal of Current Cultural Research*, *4*(4), 585–598. https://doi.org/10.3384/cu.2000.1525.124585

Portney, K. E. (2015). *Sustainability*. London, England : The MIT Press.

Powell, W. W., Gammal, D. L., & Simard, C. (2005). Close Encounters: The Circulation and Reception of Managerial Practices in the San Francisco Bay Area Nonprofit Community. In B. Czarniawska & G. Sevón (Eds.), *Global Ideas: How Ideas, Objects and Practice Travel in the Global Economy* (pp. 233–258). Liber & Copenhagen Business School Press.

Power, M. (2010). *The Audit Society: Rituals of Verification* (Reprinted). Oxford Univ. Press.

Primavera, J. H. (2006). Overcoming the Impacts of Aquaculture on the Coastal Zone. *Ocean & Coastal Management*, *49*(9–10), 531–545. https://doi.org/10.1016/j.ocecoaman.2006.06.018

Ragin, C. C. (2008). *The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies*. University of California Press.

Read, P., & Fernandes, T. (2003). Management of Environmental Impacts of Marine Aquaculture in Europe. *Aquaculture*, *226*(1–4), 139–163. https://doi.org/10.1016/S0044-8486(03)00474-5

Rey-Valette, H., Laloe, F., & Le Fur, J. (2007). Introduction to the Key Issue Concerning the Use of Sustainable Development Indicators. *International Journal of Sustainable Development*, *10*(1/2), 4. https://doi.org/10.1504/IJSD.2007.014410

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a General Theory of Planning. *Policy Sciences*, *4*(2), 155–169. https://doi.org/10.1007/BF01405730

Roheim, C. A. (2008). The Economics of Ecolabelling. In T. Ward & B. Philips (Eds.), *SEAFOOD Ecolabelling: Principles and Practice*. Blackwell Publishing Ltd.

Rose, N., & Miller, P. (1992). Political Power Beyond the State: Problematics of Government. *The British Journal of Sociology*, *43*(2), 173–205.

Røvik, K. A. (1998). *Moderne organisasjoner: Trender i organisasjonstenkningen ved tusenårsskiftet*. Fagbokforlaget.

Røyrvik, E. A. (2017). Sosialitet i målstyringens tid. In T. Larsen & E. A. Røyrvik (Eds.), *Trangen til å telle. Objektivering, måling og standardisering som samfunnspraksis* (pp. 25–54). Scandinavian Academic Press.

RSPCA. (2018). *Home*. RSPCA Assured. https://www.rspcaassured.org.uk/

Rydin, Y. (2007). Indicators as a Governmental Technology? The Lessons of Community-Based Sustainability Indicator Projects. *Environment and Planning D: Society and Space*, *25*(4), 610–624. https://doi.org/10.1068/d72j

Sahlin-Andersson, K. (1996). Imitating by Editing Success: The Construction of Organization Fields. In B. Czarniawska & G. Sevón (Eds.), *Translating Organizational Change* (pp. 69–92). Walter de Gruyter.

Samerwong, P., Bush, S. R., & Oosterveer, P. (2017). Metagoverning Aquaculture Standards: A Comparison of the GSSI, the ASEAN GAP, and the ISEAL. *The Journal of Environment & Development*, *26*(4), 429–451. https://doi.org/10.1177/1070496517736872

Samerwong, P., Bush, S. R., & Oosterveer, P. (2018). Implications of Multiple National Certification Standards for Thai Shrimp Aquaculture. *Aquaculture*, *493*, 319–327. https://doi.org/10.1016/j.aquaculture.2018.01.019

Samerwong, P., Toonen, H. M., Oosterveer, P., & Bush, S. R. (2020). A Capability Approach to Assess Aquaculture Sustainability Standard Compliance. *PLOS ONE*, *15*(1), e0227812. https://doi.org/10.1371/journal.pone.0227812

Sapkota, A., Sapkota, A. R., Kucharski, M., Burke, J., McKenzie, S., Walker, P., & Lawrence, R. (2008). Aquaculture Practices and Potential Human Health Risks: Current Knowledge and Future Priorities. *Environment International*, *34*(8), 1215–1226. https://doi.org/10.1016/j.envint.2008.04.009

Schlag, A. K. (2010). Aquaculture: An Emerging Issue for Public Concern. *Journal of Risk Research*, *13*(7), 829–844. https://doi.org/10.1080/13669871003660742

Schwartzman, H. B. (1993). *Ethnography in Organizations*. Sage Publications.

Scott, W. R. (1995). *Institutions and Organizations*. SAGE.

Scott, W. R. (1998). *Organizations: Rational, Natural, and Open Systems* (4th ed). Prentice Hall.

Shapiro, S. P. (1987). The Social Control of Impersonal Trust. *American Journal of Sociology*, *93*(3), 623–658. https://doi.org/10.1086/228791

Shore, C., & Wright, S. (2015). Audit Culture Revisited: Rankings, Ratings, and the Reassembling of Society. *Current Anthropology*, *56*(3), 421–444. https://doi.org/10.1086/681534

Smith, A. (2007). Translating Sustainabilities Between Green Niches and Socio-Technical Regimes. *Technology Analysis & Strategic Management*, *19*(4), 427–450. https://doi.org/10.1080/09537320701403334

Smith, M., Roheim, C. A., Crowder, L. B., Halpern, B. S., Turnipseed, M., Anderson, J. L., Asche, F., Bourillon, L., Guttormsen, A. G., Khan, A., Liguori, L. A., McNevin, A., O'Connor, M. I., Squires, D., Tyedmers, P., Brownstein, C., Carden, K., Klinger, D. H., Sagarin, R., & Selkoe, K. A. (2010). Sustainability and Global Seafood. *Science*, *327*(5967), 784–786. https://doi.org/10.1126/science.1185345

Sogn-Grundvåg, G., Asche, F., Zhang, D., & Young, J. A. (2019). Eco-Labels and Product Longevity: The Case of Whitefish in UK Grocery Retailing. *Food Policy*, *88*, 101750. https://doi.org/10.1016/j.foodpol.2019.101750

Sohlberg, P., & Sohlberg, B.-M. (2013). *Kunskapens former: Vetenskapsteori och forskningsmetod*. Liber.

Solås, A.-M., Hersoug, B., Andreassen, O., Tveterås, R., Osmundsen, T. C., Sørgård, B., Karlsen, K. M., Asche, F., & Robertsen, R. (2015). *Rettslig rammeverk for norsk havbruksnæring: Kartlegging av dagens status* (29/2015). Nofima.

Spradley, J. P. (2016). *Participant Observation*. Waveland Press.

Sprague, M., Dick, J. R., & Tocher, D. R. (2016). Impact of Sustainable Feeds on Omega-3 Long-Chain Fatty Acid Levels in Farmed Atlantic Salmon, 2006–2015. *Scientific Reports*, *6*(1). https://doi.org/10.1038/srep21892

SSPO. (2019). *Home—Scottish Salmon Producers' Organisation*. Scottish Salmon Producers' Organisation. http://scottishsalmon.co.uk/

Standard. (n.d.). In *Online Etymology Dictionary*. Retrieved September 20, 2019, from https://www.etymonline.com/word/standard

Stanton, G. H. (2012). Food Safety-Related Private Standards: The WTO Perspective. In A. Marx, M. Maertens, J. Swinnen, & J. Wouters (Eds.), *Private Standards and Global Governance. Economic, Legal and Political Perspectives* (pp. 235–254). Edward Elgar Publishing Limited.

Størkersen, K. V. (2012). Fish First: Sharp End Decision-Making at Norwegian Fish Farms. *Safety Science*, *50*(10), 2028–2034. https://doi.org/10.1016/j.ssci.2011.11.004

Strassheim, H., & Kettunen, P. (2014). When Does Evidence-Based Policy Turn Into Policy-Based Evidence? Configurations, Contexts and Mechanisms. *Evidence & Policy: A Journal of Research, Debate and Practice*, *10*(2), 259–277. https://doi.org/10.1332/174426514X13990433991320

Strathern, M. (2000). The Tyranny of Transparency. *British Educational Research Journal*, *26*(3), 309–321. https://doi.org/10.1080/713651562

Tashakkori, A., & Teddlie, C. (1998). *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. Sage.

Taylor, S. P. (2018). Critical Realism vs Social Constructionism & Social Constructivism: Application to a Social Housing Research Study. *International Journal of Sciences: Basic and Applied Research*, *37*(2), 216–222.

Tecklin, D. (2016). Sensing the Limits of Fixed Marine Property Rights in Changing Coastal Ecosystems: Salmon Aquaculture Concessions, Crises, and Governance Challenges in Southern Chile. *Journal of International Wildlife Law & Policy*, *19*(4), 284–300. https://doi.org/10.1080/13880292.2016.1248647

Thomann, E. (2017). The Notions of Regulation and Self-Regulation in Political Science. *Journal of Self-Regulation and Regulation*, 55-75. https://doi.org/10.11588/JOSAR.2017.0.40136

Thorstad, E. B., & Finstad, B. (2018). *Impacts of Salmon Lice Emanating From Salmon Farms on Wild Atlantic Salmon and Sea Trout* (No. 1449; pp. 1–22). Norsk institutt for naturforskning (NINA).

Tikina, A. V., & Innes, J. L. (2008). A Framework for Assessing the Effectiveness of Forest Certification. *Canadian Journal of Forest Research*, *38*(6), 1357–1365. https://doi.org/10.1139/X08-011

Tiller, R. G., De Kok, J.-L., Vermeiren, K., & Thorvaldsen, T. (2017). Accountability as a Governance Paradox in the Norwegian Salmon Aquaculture Industry. *Frontiers in Marine Science*, *4*. https://doi.org/10.3389/fmars.2017.00071

Timmermans, S., & Berg, M. (1997). Standardization in Action: Achieving Local Universality Through Medical Protocols. *Social Studies of Science*, *27*(2), 273–305. https://doi.org/10.1177/030631297027002003

Tjora, A. (2009). *Fra nysgjerrighet til innsikt: Kvalitative forskningsmetoder i praksis*. Sosiologisk Forlag.

Tlusty, M. F. (2012). Environmental Improvement of Seafood Through Certification and Ecolabelling: Theory and Analysis. *Fish and Fisheries*, *13*(1), 1–13. https://doi.org/10.1111/j.1467-2979.2011.00404.x

Tlusty, M. F., & Tausig, H. (2015). Reviewing GAA-BAP Shrimp Farm Data to Determine Whether Certification Lessens Environmental Impacts. *Reviews in Aquaculture*, *7*(2), 107–116. https://doi.org/10.1111/raq.12056

Tlusty, M. F., Tausig, H., Taranovski, T., Jeans, M., Thompson, M., Cho, M., Eppling, M., Clermont, J. J., Goldstein, J., & Fitzsimons, E. (2012). Refocusing Seafood Sustainability as a Journey Using the Law of the Minimum. *Sustainability*, *4*(9), 2038–2050. https://doi.org/10.3390/su4092038

Tlusty, M. F., Thompson, M., & Tausig, H. (2016). Statistical Tools to Assess the Breadth and Depth of Shrimp Aquaculture Certification Schemes. *Fisheries Research*, *182*, 172–176. https://doi.org/10.1016/j.fishres.2015.10.008

Tlusty, M. F., & Thorsen, Ø. (2017). Claiming Seafood is 'Sustainable' Risks Limiting Improvements. *Fish and Fisheries*, *18*(2), 340–346. https://doi.org/10.1111/faf.12170

Tomlinson, P., & Atkinson, S. F. (1987). Environmental Audits: Proposed Terminology. *Environmental Monitoring and Assessment*, *8*(3), 187–198. https://doi.org/10.1007/BF00404264

Tröster, R., & Hiete, M. (2018). Success of Voluntary Sustainability Certification Schemes – A Comprehensive Review. *Journal of Cleaner Production*, *196*, 1034–1043. https://doi.org/10.1016/j.jclepro.2018.05.240

Turnhout, E., Neves, K., & de Lijster, E. (2014). 'Measurementality' in Biodiversity Governance: Knowledge, Transparency, and the Intergovernmental Science-

Policy Platform on Biodiversity and Ecosystem Services (Ipbes). *Environment and Planning A: Economy and Space*, *46*(3), 581–597. https://doi.org/10.1068/a4629

United Nations. (n.d.). *Sustainable Development Goals—United Nations*. United Nations Sustainable Development. Retrieved March 14, 2018, from http://www.un.org/sustainabledevelopment/sustainable-development-goals/

United Nations. (1997). *Agenda for Development*.

Utne, I. B., Schjølberg, I., Holmen, I. M., & Bar, E. M. S. (2017). Risk Management in Aquaculture: Integrating Sustainability Perspectives. *Volume 7B: Ocean Engineering*, V07BT06A054. https://doi.org/10.1115/OMAE2017-61845

van Waarden, F. (2012). Governing Global Commons: The Public-Private Protection of Fish and Forests. In A. Marx, M. Maertens, J. Swinnen, & J. Wouters (Eds.), *Private Standards and Global Governance. Economic, Legal and Political Perspectives* (pp. 15–59). Edward Elgar Publishing Limited.

Vandergeest, P. (2007). Certification and Communities: Alternatives for Regulating the Environmental and Social Impacts of Shrimp Farming. *World Development*, *35*(7), 1152–1171. https://doi.org/10.1016/j.worlddev.2006.12.002

Vandergeest, P., Ponte, S., & Bush, S. R. (2015). Assembling Sustainable Territories: Space, Subjects, Objects, and Expertise in Seafood Certification. *Environment and Planning A*, *47*(9), 1907–1925. https://doi.org/10.1177/0308518X15599297

Vigneau, L., Humphreys, M., & Moon, J. (2015). How Do Firms Comply with International Sustainability Standards? Processes and Consequences of Adopting the Global Reporting Initiative. *Journal of Business Ethics*, *131*(2), 469–486. https://doi.org/10.1007/s10551-014-2278-5

Vince, J., & Haward, M. (2017). Hybrid Governance of Aquaculture: Opportunities and Challenges. *Journal of Environmental Management*, *201*, 138–144. https://doi.org/10.1016/j.jenvman.2017.06.039

Vormedal, I., & Gulbrandsen, L. H. (2018). Business Interests in Salmon Aquaculture Certification: Competition or Collective Action? *Regulation & Governance*. https://doi.org/10.1111/rego.12213

Washington, S., & Ababouch, L. (2011). *Private Standards and Certification in Fisheries and Aquaculture: Current Practice and Emerging Issues*. Food and Agriculture Organization of the United Nations.

Weitzman, J., & Bailey, M. (2018). Perceptions of Aquaculture Ecolabels: A Multi-Stakeholder Approach in Nova Scotia, Canada. *Marine Policy*, *87*, 12–22. https://doi.org/10.1016/j.marpol.2017.09.037

Woods, N. (2007). Trends in Global Economic Governance and the Emerging Accountability Gap. In P. de Senarclens & A. Kazancigil (Eds.), *Regulating Globalization—Critical Approaches to Global Governance* (pp. 93–117). United Nations University Press.

World Commission on Environment and Development (Ed.). (1987). *Our Common Future*. Oxford University Press.

Wouters, J., Marx, A., & Hachez, N. (2012). Private Standards, Global Governance and International Trade: The Case of Global Food Safety Governance. In A. Marx, M. Maertens, J. Swinnen, & J. Wouters (Eds.), *Private Standards and Global Governance. Economic, Legal and Political Perspectives* (pp. 255–292). Edward Elgar Publishing Limited.

Yin, R. K. (2003). *Case Study Research: Design and Methods* (3rd ed). Sage Publications.

Young, N., & Matthews, R. (2010). *The Aquaculture Controversy in Canada: Activism, Policy, and Contested Science*. UBC Press.

Young, O. R. (1994). *International Governance: Protecting the Environment in a Stateless Society*. Cornell University Press.

Ytrestøyl, T., Aas, T. S., & Asgård, T. (2015). Utilisation of Feed Resources in Production of Atlantic Salmon (Salmo Salar) in Norway. *Aquaculture*, *448*, 365–374. https://doi.org/10.1016/j.aquaculture.2015.06.023

Appendix I: Interview guide

Could you briefly tell us about your job, and how this relates to certification schemes?

1. Specific certification schemes

What are the certification schemes currently in use in your company?

Does your company also have a company standard in place?

(*Is it possible for us to receive a copy of the company standard? It will be used for comparison, in order to understand the strength of the company standard vs. other public standards. We will not circulate or publicize the standard of course*.)

Could you tell us about your experience with the implementation of these schemes?

(*pick one of them at a time)*

What is important to achieve a sustainable production from the perspective of the company? Do you perceive this as in line with what the national authorities deem important, or the certification schemes?

In what ways do you consider the standards helpful to achieve a sustainable production? Does the implementation of the standards help you to achieve better results? Examples.

How do you perceive the standards? Are there parts of the standards you find not

relevant, or irrational? Or any of the indicators used?

In the case of ASC certification, how do you perceive the usefulness of stakeholder meetings? Do you have many who attend these meetings?

Could you estimate how much resources your company spends on fulfilling these standards - in terms of number of employees occupied with audits, documentation etc.?

Could you estimate how much (%) of your current production is certified, and how much you are able to sell as certified?

Has your company ever declined to fulfill a standard, or considered doing so, and why?

Are there standards you do not have in place today, but would like to? What are the reasons you have not (yet) complied to the standard?

2. Comparing the different certification schemes

Are any of the standards very similar? What are the main differences between them? Where do they overlap?

How do you consider their relevance for different aspects of sustainability? (economy, environment, social)

Are there any conflicting requirements between the standards, and between the standards and national judicial framework for aquaculture production? Examples.

What are the specific customer requirements that are different from the other more general standards such as ASC and so forth? Examples.

What are the main reasons your company has decided to certify your production to the various standards?

(*Customer requirement, desire for improvement, reputation, easy to fulfill/congruent with what you already do, competition towards other salmon producers*)

3. Implementation

Does certification lead to improvements? Be it in production (sea or slaughtering), in your administrative systems, in human resource management, in your external reputation, market access or in other areas? Examples.

Could the resources you spend on documentation and conducting audits be better spent? Either towards achieving sustainability, or towards other tasks/activities?

How are you able to reap the benefits of your certification? Do you in any way communicate directly to the general public, the consumer that you are certified, and how?

Appendix II: Five research papers

Paper A:

Osmundsen, T. C., Amundsen, V. S., Alexander, K. A., Asche, F., Bailey, J. L., Finstad, B., Olsen, M. S., Hernandez, K., & Salgado, H. (2020). The Operationalisation of Sustainability: Sustainable Aquaculture Production as Defined by Certification Schemes. *Global Environmental Change, 60,* 102025. https://doi.org/10.1016/j.gloenvcha.2019.102025

Paper B:

Alexander, K. A., Amundsen, V. S., & Osmundsen, T. C. (2020). 'Social Stuff' and All That Jazz: Understanding the Residual Category of Social Sustainability. *Environmental Science & Policy, 112,* 61–68. https://doi.org/10.1016/j.envsci.2020.06.003

Paper C:

Amundsen, V. S., & Osmundsen, T. C. (2019). Virtually the Reality: Negotiating the Distance Between Standards and Local Realities When Certifying Sustainable Aquaculture. *Sustainability*, 11(9), 2603. https://doi.org/10.3390/su11092603

Paper D:

Amundsen, V. S., Gauteplass, A. Å., & Bailey, J. L. (2019). Level Up or Game Over: The Implications of Levels of Impact in Certification Schemes for Salmon Aquaculture. *Aquaculture Economics & Management*, 1–17. https://doi.org/10.1080/13657305.2019.1632389

Paper E:

Amundsen, V. S. & Osmundsen, T. C. (2020). Becoming Certified, Becoming Sustainable? Improvements from Aquaculture Certification Schemes as Experienced by Those Certified. *Marine Policy, 119.* https://doi.org/10.1016/j.marpol.2020.104097

Paper A

Osmundsen, T. C., Amundsen, V. S., Alexander, K. A., Asche, F., Bailey, J. L., Finstad, B., Olsen, M. S., Hernandez, K., & Salgado, H. (2020). The Operationalisation of Sustainability: Sustainable Aquaculture Production as Defined by Certification Schemes. *Global Environmental Change, 60,* 102025. https://doi.org/10.1016/j.gloenvcha.2019.102025

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The operationalisation of sustainability: Sustainable aquaculture production as defined by certification schemes

Tonje C. Osmundsen[a,*], Vilde S. Amundsen[b], Karen A. Alexander[c], Frank Asche[d], Jennifer Bailey[e], Bengt Finstad[f], Marit Schei Olsen[g], Klaudia Hernández[h], Hugo Salgado[i]

[a] Studio Apertura, NTNU Samfunnsforskning, Dragvoll allé 38 B, 7049 Trondheim, Norway
[b] Department of Sociology and Political Science, Norwegian University of Science and Technology, Studio Apertura, NTNU Samfunnsforskning, Norway
[c] Centre for Marine Socioecology, University of Tasmania, Institute for Marine and Antarctic Studies, University of Tasmania, Australia
[d] Institute of Sustainable Seafood Systems and School of Forest Resources and Conservation, University of Florida and Department of industrial Economics, University of Stavanger, Norway
[e] Department of Sociology and Political Science, Norwegian University of Science and Technology
[f] Norwegian Institute for Nature Research (NINA), Norway
[g] Studio Apertura, NTNU Samfunnsforskning, Norway
[h] Universidad Andres Bello Departamento de Ecología y Biodiversidad, Chile
[i] Facultad de Economía y Negocios, Universidad de Talca, Chile

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ABSTRACT

Sustainability certification has become an increasingly important feature in aquaculture production, leading to a multitude of schemes with various criteria. However, the large number of schemes and the complexity of the standards creates confusion with respect to which sustainability objectives are targeted. As a result, what is meant by 'sustainability' is unclear. In this paper, we examine the operationalisation of the concept from the vantage point of the certifying authorities, who devise standards and grant or withhold certification of compliance. We map the criteria of eight widely-used certification schemes using the four domains of the Wheel of Sustainability, a reference model designed to encompass a comprehensive understanding of sustainability. We show that, overall, the sustainability certifications have an overwhelming focus on environmental and governance indicators, and only display scattered attempts at addressing cultural and economic issues. The strong focus on governance indicators is, to a large degree, due to their role in implementing and legitimising the environmental indicators. The strong bias implies that these certification schemes predominantly focus on the environmental domain and do not address sustainability as a whole, nor do they complement each other. Sustainability is by definition and by necessity a comprehensive concept, but if the cultural and economic issues are to be addressed in aquaculture, the scope of certification schemes must be expanded. The Wheel of Sustainability can serve as a valid lexicon and asset to guide such efforts.

1. Introduction

Aquaculture production is often praised for its ability to produce nutritious seafood in a highly efficient manner (Klinger and Naylor, 2012; Sprague et al., 2016), but is also often criticised for unsustainable production practices, especially concerning use of feed (Ytrestøyl et al., 2015) and its negative impact on local environmental conditions (Klinger and Naylor, 2012; Osmundsen et al., 2017). The public is increasingly aware that aquaculture carries environmental risks (Alexander et al., 2016; Morton and Routledge, 2016; Olsen and Osmundsen, 2017) and that the seafood they consume may originate from unsustainable sources. Assuring consumers that the seafood they purchase is sustainable has become a rapidly growing business and has resulted in an abundance of certification schemes and eco-labels (Derkx and Glasbergen, 2014), which consumers find difficult to navigate (Gutierrez and Thornton, 2014) and which may ultimately reduce the credibility of the aquaculture industry (Parkes et al., 2010; Roheim et al., 2018; Washington and Ababouch, 2011). In addition, there are other limitations to sustainability certification, such as a narrow focus confined to production sites, exclusion of smallholders, and democratic deficit lacking representation from those who are affected by certification (Aguayo and Barriga, 2016; Amundsen et al.,

* Corresponding author.
E-mail address: tonje.osmundsen@samfunn.ntnu.no (T.C. Osmundsen).

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2019Bush et al., 2013).

The effectiveness of certification is often questioned (Kalfagianni and Pattberg, 2013), and many point to the adverse impact it can have on smaller firms and sectors, and those in less developed countries (Gulbrandsen, 2009; Marschke and Wilkings, 2014; Sampson et al., 2015; Vandergeest and Unno, 2012). However, the popularity of certification is rising, and there is evidence that consumers are willing to pay more for products with labels separating sustainable products from the less sustainable (Ankamah-Yeboah et al., 2016; Asche et al., 2015). The proliferation of such schemes and labels, and their interpretation of what sustainable production should be, determines what sustainable aquaculture production has come to be (Alfnes et al., 2018). *[W]hat is counted usually counts* (Miller, 2004, p. 382) as standards are not only epistemological categories, but also ontological devices that bring worlds into being (Busch, 2017, 2011; Hicks et al., 2016).

This makes it important to understand how certifications define sustainability, and the purpose of this paper is thus to understand the scope of these schemes in their operationalisation of sustainability. It is not an aim of this paper to assess the schemes to determine which scheme is superior to the others. To reach an understanding of how the schemes define sustainability, we treat metrics (which are used to assess sustainability) as a proxy for operationalising sustainability, thus creating a *de facto*, practical definition of sustainability. Analysing these schemes necessitates a multidimensional understanding of sustainability. This requires two things. First, understanding and analysing aquaculture production as both a supply and value chain, running from the production of feed through to the provision of the end product to the consumer (Ahi and Searcy, 2015). Secondly, while the fundamental activity of an aquaculture producer is to produce food, the company and its activities should be understood as interlocked with the surrounding social, political, natural, and economic environment (Christiansen and Jakobsen, 2017). Generally, there seems to exist a consensus that sustainability should be interpreted in such a broad manner, often conceptualised as the triple-bottom line. In practice, however, both as research perspectives and policy responses, a much narrower definition is applied (Ballet et al., 2011; Béné et al., 2019; Eakin et al., 2017; Foran et al., 2014), also within the realm of aquaculture (Andreassen et al., 2016; Costa-Pierce and Page, 2013; Osmundsen et al., 2020).

The consequences of applying a narrow perspective of sustainability lie in the inherent limits of a confined agenda for action. Paying foremost attention to environmental issues, without considering how these are sustained or even contradicted by social or economic structures, engenders political responses set up for failure (Tlusty and Thorsen, 2017). Moreover, there exists an economic literature indicating that firms and industries will only implement sustainability measures if it is profitable Roheim et al., 2018), and while there is limited empirical work on societal sustainability and how this can be operationalised, its importance is increasingly recognised (Kittinger et al., 2017). Given the need to take such a broad perspective, a reference model which combines research-based conceptual categories with existent applications can provide a useful basis for analysis.

The Circles of Sustainability model developed by James (2015), and his understanding of how sustainability is circumscribed and defined, is here adapted to provide a reference model for aquaculture production, entitled the Wheel of Sustainability. Rather than applying the three dimensions as do those categorizations of sustainability that follow the Rio declaration (UNCED, 1992), the model has four domains labelled economics, environment, governance, and culture. Each domain has seven subdomains representing the many components necessary for sustainable aquaculture production (see Supplements). This reference model is applied to the coding of 1916 indicators of eight of the most widely used certification schemes (see Table 1), providing crucial insight into how certification has defined what sustainable aquaculture has come to mean.

These certification schemes were selected based on those adopted by the aquaculture industry in Norway, Chile, and Scotland. Some of the schemes, such as SSPO and RSPCA, are popular with the aquaculture industry in Scotland, but not used in Norway and Chile. ASC, GlobalG.A.P, GAA, FOS, and BRC are adopted in all the three countries. IFS, however, is only in use in Norway and Chile. Geographical spread of the selected schemes is illustrated in Table 2. The choice was also based on a desire to include schemes applicable for different parts of the production cycle, encompassing the process from cradle to crate. For more information on how the various schemes target different parts of the production process, see Nilsen et al., 2018.

In the next section, we will present the development of the applied reference model and our material. Subsequently, the findings of the mapping of these certification schemes and their particular interpretation of sustainability is presented. In the discussion, we explore the skewed understanding of sustainability found in these schemes, and suggest further avenues for application of our reference model.

2. Materials and methods

2.1. Reference model

The methodological foundation for the below findings is the development and application of a reference model, the Wheel of Sustainability. An analysis of sustainable aquaculture production warrants a comprehensive understanding of its complexity, but also an abstract representation that is valid across practitioner and stakeholder communities (Reiter et al., 2013). Our model provides an overview of relevant topics to consider and the significant relationships between these topics, but stops short of valuation. Reference models do not specify the importance, weight, or value attached to individual topics or their combination (MacKenzie et al., 2006). A reference model is a valuable method in that it provides a common vocabulary that serves to unify the many elements of sustainable aquaculture production, thereby informing decision-making processes (Olander et al., 2018). By creating distinguishable entities of the many complexities of sustainable aquaculture production, one may focus on a particular set of issues, while also seeing these in connection with the larger whole. This allows the identification of both targeted and unintended outcomes of implemented initiatives, as the model provides an understanding of competing issues and tensions (Olander et al., 2016). It is worth noting that the development of such a model necessarily implies simplification of a complex reality, including difficult choices as to the designation of boundaries. We have, therefore, chosen to design a model comprising subdomains with broad descriptions as well as concrete examples, making the model both universal and applicable.

2.2. Working group

The Wheel of Sustainability is the result of collaboration by a multidisciplinary team working extensively over a three-year period. The team includes four professors, three senior researchers, and two junior researchers within fields such as political science, public and environmental governance, marine social science, organisational research, anthropology, marine biology, natural resource economics, sociology, and eco-system modelling. All project members have in-depth research experience with the aquaculture sector, both from their countries of origin and through research stays abroad in Norway, Chile, Scotland, USA, Colombia and Australia. The collaboration process included four multi-day workshops and continuous communication throughout the three-year period.

2.3. Process

Through an initial brain-storming session during the first project workshop, the team opted to identify all relevant issues of sustainable

Table 1
Chosen certification schemes and standards

Certification scheme	Standard	Version[a]	Intent/ambition
Aquaculture Stewardship Council (ASC)	Salmon	v1.0	Minimise or eliminate the key negative environmental and social impacts of salmon farming, while permitting the industry to remain economically viable
GLOBALG.A.P.	Aquaculture/ GRASP	v5.0/v1.3	Economically, ecologically, socially and culturally responsible agriculture (and aquaculture)
Friend of the Sea (FOS)	Marine Aquaculture	v1.1	Conserve the marine environment while ensuring sustainable fish stocks for generations to come
International Featured Standards (IFS)	Food	v6.0	Quality assurance and food safety
BRC Global Standards (BRC)	Food Safety	v7.0	Food safety, quality and operational criteria in food manufacturing
Royal Society for the Prevention of Cruelty to Animals (RSPCA)	Farmed Atlantic Salmon	*09/2015*	Animal welfare, sustainability, traceability, biosecurity
Global Aquaculture Alliance (GAA)	BAP Salmon	v2.3	Food safety, social welfare, environmental, animal health and welfare
Scottish Salmon Producers' Organisation (SSPO)	Code of Good Practice - Seawater Lochs	*02/2015*	Balance between industry activities and regulatory detail or bureaucracy, assurance of quality, high minimum standard and continuous improvement

[a] Version number and/or date corresponds with the name given the version by the certification schemes, and refers to the most current version available for coding at the time of writing.

Table 2
Adoption of schemes by country.

	Chile	Scotland	Norway
Aquaculture Stewardship Council (ASC)	x	x	x
GLOBALG.A.P.	x	x	x
Friend of the Sea (FOS)	x	x	x
International Featured Standards (IFS)	x		x
BRC Global Standards (BRC)	x	x	x
Royal Society for the Prevention of Cruelty to Animals (RSPCA)		x	
Global Aquaculture Alliance (GAA)	x	x	x
Scottish Salmon Producers' Organisation (SSPO)		x	

aquaculture production by gathering its many definitions and understandings. In the attempt to unify these into a reference model, we sought to go beyond the common 3-dimensional understanding of economic, environmental, and social sustainability, as it proved inadequate in representing the many different elements of sustainable aquaculture production. The reference model, the Wheel of Sustainability, is thus an adaptation of the Circles of Sustainability model developed by James (2015).

The Circles of Sustainability method is designed for urban development, and is as such not directly applicable to the domain of aquaculture production. However, James' understanding of sustainability as derived and created by social life and practice is a strong argument for choosing this model as our point of departure. The four domains of social practice chosen as primary in his method is understood as the minimal number of domains that together are useful for giving a complex sense of the whole of social life. These domains include economics, ecology, politics, and culture. The author is explicit about the need to understand that all of these are a part of social life and human activity and thus influenced by humans, and must be seen in relation to each other and to nature. All four domains are divided into seven subdomains designed to capture the key aspects of each.

Assessing urban sustainability is of course quite different from assessing aquaculture production, so we have made some important alterations. For one, we have replaced the category of ecology in the original model with environment. We do acknowledge that the intersections between the social and natural realms are blurry, and that human activity such as aquaculture production is both placed within nature and modifies nature. These are both sound arguments for using ecology as a label for this domain. However, to replace ecology with environment in the context of aquaculture production is to acknowledge that the environment is an entity in its own regard, where the influences of aquaculture production may cause permanent modifications. Much of the controversies regarding aquaculture production are precisely about the extent of impact caused to the environment. We have also chosen to replace the label politics with governance. Politics in general is of course relevant for aquaculture production, but we find that the impact of how the industry is governed either by national rules or regulations, or by norms and expectations arising from society, or the industry itself, is of higher relevance (Vigneau et al., 2015).

The Wheel of Sustainability was developed through an iterative process between the deliberations of the multidisciplinary project team and the coding of specific certification schemes. Each domain was discussed and compared to relevant research, and a list of topics relevant for sustainable aquaculture production was compiled. Following the first workshop, a suggested list of subdomains was created based on these topics, with each subdomain described and exemplified. The preliminary model was reviewed by each project member and suggestions for revisions and clarifications were communicated by email.

Author 2, Amundsen, with the aid of author 1, Osmundsen, applied the suggested domains and subdomains to a preliminary coding of the indicators in one of Aquaculture Stewardship Council's (ASC) standard. The coding was conducted in N-VIVO, with each suggested subdomain given an individual coding node. All indicators that did not pertain to any of the subdomains were coded as *Not Applicable*. These indicators were then grouped together under new possible subdomains based on their commonalities. This coding, thus, made redundant items and further specifications of the preliminary model apparent, allowing a more elaborate version to be presented to the project team at the second workshop.

During the second workshop, all subdomains within and across all four domains were discussed, over a two-day session. The group further deliberated on what other topics would be essential for achieving a sustainable industry, each drawing on their respective expertise area. Subdomains were refined, aiming to reflect the complexity of each of the topics, until the model was at a more elaborate stage. After the second workshop, Amundsen, with the aid of Osmundsen, recoded ASC, and a range of other certification scheme standards. These included GLOBALG.A.P., Global Aquaculture Alliance (GAA), BRC Global Standards (BRC), International Featured Standards (IFS), Scottish Salmon Producers' Organisation (SSPO), Royal Society for the Prevention of Cruelty to Animals (RSPCA), and Friend of the Sea (FOS), comprising a total of 1916 indicators. All these standards pertain to aquaculture production. For those schemes that have species-specific standards, we chose the version applicable to salmon aquaculture, reflecting the dominance of this industry in Norway, Scotland, and Chile. Although species-specific, issues addressed by these standards are applicable across others systems of aquaculture. The list of chosen standards was the result of a joint discussion and investigation identifying the most prevalent certification schemes for aquaculture in these countries. The inclusion of other countries and then perhaps other schemes could have produced a different result. On the other hand, the

majority of aquaculture companies in these countries portray themselves as global organisations, and the schemes selected also have a global reach.

This coding session served to verify, refine or disprove the already defined subdomains, while also revealing which indicators did not fit in this preliminary version. The coding resulted in a new list of *Not Applicable* indicators, which were again grouped together according to topic. These new potential subdomains were presented at a third project workshop, resulting in a new version of the model. To ensure relevance and robustness, this version was also presented and discussed during an open and interactive stakeholder workshop in Montpellier, France, during the Aqua2018 conference. The participants included professors, researchers, students, and consultants from Scotland, USA, Sweden, Italy, Israel, and Brazil, who confirmed the validity of the chosen domains and subdomains. All eight certification standards were thus recoded according to the model, forming the empirical data for this paper. For complete dataset, see data paper by Amundsen and Osmundsen, 2018.

An inevitable challenge of attempting to put a complex reality into a simplified model is that many issues will have aspects relevant for several subdomains. The model takes this into account, and the subdomains of our model are therefore not mutually exclusive. For this reason, each indicator was coded according to all relevant subdomains. The strength of this flexible approach is in allowing the inclusion of all aspects of a complex issue. Labour issues are, for instance, multifaceted and touch upon several topics. In this model, labour issues are therefore coded according to three different subdomains: **Labour & employment** (economics) which concerns economic compensation for labour, e.g. overtime, minimum wages, and seasonal employment. **Social assurance** (governance) which concerns basic rights of employment, such as freedom of association, contracts, and health and safety. **Employee interests & well-being** (culture) which transcends these basic rights, and includes issues such as development of expertise and career opportunities.

3. Findings

The mapping of the certification schemes shows that GLOBALG.A.P has the most extensive standard, covering 24 of 28 subdomains in the Wheel of Sustainability, closely followed by ASC (21 of 28) and GAA (20 of 28). The FOS standard is predominantly in the environmental domain as it covers all seven environmental subdomains, although it also touches somewhat upon issues within the economic and governance domains. The SSPO standard covers 13 of 28 subdomains, predominantly focusing on the environment and governance domains. RSPCA covers 11 subdomains, but being an animal welfare standard, 417 of its 468 indicators are within the subdomain of Fish Health and Welfare. IFS covers 10 subdomains and BRC, as the least extensive standard, covers 6 of 28 subdomains.

As seen in Fig. 1, there is an overwhelming focus across all schemes on environmental and governance indicators, while far fewer indicators attempt to measure impact in the domains of economics and culture (for further details, see Supplements). While 46% of the indicators fall into the environmental domain and 50% fall into the governance domain, only 3% and 1% of the indicators were identified as relevant for the economic and cultural domains, respectively.

The environmental domain focuses on the interconnections between human activity and the surrounding ecosystem. Environmental conditions range from the untouched to the modified, and this domain emphasises humans' responsibility to limit their impact on nature, while still acknowledging their place in it. The subdomains identified as most prevalent were **fish health and welfare, biotic effects**, and **abiotic effects**, in descending order. **Fish health and welfare** concerns the health and welfare of the produced species (e.g. salmonid species), as well as other species employed in production (e.g. wrasse and lumpfish used for biological delousing). The prevalence of fish health and welfare is augmented by the presence of RSPCA, a fish health standard. Omitting results from this standard, the number of indicators under fish health and welfare is reduced by 51.6% (from 808 to 391 indicators). The subdomain of **biotic effects** includes monitoring, and regulative and corrective actions to ensure minimal impact on native species and biodiversity in surrounding areas. **Abiotic effects** includes the impact aquaculture production may have on all non-living things in an ecosystem. This includes the extent to which such impacts are monitored, and preventive and corrective actions are planned for and instituted both at a company and on a national regulatory level.

The governance domain emphasises basic issues of social power through the regulation and provision of public goods and services. This includes how the industry is regulated on a public level, but encompasses also norms and practices initiated on a company-level. The subtopics that receive most attention across the certification schemes are **transparency and traceability, food safety, accountability and enforcement**, and **social assurance**, in descending order. The subdomain of **transparency and traceability** pertains to documenting how the production impacts other domains, especially that of the environment, ensuring traceability of certified fish and transparency in contracts and wage setting for workers. It is of utmost concern for a food producer to ensure that the food they produce is safe for consumption, hence the subdomain of **food safety**. The prevalence of food safety is due to the presence of two food safety standards, the IFS and BRC. Omitting results from these standards diminishes the prevalence of food safety by 88.6% (from 492 to 56 indicators). Covered by the subdomain of **accountability and enforcement** are measurements of whether the company acknowledges and assumes responsibility for its activities, whether the producer demonstrates compliance with national regulatory rules, performs internal audits, and amends and changes operations when sanctions are imposed, or errors detected. The subdomain of **social assurance** involves measurements regarding how the employer assumes responsibility for workers, and their health and safety. It includes, for example, whether the firm abides by national and international (ILO) rules concerning rights for workers, and actively works to create a healthy working environment through proper training, protective gear, and first aid.

The economic domain concerns the impact a commercial actor has on the surrounding community, through economic contribution and responsible use and management of resources. Hence, this domain refers to issues beyond the profitability of the certified firm and includes economic effects on a larger scale. In this domain, the subdomains of **investments in technology and innovation** and **labour and employment** occur most frequently. The former includes investments in research and innovation projects that may lead to development of new technology, as well as continuous maintenance and calibration of existent technology. The subdomain of **labour and employment** concerns issues related to salaries, contracts, and overtime. One of the subdomains developed as part of the reference model, **indirect effects on economic activity**, did not correspond to indicators from any of the schemes. This subdomain considers the ripple-effects of aquaculture production, i.e. its economic and employment-related significance in the local community and for the business sector at large. Examples include professional consulting and technical services, and construction activities leading to improved socio-economic conditions, as described by Filipski and Belton (2018).

The cultural domain addresses issues relating to the role of the organisation in society, acknowledging that business actors like other actors in the community bear a responsibility for the wider social fabric of their communities. The subdomains of **employee interest and well-being** and **respect for native culture** are most prevalent here. The subdomain of **employee interest and well-being** includes how the company can be seen to take responsibility for its workers, in ensuring that they have opportunities to lead a valuable life, both professionally and socially. This includes providing opportunities to learn and advance in their jobs, as well as foreseeing that grievances can be freely

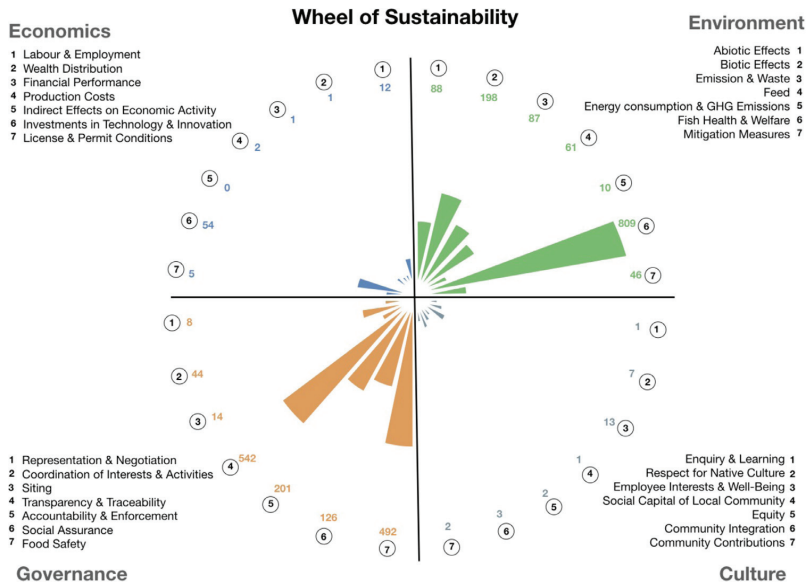

Fig. 1. Distribution of indicators across the subdomains of the Wheel of Sustainability. Coloured numbers denote the total indicators per subdomain.

communicated. **Respect for native culture** covers measurements of how the aquaculture producer can be seen to respecting, valuing, and promoting indigenous culture through consultation processes and established agreements.

4. Discussion

4.1. A skewed understanding of sustainability

Certification schemes for sustainable aquaculture production address the concept of sustainability in a practical manner by requiring aquaculture producers to comply with a predefined set of indicators. Through the indicators they measure, certification schemes define and give meaning to sustainability. As a relatively new and swiftly growing industry, aquaculture seems to hold much promise to meet the protein demands of an increasingly affluent and expanding world population. However, its rapid growth, its expansion into marine areas used by other stakeholders, the occasional crash of the production of specific species within the industry, and the multitude of claims as to the benefits of the industry have led to skepticism in some quarters. International third-party certification schemes uniquely provide a way of meeting the resulting challenges: they offer concert operationalisations of the abstract concept of sustainability, provide clear roadmaps to achieving sustainability, give producers a way to communicate their standards and values to distant consumers, and provide confidence to concerned consumers and activists by providing clear criteria and monitoring by neutral parties. However, by taking on these roles, the schemes acquire a high degree of structural power. By devising the standards and operationalisations, and granting or withholding certification of compliance, the schemes give concrete meaning to the concept of sustainability and become the arbitrators of what sustainability means.

While these schemes do to some degree focus on different issues, they do not complement each other in addressing the many different aspects of sustainability. The findings show that eight of the most widely used certification schemes predominantly emphasise issues relevant for environmental concerns and governance. The heavy weight of indicators in the environmental domain was to be expected mainly for two reasons. Firstly, the concept of sustainability arose from the environmental movement and is historically rooted in issues concerning environmental conservation (Dresner, 2012). Secondly, controversies around aquaculture production predominantly focus on environmental impacts (Forseth et al., 2017; Olsen and Osmundsen, 2017; Schlag, 2010; Taranger et al., 2015; Vollset et al., 2018).

The strong prevalence of indicators in the governance domain may be interpreted as also reinforcing the emphasis on environmental indicators, as the tools to improve environmental sustainability can be obtained from governance systems. Such tools are frequently referred to in the standards as 'presence of document and evidence', that demonstrate sampling of e.g. water quality, diseases, type and number of therapeutants, and impact on biodiversity. The main function of the subdomains occurring most frequently in the governance domain (transparency and traceability, food safety and accountability and enforcement) is to implement and legitimise environmental indicators by demonstrating control and overview of production and its potential impact. Governance also reinforces other domains and subdomains, but to a lesser extent. Looking at the coding, indicators in the governance domain overlap with the environment domain in 368 occurrences, while this is the case for only 62 indicators in the economics domain, and 19 in the cultural domain (see Table 2 in Supplements). In sum, the heavy weight of indicators in the environment and governance domain reinforces the finding that the certification schemes mainly focus on the environmental domain. The indicators for both economic and cultural sustainability are few and far between as compared to the other two domains. While this is somewhat surprising if one is concerned with sustainability in general, it is in accordance with the observations of other studies addressing social and economic sustainability (Asche et al., 2018; Kittinger et al., 2017). These studies and others (Anderson et al., 2015; Hicks et al., 2016) point to how the hegemony of environmental issues is coupled with a limited conceptual understanding of how aquaculture production also impacts the livelihoods of people and communities (Sanchez-Jerez et al., 2016).

Despite the broad character of the sustainability concept as promoted by global actors such as the UN, it seems to have developed into a narrower concept in practice, at least in terms of how certification schemes define sustainability. The concept as defined by these schemes

does not capture the intricate reality of aquaculture production, but rather promotes a skewed definition that largely ignores the economic and cultural aspects that are central to a panoptic perspective on sustainability. One reason may be that certification scheme standards are drafted to respond to the most apparent and publicly discussed risks related to aquaculture production, e.g. food safety, transparent and traceable production, and environmental impact (Osmundsen and Olsen, 2017). Indeed, Roheim et al. (2018) argue that risk management is one of the main motivations for retail chains to engage in ecolabels.

The concept of sustainability as advanced by these schemes also has a bearing on how regulatory authorities, aquaculture producers, retailers, and the general public understand and interpret sustainability, as these schemes serve as ontological devices that advance one interpretation of sustainability above others. Consequently, they influence what aquaculture producers choose to focus on, where efforts for improvements are targeted, and which issues are considered less important. For other stakeholders, such as the public, how sustainable the aquaculture industry is perceived to be is equated with environmental impact as long as other topics are downplayed.

Such a skewed or lopsided perspective on sustainability in an industry that so clearly has a key role to play in global food production may limit the development of the industry (Alexander and Abernethy, 2019). For instance, it can overlook the crucial role aquaculture companies play as an employer in rural communities, and as a global food supplier. And while such positive impacts should be accentuated in a more complete understanding of sustainability, the disregard of these issues also leads to a limited understanding of how sustainability should be achieved. The mutual dependence between issues and impacts in the environment, economic, culture, and governance domains needs to be highlighted in order to create solutions that are truly sustainable. Disregarding a broad definition of sustainability means ignoring the difficult questions and choices that society needs to face when promoting sustainable food production, which in turn can have significant implications for policy decisions. Efforts to make the industry more sustainable require a broad perspective of sustainability, not because environmental impacts are unimportant, far from it, but because trade-offs and dependencies between issues must be acknowledged. As the analysis of the different schemes has shown, this complexity is not well reflected in the schemes.

While the findings presented here point to clear limitations of these certification schemes, it is important to remember that certification is only part of a larger global governance regime and our expectations of their reach must reflect that. The various segments of aquaculture production are also subject to public regulations by their respective national authorities, in addition to the companies' own commitments to self-regulate. Furthermore, certification will have innate limitations in terms of the nature of their criteria, as metrics must be measurable, transferable, and comparable in order to allow remote assessment and compliance validation. Issues that are beyond the control of the companies are necessarily also precluded, such as the indirect effects, both positive and negative, that the industry has on local economic activity. These predetermined limitations must be taken into account when discussing certification.

4.2. Applying the wheel of sustainability

The Wheel of Sustainability as a reference model, i.e. an abstract framework that specifies the objects (or in this case subdomains) that comprise the model and their relationship to one another, has potential for broad application in improving sustainable aquaculture production. It presents a comprehensive overview of the many interconnected elements of the industry, thereby identifying the complexity that characterises the many issues to be addressed. The purpose of the model is threefold.

Firstly, it provides a valid lexicon that can serve as an asset for business managers, public administrators, scientists and others who seek to understand and grapple with sustainability in aquaculture production. It breaks up what sustainable aquaculture production entails into entities (domains/subdomains), and is an explicit recognition of concepts that many people already share. In defining how these concepts differ from, and relate to, one another, the model can improve communication between individuals involved in using these concepts.

Secondly, it functions as a tool for comparison. Although sustainability is spoken of as a widely encompassing project, both from business leaders and politicians alike, instigated initiatives of improvement are rarely equally broad. Similarly to what has been done here, the model can help contrast different schemes, initiatives, or agencies, identifying gaps and overlaps in challenges that are addressed. Furthermore, by breaking up the complexities of aquaculture production into basic concepts, the Wheel of Sustainability can be used to examine potential consequences of planned policies and practices, seeing how different priority areas may impact other aspects of the industry. In doing so, the component parts of a strategy can be discussed in relation to one another, accommodating the necessary complexity of the issues at hand.

Thirdly, the model can aid in considering trade-offs in intuitive and socially relevant terms, in that it provides an overview of relevant topics for consideration in the endeavour to achieve a more holistic form of sustainability. In contrast to the definition of sustainability provided by the certification schemes discussed in this article, the Wheel of Sustainability is a flexible framework that ensures a broad understanding of sustainability. The reference model thus reclaims the power of defining what sustainable aquaculture production is, and provides the potential for a holistic discussion and applicability of the concept.

5. Conclusion

Certification schemes have taken on the role of guiding consumers and the general public towards making sustainable choices. And while some of these standards have labels that are recognised by consumers, seldom do consumers comprehend what the standards require and how this relates to what sustainability is and should be. The main reason is the large number of schemes, and the complexity of their standards and numerous indicators. In this paper, we have investigated eight of the most widely used certification schemes for aquaculture, and shown that the scope of these schemes mostly focuses on environmental impact, while other issues pertaining to the concept of sustainability are largely ignored. The Wheel of Sustainability, as discussed in this paper, can represent a reference model for improving these certification schemes towards standards that encompass a comprehensive understanding of sustainability. Furthermore, by providing such a comprehensive overview of the many issues of sustainable aquaculture, the model can contribute to the general understanding of how to improve the industry, as well as influence initiatives in other industries.

Data availability

The data that support the findings of this study are also available in an open source database: https://sustainfish.wixsite.com/sustainfishproject/search-indicator-database

Credit authorship contribution statement

Tonje C. Osmundsen: Conceptualization, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Vilde S. Amundsen:** Conceptualization, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Karen A. Alexander:** Conceptualization, Writing - review & editing. **Frank Asche:** Conceptualization, Writing - review & editing. **Jennifer Bailey:** Conceptualization, Writing - review & editing. **Bengt Finstad:** Conceptualization, Writing - review & editing. **Marit Schei Olsen:** Conceptualization, Writing - review & editing. **Klaudia Hernández:**

Conceptualization, Writing - review & editing. **Hugo Salgado:** Conceptualization, Writing - review & editing.

CRediT authorship contribution statement

Tonje C. Osmundsen: Conceptualization, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Vilde S. Amundsen:** Conceptualization, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. **Karen A. Alexander:** Conceptualization, Writing - review & editing. **Frank Asche:** Conceptualization, Writing - review & editing. **Jennifer Bailey:** Conceptualization, Writing - review & editing. **Bengt Finstad:** Conceptualization, Writing - review & editing. **Marit Schei Olsen:** Conceptualization, Writing - review & editing. **Klaudia Hernández:** Conceptualization, Writing - review & editing. **Hugo Salgado:** Conceptualization, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no competing interests.

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Supplementary materials

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References

Aguayo, B.E.C., Barriga, J., 2016. Behind certification and regulatory processes: contributions to a political history of the Chilean salmon farming. Glob. Environ. Change 39, 81–90. https://doi.org/10.1016/j.gloenvcha.2016.04.005.

Ahi, P., Searcy, C., 2015. An analysis of metrics used to measure performance in green and sustainable supply chains. J. Clean. Prod. 86, 360–377. https://doi.org/10.1016/j.jclepro.2014.08.005.

Alexander, K.A., Abernethy, K.E., 2019. Determinants of socially-supported wild-catch fisheries and aquaculture in Australia. Fisheries Research and Development Corporation.

Alexander, K.A., Freeman, S., Potts, T., 2016. Navigating uncertain waters: European public perceptions of integrated multi trophic aquaculture (IMTA). Environ. Sci. Policy 61, 230–237. https://doi.org/10.1016/j.envsci.2016.04.020.

Alfnes, F., Chen, X., Rickertsen, K., 2018. Labeling farmed seafood: a review. Aquac. Econ. Manag. 22, 1–26. https://doi.org/10.1080/13657305.2017.1356398.

Amundsen, V.S., Gauteplass, A., Bailey, J.L., 2019. Level Up or Game Over: The Implications of Levels of Impact in Certification Schemes for Salmon Aquaculture. Aquaculture Economics & Management 23 (3), 237–253. https://doi.org/10.1080/13657305.2019.1632389.

Amundsen, V.S., Osmundsen, T.C., 2018. Sustainability indicators for salmon aquaculture. Data in Brief 20, 20–29. https://doi.org/10.1016/j.dib.2018.07.043.

Anderson, J.L., Anderson, C.M., Chu, J., Meredith, J., Asche, F., Sylvia, G., Smith, M.D., Anggraeni, D., Arthur, R., Guttormsen, A., McCluney, J.K., Ward, T., Akpalu, W., Eggert, H., Flores, J., Freeman, M.A., Holland, D.S., Knapp, G., Kobayashi, M., Larkin, S., MacLauchlin, K., Schnier, K., Soboil, M., Tveteras, S., Uchida, H., Valderrama, D., 2015. The fishery performance indicators: a management tool for triple bottom line outcomes. PLoS One 10, e0122809. https://doi.org/10.1371/journal.pone.0122809.

Andreassen, O., Karlsen, K., Robertsen, R., Solås, A.-M., 2016. Utvikling av et bærekraftsbarometer for norsk lakseoppdrett - Forprosjekt. 13 Nofima, Tromsø, Norway.

Ankamah-Yeboah, I., Nielsen, M., Nielsen, R., 2016. Price premium of organic salmon in Danish retail sale. Ecol. Econ. 122, 54–60. https://doi.org/10.1016/j.ecolecon.2015.11.028.

Asche, F., Garlock, T.M., Anderson, J.L., Bush, S.R., Smith, M.D., Anderson, C.M., Chu, J., Garrett, K.A., Lem, A., Lorenzen, K., Oglend, A., Tveteras, S., Vannuccini, S., 2018. Three pillars of sustainability in fisheries. Proc. Natl. Acad. Sci. 115, 11221–11225. https://doi.org/10.1073/pnas.1807677115.

Asche, F., Larsen, T.A., Smith, M.D., Sogn-Grundvåg, G., Young, J.A., 2015. Pricing of eco-labels with retailer heterogeneity. 10.1016/j.foodpol.2015.04.004.

Ballet, J., Dubois, J.-L., Mahieu, F.-R., 2011. La soutenabilité sociale du développement durable: de l'omission à l'émergence. Mondes En Dev 156, 89–110.

Béné, C., Oosterveer, P., Lamotte, L., Brouwer, I.D., de Haan, S., Prager, S.D., Talsma, E.F., Khoury, C.K., 2019. When Food Systems Meet Sustainability – Current Narratives and Implications for Actions. World Development 113, 116–130. https://doi.org/10.1016/j.worlddev.2018.08.011.

Busch, L., 2011. Food standards: the cacophony of governance. J. Exp. Bot. 62, 3247–3250. https://doi.org/10.1093/jxb/erq439.

Busch, L., 2017. Standards and their problems: from technical specifications to world-making, in: transforming the rural. Research in Rural Sociology and Development. Emerald Publishing Limited, pp. 97–114. https://doi.org/10.1108/S1057-192220170000024005.

Bush, S.R., Belton, B., Hall, D., Vandergeest, P., Murray, F.J., Ponte, S., Oosterveer, P., Islam, M.S., Mol, A.P.J., Hatanaka, M., Kruijssen, F., Ha, T.T.T., Little, D.C., Kusumawati, R., 2013. Certify Sustainable Aquaculture? Science 341, 1067–1068. https://doi.org/10.1126/science.1237314.

Christiansen, E.A.N., Jakobsen, S.-E., 2017. Diversity in narratives to green the Norwegian salmon farming industry. Mar. Policy 75, 156–164. https://doi.org/10.1016/j.marpol.2016.10.020.

Costa-Pierce, B.A., Page, G.G., 2013. Sustainability Science in Aquaculture. In: Christou, P., Savin, R., Costa-Pierce, B.A., Misztal, I., Whitelaw, B. (Eds.), Sustainable Food Production. Springer, New York, pp. 206–222.

Derkx, B., Glasbergen, P., 2014. Elaborating global private meta-governance: an inventory in the realm of voluntary sustainability standards. Glob. Environ. Change 27, 41–50. https://doi.org/10.1016/j.gloenvcha.2014.04.016.

Dresner, S., 2012. The Principles of Sustainability. Taylor and Francis, Hoboken.

Eakin, H., Connors, J.P., Wharton, C., Bertmann, F., Xiong, A., Stoltzfus, J., 2017. Identifying attributes of food system sustainability: emerging themes and consensus. Agriculture and Human Values 34 (3), 757–773.

Filipski, M., Belton, B., 2018. Give a man a fishpond: modeling the impacts of aquaculture in the rural economy. World Dev. 110, 205–223. https://doi.org/10.1016/j.worlddev.2018.05.023.

Foran, T., Butler, J.R.A., Williams, L.J., Wanjura, W.J., Hall, A., Carter, L., Carberry, P.S., 2014. Taking Complexity in Food Systems Seriously: An Interdisciplinary Analysis. World Development 61, 85–101. https://doi.org/10.1016/j.worlddev.2014.03.023.

Forseth, T., Barlaup, B.T., Finstad, B., Fiske, P., Gjøsæter, H., Falkegård, M., Hindar, A., Mo, T.A., Rikardsen, A.H., Thorstad, E.B., Vøllestad, L.A., Wennevik, V., 2017. The major threats to Atlantic salmon in Norway. ICES J. Mar. Sci. 74, 1496–1513. https://doi.org/10.1093/icesjms/fsx020.

Gulbrandsen, L.H., 2009. The emergence and effectiveness of the Marine Stewardship Council. Mar. Policy 33, 654–660. https://doi.org/10.1016/j.marpol.2009.01.002.

Gutierrez, A., Thornton, T., 2014. Can consumers understand sustainability through seafood eco-labels? A U.S. and UK case study. Sustainability 6, 8195–8217. https://doi.org/10.3390/su6118195.

Hicks, C.C., Levine, A., Agrawal, A., Basurto, X., Breslow, S.J., Carothers, C., Charnley, S., Coulthard, S., Dolsak, N., Donatuto, J., Garcia-Quijano, C., Mascia, M.B., Norman, K., Poe, M.R., Satterfield, T., St. Martin, K., Levin, P.S., 2016. Engage key social concepts for sustainability. Science 352, 38–40. https://doi.org/10.1126/science.aad4977.

James, P., 2015. Urban Sustainability in Theory and Practice: Circles of Sustainability, Advances in Urban Sustainability. Routledge, Taylor & Francis Group : Earthscan, from Routledge, Abingdon, Oxon, New York, NY.

Kalfagianni, A., Pattberg, P., 2013. Fishing in muddy waters: Exploring the conditions for effective governance of fisheries and aquaculture. Mar. Policy 38, 124–132. https://doi.org/10.1016/j.marpol.2012.05.028.

Kittinger, J.N., Teh, L.C.L., Allison, E.H., Bennett, N.J., Crowder, L.B., Finkbeiner, E.M., Hicks, C., Scarton, C.G., Nakamura, K., Ota, Y., Young, J., Alifano, A., Apel, A., Arbib, A., Bishop, L., Boyle, M., Cisneros-Montemayor, A.M., Hunter, P., Le Cornu, E., Levine, M., Jones, R.S., Koehn, J.Z., Marschke, M., Mason, J.G., Micheli, F., McClenachan, L., Opal, C., Peacey, J., Peckham, S.H., Schemmel, E., Solis-Rivera, V., Swartz, W., Wilhelm, T.'Aulani, 2017. Committing to socially responsible seafood. Science 356, 912–913. https://doi.org/10.1126/science.aam9969.

Klinger, D., Naylor, R., 2012. Searching for solutions in aquaculture: charting a sustainable course. Annu. Rev. Environ. Resour. 37, 247–276. https://doi.org/10.1146/annurev-environ-021111-161531.

MacKenzie, M., Laskey, K., McCabe, F., Brown, P.F., Metz, R., 2006. Reference Model for Service Oriented Architecture. OASIS Comte Draft 1.0.

Marschke, M., Wilkings, A., 2014. Is certification a viable option for small producer fish farmers in the global south? Insights from Vietnam. Mar. Policy 50, 197–206. https://doi.org/10.1016/j.marpol.2014.06.010.

Miller, P., 2004. Governing by Numbers: why calculative practices matter. In: Amin, A., Thrift, N. (Eds.), The Blackwell Cultural Economy Reader. Blackwell Publishing Ltd., Oxford, UK, pp. 179–189. https://doi.org/10.1002/9780470774274.ch10.

Morton, A., Routledge, R., 2016. Risk and precaution: salmon farming. Mar. Policy 74, 205–212. https://doi.org/10.1016/j.marpol.2016.09.022.

Olander, L., Urban, D., Johnston, R.J., Van Houtven, G., Kagan, J., 2016. Proposal for Increasing Consistency When Incorporating Ecosystem Services into Decision Making (Policy Brief No. 16– 01). National Ecosystem Services Partnership.

Nilsen, M., Amundsen, V.S., Olsen, M.S., 2018. Swimming in a slurry of schemes: Making sense of Aquaculture Standards and Certification Schemes. In: Haugen, S., Barros, A., van Gulijk, C., Kongsvik, T., Vinnem, J.E. (Eds.), Safety and Reliability - Safe Societies in a Changing World. Taylor & Francis Group, London, pp. 3149–3156.

Olander, L.P., Johnston, R.J., Tallis, H., Kagan, J., Maguire, L.A., Polasky, S., Urban, D., Boyd, J., Wainger, L., Palmer, M., 2018. Benefit relevant indicators: Ecosystem services measures that link ecological and social outcomes. Ecol. Indic. 85, 1262–1272. https://doi.org/10.1016/j.ecolind.2017.12.001.

Olsen, M.S., Osmundsen, T.C., 2017. Media framing of aquaculture. Mar. Policy 76, 19–27. https://doi.org/10.1016/j.marpol.2016.11.013.

Osmundsen, T.C., Almklov, P., Tveterås, R., 2017. Fish farmers and regulators coping with the wickedness of aquaculture. Aquac. Econ. Manag. 1–21. https://doi.org/10.1080/13657305.2017.1262476.

Osmundsen, T.C., Olsen, M.S., 2017. The imperishable controversy over aquaculture. Mar. Policy 76, 136–142. https://doi.org/10.1016/j.marpol.2016.11.022.

Osmundsen, T.C., Olsen, M.S., Thorvaldsen, T., 2020. The making of a louse - Constructing governmental technology for sustainable aquaculture. Environ. Sci. Policy 104, 121–128. https://doi.org/10.1016/j.envsci.2019.12.002.

Parkes, G., Young, J.A., Walmsley, S.F., Abel, R., Harman, J., Horvat, P., Lem, A., MacFarlane, A., Mens, M., Nolan, C., 2010. Behind the signs—a global review of fish sustainability information schemes. Rev. Fish. Sci. 18, 344–356. https://doi.org/10.1080/10641262.2010.516374.

Reiter, M., Fettke, P., Loos, P., 2013. Towards a reference model for ecological IT service management. In: ICIS. Milan.

Roheim, C.A., Bush, S.R., Asche, F., Sanchirico, J.N., Uchida, H., 2018. Evolution and future of the sustainable seafood market. Nat. Sustain. 1, 392–398. https://doi.org/10.1038/s41893-018-0115-z.

Sampson, G.S., Sanchirico, J.N., Roheim, C.A., Bush, S.R., Taylor, J.E., Allison, E.H., Anderson, J.L., Ban, N.C., Fujita, R., Jupiter, S., Wilson, J.R., 2015. Secure sustainable seafood from developing countries. Science 348, 504–506. https://doi.org/10.1126/science.aaa4639.

Sanchez-Jerez, P., Karakassis, I., Massa, F., Fezzardi, D., Aguilar-Manjarrez, J., Soto, D., Chapela, R., Avila, P., Macias, J., Tomassetti, P., Marino, G., Borg, J., Franičević, V., Yucel-Gier, G., Fleming, I., Xb, X., Nhhala, H., Hamza, H., Forcada, A., Dempster, T., 2016. Aquaculture's struggle for space: the need for coastal spatial planning and the potential benefits of Allocated Zones for Aquaculture (AZAs) to avoid conflict and promote sustainability. Aquac. Environ. Interact. 8, 41–54. https://doi.org/10.3354/aei00161.

Schlag, A.K., 2010. Aquaculture: an emerging issue for public concern. J. Risk Res. 13, 829–844. https://doi.org/10.1080/13669871003660742.

Sprague, M., Dick, J.R., Tocher, D.R., 2016. Impact of sustainable feeds on omega-3 long-chain fatty acid levels in farmed Atlantic salmon, 2006–2015. Sci. Rep. 6. https://doi.org/10.1038/srep21892.

Taranger, G.L., Karlsen, Ø., Bannister, R.J., Glover, K.A., Husa, V., Karlsbakk, E., Kvamme, B.O., Boxaspen, K.K., Bjørn, P.A., Finstad, B., Madhun, A.S., Morton, H.C., Svåsand, T., 2015. Risk assessment of the environmental impact of Norwegian Atlantic salmon farming. ICES J. Mar. Sci. 72, 997–1021. https://doi.org/10.1093/icesjms/fsu132.

Tlusty, M.F., Thorsen, Ø., 2017. Claiming seafood is 'sustainable' risks limiting improvements. Fish and Fisheries 18 (2), 340–346.

UNCED, 1992. Agenda 21. United Nations Conference on Environment & Development. Rio de Janeiro.

Vandergeest, P., Unno, A., 2012. A new extraterritoriality? Aquaculture certification, sovereignty, and empire. Polit. Geogr. 31, 358–367. https://doi.org/10.1016/j.polgeo.2012.05.005.

Vigneau, L., Humphreys, M., Moon, J., 2015. How do firms comply with international sustainability standards? Processes and consequences of adopting the global reporting initiative. J. Bus. Ethics 131, 469–486. https://doi.org/10.1007/s10551-014-2278-5.

Vollset, K.W., Dohoo, I., Karlsen, Ø., Halttunen, E., Kvamme, B.O., Finstad, B., Wennevik, V., Diserud, O.H., Bateman, A., Friedland, K.D., Mahlum, S., Jørgensen, C., Qviller, L., Krkošek, M., Åtland, Å., Barlaup, B.T., Handling editor: Mark Gibbs, 2018. Disentangling the role of sea lice on the marine survival of Atlantic salmon. ICES J. Mar. Sci. 75, 50–60. https://doi.org/10.1093/icesjms/fsx104.

Washington, S., Ababouch, L., 2011. Private Standards and Certification in Fisheries and Aquaculture: Current Practice and Emerging Issues, FAO Fisheries and Aquaculture Technical Paper. Food and Agriculture Organization of the United Nations, Rome.

Ytrestøyl, T., Aas, T.S., Åsgård, T., 2015. Utilisation of feed resources in production of Atlantic salmon (Salmo salar) in Norway. Aquaculture 448, 365–374. https://doi.org/10.1016/j.aquaculture.2015.06.023.

Supplementary Material

Table 1. Indicators coded according to domain and subdomain*

	ASC	GLOBAL G.A.P.	GAA	BRC	IFS	SSPO	RSPCA	FOS	**Total**
Total number of indicators	**152**	**267**	**137**	**255**	**278**	**307**	**468**	**52**	**1916**
Economics									
Labour & Employment	4	3	4					1	**12**
Wealth & Distribution	1								**1**
Financial Performance		1							**1**
Production Costs		1	1						**2**
Indirect Effects on Economic Activity									**0**
Investments in Technology & Innovation	3	4	1	7	16	12	10	1	**54**
License & Permit Conditions		1	3					1	**5**
Environment									
Abiotic Effects	26	21	8		1	1	10	21	**88**
Biotic Effects	46	21	22		1	68	33	7	**198**
Emission & Waste	7	24	13	8	7	13	14	1	**87**
Feed	12	16	10			3	17	3	**61**
Energy Consumption & GHG Emissions	5	3						2	**10**
Fish Health & Welfare	34	95	30			226	418	6	**809**
Mitigation Measures	2	8	7	3	6	6	12	2	**46**
Governance									
Representation & Negotiation	5	1	2						**8**
Coordination of Interests & Activities	6	3	9			24	2		**44**
Siting	4	5	3			1		1	**14**
Transparency & Traceability	20	72	42	152	133	66	48	9	**542**
Accountability & Enforcement	14	20	33	42	64	4	15	9	**201**
Social Assurance	27	45	41		4	4	1	4	**126**
Food Safety	5	36	11	219	217	4			**492**
Culture									
Enquiry & Learning	1								**1**
Respect for Native Culture	5		2						**7**
Employee Interests & Well-Being	4	5	3		1				**13**
Social Capital for Local Communities		1							**1**
Equity		1	1						**2**
Community Integration	2	1							**3**
Community Contributions		2							**2**

* Some indicators are coded under more than one subdomain, therefore the total number of codes thus supersedes that total number of indicators.

Table 2. Overlap between indicators.

	Economics	Governance	Environment	Culture
Economics		62	28	4
Governance	62		368	19
Environment	28	368		4
Culture	4	19	4	

Full description of The Wheel of Sustainability

The WOS has four domains; environment, culture, governance and economics. Each domain and pertaining subdomains will be described below. These descriptions outline the relevant aspects of each domain and are as such open for additional congruent issues not mentioned here.

ENVIRONMENT

Environment includes the practices, discourses and material expressions that occur across the intersection between the social and natural realms. The natural realm includes a spectrum of environmental conditions, from the untouched to the modified. This domain thus focuses on the questions of social-environmental interconnection, including the human impact on and place within the environment.

Abiotic Effects

This subdomain includes how impacts on local habitat and water quality are assessed, and whether key environmental variables, such as terrestrial, seabed, and water resources are continuously monitored, and subsequent preventive or corrective actions.

Biotic Effects

This subdomain includes how impacts on native species are assessed, whether biodiversity in the surrounding areas is continuously monitored, and means to ensure limited interaction with wildlife, such as measures to prevent escapes. Biodiversity includes birds, mammals, fish and bottom fauna.

Emission & Waste

This includes the assessment of environmental impacts caused by production waste and pollution through mortality, feed, the use of chemicals, etc. Further, it relates to what extent

biological and non-biological waste is handled in a proper and responsible manner, through for instance recycling.

Feed

This subdomain includes the composition and traceability of raw materials in feed as well as the efficiency of how the salmon is fed. Examples of indicators are feed factor, use of trimmings, and fishmeal/Fish Oil Forage Fish Dependency Ratio.

Energy Consumption & GHG Emissions

This includes assessment of efficient and sustainable use of energy, and continuous monitoring of emissions throughout the production chain.

Fish Health & Welfare

Measures taken by the aquaculture company to ensure the health and welfare of salmon and cleaner fish. This subdomain includes monitoring of diseases and parasites, vaccines, therapeutic treatments, extent of mortalities, etc.

Mitigation Measures

This subdomain includes the existence of contingency plans, clean-ups, emergency plans, and established routines to deal with potential mishaps.

CULTURE

Culture is the part of the social domain that emphasizes the practices, discourses and material expression that over time express the continuities and discontinuities of social meaning of a life held in common. Culture is understood as how and why we do things around here.

Enquiry & Learning

This includes the company's engagement in research and development. This can be realized through the collaboration on behalf of the aquaculture company with the local community, schools, universities or others for research, knowledge-building and dissemination purposes.

Respect for Native Culture

This subdomain is about ensuring that the company’s activities respect, value and promote the ancestral culture of the region, as many aquaculture operations are placed in areas that are claimed as traditional territories or where indigenous groups are present. This includes entering into dialogue, and establishing agreements with such groups.

Employee Interests & Well-Being

This includes how the company ensures the well-being of the employees through initiatives such as development of expertise, career advancement opportunities, language and integration courses for foreigners, social events, etc. Also procedures for conflict resolution between workers and between employer/employees are included.

Social Capital of Local Communities

This subdomain includes how the aquaculture company attempts to sustain and promote the social capital of the community, or in other words, the social fabric of the community, e.g. resources, relationships, social networks, and adaptive capacity. Elements of this may be expressed in the form of a social license.

Equity

This includes how the company may be seen to be upholding and improving the social structures and collective capabilities of the local community, such as gender equality, age non-discrimination, and by ensuring a generational approach. Equity emphasizes how the industry, alongside public efforts, are seen to meet the needs of groups in the local community.

Community Integration

Community integration is about fostering a sense of identity between the company and the local community, and about taking initiatives to make the employees feel integrated in the company and creating a sense of belonging.

Community Contributions

This subdomain includes how the aquaculture company can be seen to contribute to the local community by e.g. donating money to local communities, e.g., schools, sport teams, events, or by hosting or sponsoring events.

GOVERNANCE

Governance is the part of the social domain that emphasizes practices and meaning related to how public goods and services are provided and regulated. This refers to basic issues of social power as they pertain to the organization, authorization, legitimation and regulation of a social life held in common. It includes how the industry is regulated on a national level, but encompasses also the norms and practices initiated on a local and company level.

Representation & Negotiation

This subdomain includes the presence and influence of stakeholders facilitated through available forums where different interests and concerns can be communicated and discussed. It also contains the encouragement of participation and inclusion of the local community through access to information regarding the company's operations, intentions, and plans. Resources and capacity to receive and process criticism and complaints, and evidence of how such conflicts are handled is also encompassed by this subdomain.

Coordination of Interests & Activities

This includes the coordination with other activities in the area, such as fisheries, recreation, and tourism, such as planning capacity and willingness to deal with conflicts from multiple uses of marine space and resources, e.g. conflicts of interest, displacement of other activities, and general loss of amenity. Also collaboration and coordination with nearby aquaculture facilities and their production is included. Participatory marine spatial planning, as instigated by government or by shared agreement, is also underneath this subdomain.

Siting

This subdomain includes how the siting process of an aquaculture location is undertaken, referring to the geographical location of the site. It encompasses how local communities and other stakeholders are consulted and heard, whether protected areas and waterways with migrating salmon is considered, and whether assessment and knowledge about nearby eco-systems are included into the planning process.

Transparency & Traceability

This subdomain includes how the aquaculture company allows for openness surrounding daily operations, and the decision-making process. This also includes the accessibility and circulation of information, both on own initiative and on request. Additional information may include e.g. degree of accessibility, available information channels, choice of language, and format. Both internal transparency within the company and external transparency towards the public, as well as record-keeping are part of this subdomain.

Accountability & Enforcement

This includes knowledge of and compliance with all applicable national and local rules and regulations by the aquaculture company, as well as enforcement and sanctions when rules and

regulations are not followed. Whether or not the company has internal requirements to behaviour, and/or internal audits is also included.

Social Assurance

This subdomain includes upholding the rights of employees, based on national regulations and as stated by the International Labour Organization (ILO)– e.g. freedom of association, contracts, working hours, equality in hiring process, and no discrimination.

Health and safety is also included here, meaning requirements of use and availability of personal protective equipment, as well as necessary training. An emphasis on upholding a safety culture through training, health plans, and a focus on potential risks in procedures and contingency plans is encompassed.

Food Safety

This subdomain includes how food safety is ensured throughout the production chain. This may be done through for instances procedures, HACCP, quality systems and risk assessments.

ECONOMICS

Economics includes the practices, discourses and material expressions related to production, use and management of resources for seafood production. This domain contains direct measures of economic sustainability such as firms' financial return on investment, as well as economic effects on a larger scale to capture the impact of the production activity on the surrounding society.

The subdomains of economics are:

Labour & Employment

This subdomain includes indicators that measure the relative level of salaries compared to the local, regional or national level, required skills or competence, and the availability of jobs. This refers also to the permanency vs. seasonal positions.

Wealth Distribution

Distribution of wealth encompasses how the aquaculture company distributes its wealth in the local, regional or national community. Municipal taxes may be one such indicator.

Financial Performance

The financial performance of the aquaculture company as measured by several possible indicators, e.g. profits, EBIT, EBIT/kg, ROI, ratio between production and mortality/loss, and difference between price and total cost (excl. salaries).

Production Costs

This subdomain includes indicators that refer to different aspects of production costs, such as feed, transportation, slaughtering, labour, investment, capital and access to credit, but also environmental monitoring and measurements. It refers to the cost of treatment of diseases and parasites, such as vaccines, therapeutic treatments, non-medical treatments and veterinary services.

Indirect Effects on Economic Activity

The aquaculture company may make investment in public infrastructure that benefits the local community, e.g. roads, buildings, piers, slips, broadband, and housing. This subdomain also includes ripple effects such as local businesses established throughout the supply chain, e.g. net-makers/cleaners, smokehouses, supply and waste management, or other businesses funded by aquaculture money.

Investments in Innovation & Technology

This subdomain includes investments done in research and innovation projects which may lead to development of new technology.

License & Permit Conditions

This subdomain encompasses the conditions pertaining to how licenses and permits are obtained by the aquaculture industry, including price, length of the permit, type of ownership, and conditions of rent, as well as conditions for production set in obtained licenses and permits.

Paper B

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'Social stuff' and all that jazz: Understanding the residual category of social sustainability

Karen A. Alexander[a,b,*], Vilde S. Amundsen[c,d], Tonje C. Osmundsen[d]

[a] Centre for Marine Socioecology, University of Tasmania, Private Bag 49, Hobart TAS, 7000, Australia
[b] Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 49, Hobart TAS, 7000, Australia
[c] Department of Sociology and Political Science, Norwegian University of Science and Technology, Norway
[d] Studio Apertura, NTNU Samfunnsforskning, Dragvoll Allé 38 B, 7049 Trondheim, Norway

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ABSTRACT

Recently we have seen a substantial increase in pressure for industries, such as aquaculture, to become more sustainable. When it comes to practical attempts to operationalise sustainable development, however, the 'social stuff' is often neglected. In this paper, we provide a detailed exploration of how the concept of social sustainability is operationalised (and therefore understood) within the aquaculture certification context. We found that a) certification schemes do address social sustainability, but relevant indicators mostly focus on workers' rights, or link directly back to environmental sustainability (through the consequences of environmental impact on humans); and b) the actions required often add little over and above existing legal requirements. Essentially, aquaculture sustainability certification schemes have not (yet) taken the opportunity to further shape our understanding of what social sustainability means, or how it is practiced. The consequence of this may be the impression that industries are truly sustainable, just because they have obtained sustainability certification.

1. Introduction

In recent years, there has been a substantial increase in pressure for industries to become more sustainable (Portney, 2015). One such industry is aquaculture (Andreassen et al., 2016; Osmundsen et al., 2020b; Costa-Pierce and Page, 2010). Seafood is the world's most widely traded food commodity (Kittinger et al., 2017), and aquaculture comprises 47 per cent of the world's total global fish production (FAO, 2018). Furthermore, aquaculture occurs in almost every country, in every permanently inhabited continent, and the bulk of production occurs in developing countries (Subasinghe et al., 2009). This suggests that aquaculture is a critical industry globally, whose challenges in identifying and meeting the criteria for social sustainability could offer important lessons for the field of sustainability studies.

Of the three commonly accepted pillars of sustainable development – economic, environmental and social – the social dimension is often the vaguest and least explicit, and even neglected, when it comes to practical attempts to shape sustainable development (Vifell and Soneryd, 2012; Anderson et al., 2015; Ballet et al., 2011; Béné et al., 2019; Eakin et al., 2017; Foran et al., 2014). This is likely due to the intangible (i.e. difficult to pin down), qualitative nature of social sustainability, making it harder to quantify or measure, in addition to a lack of awareness of, and consensus on, relevant criteria (Von Geibler et al., 2006; Hicks et al., 2016). Furthermore, the social is often seen and treated together with economic (social-economic), further mystifying the idea of social sustainability (Kuhlman and Farrington, 2010). This means that the other dimensions tend to be privileged over the social domain.

When it comes to the sustainability of aquaculture, we see the same thing. As a result of criticism pertaining to issues such as emissions, spread of disease, irresponsible sourcing of feed, and conflicts with other marine users, the aquaculture industry has struggled in terms of public perception and trust (Burridge et al., 2010; Graziano et al., 2018; Krause et al., 2015; Osmundsen and Olsen, 2017; Ytrestøyl et al., 2015). This has intensified the 'sustainable seafood movement', involving a widespread demand for more responsible practices and increased accountability (Bush and Roheim, 2019). Aquaculture also has social sustainability impacts on, for example livelihoods and community resilience (Orchard et al., 2015) but research into what these impacts are is currently lacking. Regardless, social issues primarily lose ground to the environmental dimension within aquaculture, which is reflected both in the media (Olsen and Osmundsen, 2017) and in aquaculture certification schemes (Osmundsen et al., 2020a).

Aquaculture certification is considered one approach to steer

* Corresponding author at: Centre for Marine Socioecology, University of Tasmania, Private Bag 49, Hobart TAS, 7000, Australia.
E-mail address: Karen.Alexander@utas.edu.au (K.A. Alexander).

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aquaculture towards sustainable production (Bush et al., 2013), and in this paper we build upon previous work, which mapped aquaculture certification schemes against domains of sustainability (Osmundsen et al., 2020a), to explore how the concept of social sustainability specifically is operationalised (and therefore understood) within the aquaculture certification context.

1.1. Conceptualising the 'social stuff': three approaches

Similar to other industries, the seafood sector has been criticised for neglecting social issues (Kittinger et al., 2017). However, before we turn to social sustainability in aquaculture, and aquaculture certification specifically, it would be pertinent to review how social sustainability is understood in the business world more generally. Despite the clear social mandate in sustainable development, social sustainability is a 'concept in chaos' with much uncertainty regarding the term's many meanings and applications (Vallance et al., 2011). Rather than try to unravel the chaos, we take a different path. We highlight three key business-oriented approaches which consider social matters regarding sustainability: Corporate Social Responsibility, the Triple Bottom-Line approach and Social Licence to Operate. We present each in turn before synthesising the approaches to produce a business-oriented understanding of social sustainability which may be useful for assessing a market-based tool such as certification.

1.1.1. Corporate social responsibility

Although references to a concern for social responsibility appeared earlier, the body of literature regarding the concept of Corporate Social Responsibility (CSR) began to develop in the 1950's. It expanded during the 1960's and proliferated during the 1970's; since which time the concept has matured (for a discussion on the evolution of the topic, see Carroll, 1999). Indeed, it is now a concept which has become dominant in business reporting and almost every corporation has a policy concerning CSR and produces an annual report detailing its activity in this space (Crowther and Seifi, 2018).

Despite the broad base of knowledge relating to CSR, there is still some confusion regarding how it should be defined. The broadest definition of CSR is concerned with the relationship between business and society. Dahlsrud (2008), however, suggested there are five dimensions to CSR: the stakeholder dimension (how the organisation interacts with stakeholders including employees), the social dimension (the relationship between business and society), the economic dimension (socio-economic or financial contribution), the voluntariness dimension (going beyond legal obligations), and the environmental dimension (stewardship of the natural environment).

In addition to the proliferation of definitions, there are also myriad theories of and approaches to CSR. To 'map the territory', Garriga and Melé (2004) classed the main theories and related approaches into four groups. They suggest that most current theories of CSR focus on one of four main dimensions: (i) producing long-term profits, (ii) using business power responsibly, (iii) integrating social demands, and (iv) doing what is ethically correct for society. The authors further suggest that a new theory on the business and society relationship should integrate all four dimensions. No matter how the concept is presented, it would appear that Crowther and Seifi (2018) are correct when they propose that the debate is "concerned with some sort of social contract between operations and society" (p.11).

More recently, researchers have started to question the role that CSR could/should have in addressing social justice issues such as poverty, social exclusion and other development challenges (Newell and Frynas, 2007; Manteaw, 2008). However, there is much debate in this space. Some authors argue that CSR can contribute towards socio-economic wellbeing (Jafar, 2019; Xia et al., 2018), whilst others argue that CSR practices are more about building public image and undermine the social wellbeing goal for sustainable development (Hoque et al., 2018).

1.1.2. Triple bottom-line

As sustainability has received much criticism for being difficult to put into practice due to its vague character (Custance and Hillier, 1998; Davidson, 2011), the Triple Bottom Line (TBL) concept has attempted to concretise sustainability through the three pillars model of environmental, economic, and social sustainability. This tripartite conceptualisation can be traced back to John Elkington (1998), who argued that "[s]ociety depends on the economy — and the economy depends on the global ecosystem, whose health represents the ultimate bottom line (p. 73)." Elkington (1998) describes the three 'bottom-lines' in terms of different types of capital. The environmental bottom-line includes natural capital; the economic bottom-line includes physical, financial, human, and intellectual capital; and the social bottom-line includes human and social capital. In some instances, the concept of the Quadruple Bottom-Line (QBL) is now being used, which includes a governance pillar in addition to the standard three. Under this pillar, aspects such as ethics, integrity, financial resilience, community engagement, transparency and accountability are also considered (Alibašić, 2018).

From the inception of the TBL concept and continuing today with QBL, businesses have been criticised for not acknowledging the importance of the social dimension (Elkington, 1998; Hicks et al., 2016; Pedersen, 2006). However, increasingly attention is being paid to how social life and human activity is intertwined with the economic sphere, be it social movements' impact on economic activity or the impact of economic activity on global society (Elkington, 1998; James, 2014; Kittinger et al., 2017). In doing this, the sustainability agenda is set in the corporate context by addressing economies' placement *within* society (Mauerhofer, 2008). As an approach, the TBL/QBL is utilised as a reporting instrument for companies to demonstrate how implemented measures "protect or improve the environment, […] grow the economy through their own financial bottom line, and […] improve equity" (Portney, 2015 p. 39). With this, the aim is to broaden the centre of attention of businesses beyond profits, to also include planet and people (Henson and Humphrey, 2012).

1.1.3. Social licence to operate

Historically, the term social licence or social licence to operate (SLO), was used for industrial activities (often mining) in countries with relatively weak regulations, to create legitimacy for industry in the absence of well-established formal institutions. In recent years, SLO is increasingly applied to different types of industries, and across different institutional contexts. Within the marine sector and in aquaculture (for an overview see: Mather and Fanning, 2019b), SLO is still considered an emergent concept (Kelly et al., 2019), even though some studies have been conducted such as in Scotland (Whitmarsh and Palmieri, 2009; Whitmarsh and Wattage, 2006; Alexander et al., 2014), Greece (Katranidis et al., 2003), Australia (Leith et al., 2014; Alexander and Abernethy, 2019), Canada (Rayner and Howlett, 2007), New Zealand (Quigley and Baines, 2014), and in Europe (Alexander et al., 2016a, b).

Social licence has been interpreted and defined in several different ways (Prno and Slocombe, 2012; Owen and Kemp, 2013; Kelly et al., 2019), and been contentious (Owen and Kemp, 2013; Moffat et al., 2016). A general definition is that SLO is the result of acceptance or approval of an industrial activity by local community stakeholders who are affected by it (Joyce and Thomson, 2000; Nelsen and Scoble, 2006; Moffat and Zhang, 2014; Boutilier and Thomson, 2011). Social licence is often operationalised as trust or approval and this implies that the relationship between a company and the community is one of collaboration, goodwill and characterised by perceptions of having a common/shared experience and goals.

There are numerous factors that influence a SLO. The dialogue between the company and the public, and the company's actions following that, matters for the social licence (Moffat and Zhang, 2014; Mercer-Mapstone et al., 2017, 2018). Earlier studies of the mechanisms of social acceptability of aquaculture focused on the material outcomes

from it, both economic (wages and taxes), environmental and social in terms of employment (Whitmarsh and Palmieri, 2009), and later studies also find that distribution of benefits matters (Alexander and Abernethy, 2019). Governance arrangements that ensure responsible industry performance, and how the public perceives these arrangements as capable of managing the social and environmental impact of aquaculture activities, is influential in creating a SLO (Alexander and Abernethy, 2019; Zhang et al., 2015). In sum, factors such as whether the activities of the firm are deemed acceptable and within social norms, its dialogue with the community, distribution of benefits, presence of collaboration and involvement, and trust in governmental regulation will affect the community's willingness to accept or approve of industrial activities, i.e. granting a social licence.

1.1.4. A working definition of 'social sustainability'

All three approaches situate the private company as **an actor 'of and in society'**, and it is through such a definition that the company receives duties and obligations. As an employer, they must consider labour issues, e.g. fair pay, contracts, health and safety, training. As a social player, they must consider ethical conduct, the consideration of social demands, fair distribution of benefits, equity, and collaboration with society based on trust and reciprocity. Therefore, we propose this as a working definition of social sustainability for the purposes of this paper. We recognise that this is a normative and a Western-centred definition, but in the absence of a more encompassing definition, we use this as a starting point for our investigation.

1.2. Operationalising the 'social stuff'

The ways in which these three approaches have been operationalised in aquaculture has been the subject of some scholarly investigation (Costa-Pierce and Page, 2010; Leith et al., 2014; Vince and Haward, 2019; Huemer, 2010; Bailey et al., 2018). However, questions remain regarding whether the activities relating to these approaches are enough in addressing social sustainability. As seen here, all three approaches are characterised by vague definitions, suggesting that they are not easily operationalised. Furthermore, whilst such approaches (particularly SLO) were primarily used by the company to improve relations with relevant stakeholders and communities, they are now increasingly concepts used by environmental justice groups, non-governmental organisations and local communities to contest unpopular industrial developments (Mather and Fanning, 2019a). This means that ways of concretising the 'social stuff' are increasingly originating from outside of the industries themselves.

With regards to aquaculture, we have seen a move towards a more hybrid form of governance (where non-state market driven actors contribute to a new form of governance that links the market and community; Vince and Haward, 2019). The market, in the form of third party certification, plays an increasing role in determining how sustainability is represented, and operationalised, within the aquaculture industry (Osmundsen et al., 2020a). Currently there are more than 25 seafood certification schemes in existence (Parkes et al., 2010), many of which focus solely on aquaculture. Each scheme is established with a purpose in mind. Some focus on single issues such as the IFS Food Standard (food safety and quality) and the Royal Society for the Prevention of Cruelty to Animals (RSPCA) certification (animal welfare), while others are more general, covering aspects of food safety and quality, social impacts, environmental impacts, and animal welfare (Nilsen et al., 2018). This means that companies often aim to comply with several schemes and the various combinations of certifications can 'muddy the waters' when it comes to sustainability. The version of sustainability presented by each individual company can be vastly different. Overall, however, sustainability as presented by aquaculture certification schemes tends to be skewed towards environmental sustainability and the governance requirements to enforce it; the social is much less often a focus (Osmundsen et al., 2020a).

Therefore, we must understand how certification schemes do represent social sustainability, particularly given the focus of hybrid governance on addressing community concerns about the sustainability of the industry (Vince and Haward, 2019). To do this, we ask two key questions: a) do aquaculture certification schemes address social sustainability and if so, which aspects of social sustainability do they address (as per our working definition), and b) how do aquaculture certification schemes attempt to measure these facets of sustainability?

2. Material and methods

This is a qualitative research study which takes an inductive approach. We undertook a comparative analysis of secondary data. We used data collated through the Norwegian Research Council funded SustainFish project. The SustainFish project constructed a reference model for sustainability in salmon aquaculture, named the "Wheel of Sustainability" against which eight aquaculture certification standards were coded for a variety of sustainability domains and sub-domains (Osmundsen et al., 2020a). The schemes assessed were: i) Aquaculture Stewardship Council; ii) Global G.A.P; iii) Friend of the Sea; iv) International Featured Standards; v) BRC Global Standards[1] ; vi) Royal Society for the Prevention of Cruelty to Animals; vii) Global Aquaculture Alliance; viii) Scottish Salmon Producer's Organisation Standards. The study presented here was conducted by the same group of researchers, and as such we believe that the data collected is valid for the purpose of this study.

Based on the three approaches described above, CSR, TBL and SLO, and our synthesised definition of social sustainability based on those approaches, we identified that several sub-domains from the Wheel of Sustainability reference model were directly relevant to social sustainability. These included: accountability and enforcement, community contributions, coordination of interests and activities, employee interests and well-being, enquiry and learning, equity, labour and employment, representation and negotiation, respect for native culture, social assurance and social capital of local communities (for more information on what each sub-domain consists of, see Amundsen and Osmundsen, 2018). Therefore, we used the Wheel of Sustainability reference model as a point of departure for this study.

Data analysis consisted of two steps. As a first step, we created a database in Microsoft Excel to capture the indicators used by each scheme, which aligned with the relevant social sustainability sub-domains from the Wheel of Sustainability. We used pivot tables to analyse how many indicators related to each of the sub-domains, to provide a broad overview of how they related to our definition of social sustainability. As a second step, the data was thematically re-coded, using NVivo 10, to provide more specific and richer detail regarding the focus of each indicator. The text was coded in two key ways. Firstly, it was coded into themes relating to the specific area of focus of each indicator. Secondly, the indicators were coded according to the action required by each indicator (e.g. if a measurement was required, if documentation was required or if a process required implementation).

The most obvious advantage of the secondary analysis of existing data is the low cost. Inherent to the nature of the secondary analysis of existing data, the available data are not collected to address the particular research question or to test the particular hypothesis. Another major limitation of the analysis of existing data is that the researchers who are analysing the data are not usually the same individuals as those involved in the data collection process. In this case, however, the researchers were the same individuals.

Importantly, whilst we are examining eight different standards, this study is not intended as a comparison of these standards. Rather, we are examining a wide range of standards for sustainable aquaculture in

[1] BRC Global Standards became BRCGS after the research was conducted and is, therefore, referred to as BRC throughout this paper.

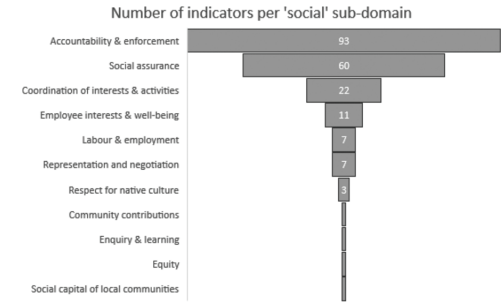

Fig. 1. The number of indicators identified as belonging to each of the sub-domains from the Wheel of Sustainability reference model.

order to obtain a comprehensive picture of which social issues are addressed by sustainability certification, how these issues are addressed, and how these relate to our definition of social sustainability.

3. Results

3.1. Do aquaculture certification schemes address social sustainability and if so, which aspects of social sustainability do they address?

In total, 11 per cent of indicators (206 of the 1916 indicators coded in the reference model) were identified as directly relevant to social sustainability. This suggests that social sustainability is addressed by certification schemes, although it is clearly not a key focus.

Our results indicate that some social sustainability relevant sub-domains from the Wheel of Sustainability reference model are significantly more present in certification schemes than others (Fig. 1). Accountability and enforcement (93 indicators) and social assurance (60 indicators) are the sub-domains with the largest number of indicators. For social sub-domains such as community contributions, enquiry and learning, equity, and social capital of local communities, we only identified one indicator for each. At this broader level, we see little evidence of certification schemes requiring companies to act as a social player, other than in their roles that relate to accountability regarding environmental impact, and as an employer.

As we moved from using the sub-domains as a broad-brush analysis framework to a more detailed thematic examination of the text of the social sustainability indicators, allocating a theme for the area of focus for each indicator (Fig. 2), we found that impacts on the environment or product were the largest area of concern (62 indicators). This theme included concerns around allergens, biosecurity, contamination, waste disposal and food safety. For example:

> *The company shall provide staff facilities, which shall be proportional in size, equipped for the number of personnel and designed and operated so as to minimise food safety risks. Such facilities shall be kept in clean and good condition.*
> *Has the producer considered how to enhance the environment for the benefit of the local community and flora and fauna? Is this policy compatible with sustainable commercial agricultural production and does it strive to* minimize *environmental impact of the agricultural activity?*

For this theme, much of the focus is on the consequences that environmental impacts have for people/local communities, or the governance of such, and so are 'social' only in the broadest sense of the term.

We identified workers' rights (54 indicators) as the second largest theme area. Workers' rights address the responsibility that companies have for their employees. This theme included sub-themes such as basic/minimum wages, bullying and harassment, child labour, collective bargaining, disciplinary action, discrimination, forced labour,

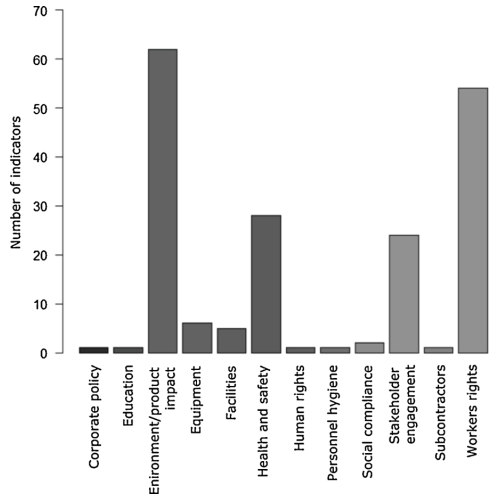

Fig. 2. Number of indicators by thematic area of focus.

grievances, and workers' health/transport/housing. For example:

> *The applicant shall meet or exceed the minimum wage rate and benefits required by local and national* labor *laws.*
> *All work, including overtime, must be voluntary. The facility shall not engage in any form of forced or bonded* labor.
> *If provided, employee housing shall meet local and national standards (e.g., water-tight structures, adequate space, heating/ ventilation/ cooling), and shall be free of accumulated trash and garbage.*

Health and safety, the third most common theme identified (28 indicators), is also largely related to how workers are treated on-site. This relates to the use of e.g. protective clothing, safe use of boats and diving equipment, first aid, accidents, and training to deal with such issues. In several of these indicators, site sub-contractors and visitors are also referred to, otherwise we would have considered health and safety a sub-set of workers' rights.

Stakeholder engagement and consultation (24) emerged as the fourth most commonly analysed theme, far above the remaining identified areas of concern. This theme included sub-themes such as consultation with communities and indigenous peoples, conflict avoidance or resolution, complaints, resource access and public requests for information. For example:

> *Where applicable, the applicant shall demonstrate dialogue with local native peoples and a process for conflict resolution with them under the laws governing their rights.*
> *Presence and evidence of an effective policy and mechanism for the presentation, treatment and resolution of complaints by community stakeholders and organizations.*
> *The applicant shall accommodate local inhabitants by not blocking access to fishing areas and other public resources.*

Several thematic areas (education, human rights, personnel hygiene, subcontractors and corporate policy) were only mentioned in 0.05 % of the indicators (i.e. each in only 1 of 1916 indicators). The education indicator focused on a requirement for courses, certificates and degrees for workers. The indicator relating to human rights required a self-declaration on good social practice regarding human rights which was signed by the management and the employees' representative(s) and communicated to the employees. The personnel hygiene indicator required compliance with personnel hygiene requirements to be checked regularly. The subcontractor indicator related to the need for subcontractors to be legally allowed to undertake the

work that was required of them. That each of these aspects are only mentioned in a single indicator each suggests that they are not aspects that are considered of huge importance. Lastly, the corporate policy indicator related to the need for the senior management to draw up a policy which covered customer focus, environmental responsibility, sustainability, ethics and personnel responsibility, and product requirements. This was, essentially, a catch-all indicator which could not easily be designated elsewhere.

Even with this deeper and more detailed analysis of the certification schemes, there is little evidence that certification schemes require companies to act as social players. We see little reference to ethical conduct, the consideration of social demands, fair distribution of benefits, equity, and collaboration with society based on trust and reciprocity – as presented in our working definition. We do see stakeholder engagement and consultation emerge as an important theme – but this could indicate that only public relations are considered important, as opposed to truly conforming with social sustainability norms.

3.2. How do aquaculture certification schemes attempt to measure social sustainability?

A total of 235 actions were identified in our analysis. This number is higher than the number of indicators because on several occasions an indicator required more than one action. Moreover, few indicators were quantitative (in that they required numerical measurements; 10 indicators).

Regarding the type of action that is required by these indicators, we see that compliance with national law/legal commitments is the largest action (60 indicators; Fig. 3). Examples include:

> *Where required by legislation, the site shall be registered with, or be approved by, the appropriate authority.*
> *All current legal requirements for waste disposal shall be met.*
> *All relevant legislation regarding notifiable diseases must be understood and adhered to.*

This reveals that in many instances, the requisite actions add little over and above existing legal requirements. This raises the question of how committed corporations really are to social sustainability or whether they are committed only to traditional legal compliance.

The second most common way in which social sustainability indicators are assessed is through the provision of documentation (45 indicators). This may relate to documentation of new procedures that are required (see below), or it may be the documentation of practices which already exist. Examples include:

> *Is there documented evidence indicating regular payment of salaries corresponding to the contract clause?*
> *There shall be a written worker grievance process, made available to all workers, that allows for the anonymous reporting of grievances to management without fear of retaliation.*
> *The producer must, through documented evidence, demonstrate that any co-operative management schemes between operations in the same loch/area aimed at reducing sea lice populations have been entered into.*

The latter example is an interesting one because of its use of the term 'evidence'. A requirement for evidence was stated in 22 of the indicators – however, on many occasions it was not clear what such 'evidence' should look like. For example:

> *Evidence of regular consultation and engagement with community representatives and organizations*
> *Evidence that workers are free to form organizations, including unions, to advocate for and protect their rights*
> *Evidence of a functioning disciplinary action policy whose aim is to improve the worker*

It may be that documentation is the means by which such evidence would be provided. However, because this was often not stated explicitly in the indicator, the requirement for evidence was coded as a separate type of action.

Our results also revealed that the establishment of a procedure or process was also a key action by which to assess social sustainability (22 indicators). In some cases, this involved the reporting of issues, in others it involved activities such as internal audits or on-site inspection. Examples include:

> *The applicant shall demonstrate interaction with the local community to avoid or resolve conflicts through meetings performed annually or more often, committees, correspondence, service projects or other activities.*
> *Presence and evidence of an effective policy and mechanism for the presentation, treatment and resolution of complaints by community stakeholders and organizations.*
> *Have effective corrective actions been taken as a result of non-conformances detected during the internal self-assessment or internal producer group inspections?*

Regarding some of the less-commonly referred-to actions, the indicators were often quite specific – i.e. identify a responsible person, undertake a risk assessment, make sure training is available, or communicate with stakeholders or relevant organisations.

These findings suggest that either it is not possible to, we do not know how to, or there is no will to measure the social sustainability of aquaculture.

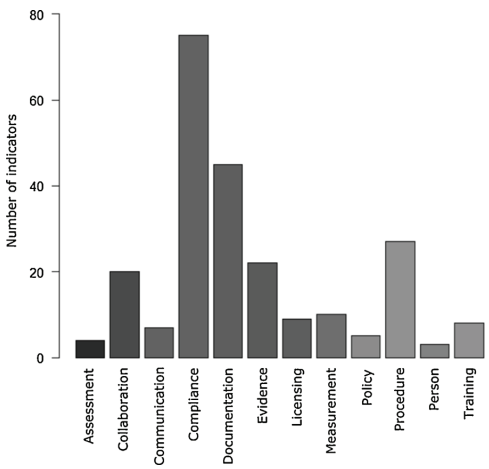

Fig. 3. Number of indicators by action required.

4. Discussion

Two key findings have arisen in this study. Firstly, when combined, these aquaculture sustainability schemes can be considered to address *some aspects* of 'social sustainability' as per our working definition. However, there is little evidence that certification schemes require companies to do more than consider public relations, as opposed to truly conforming with social sustainability norms. Secondly, the actions required often add little over and above existing legal requirements. This suggests obstacles to measuring social sustainability, be it due to a lack of knowledge or a lack of will.

Sustainability certifications appear to have become the 'new fashion' when it comes to advancing sustainability, the idea being that certifications provide businesses with an incentive to use more sustainable practices (Bush et al., 2013). However, there is little evidence to prove such suggestions true. In some cases, it has been suggested that such schemes may lead to improved environmental sustainability, for

example reducing deforestation (Carlson et al., 2018) and aquaculture related emissions (Nhu et al., 2016). Much of the criticism relates to the assumed inherent limitations of site/company-level certification, questioning their capability of addressing externalities beyond individual production sites (Amundsen et al., 2019; Bush et al., 2013). Although improvements in environmental sustainability due to certification are often not evident (Gupta and Racherla, 2016; Morgans et al., 2018), there is even less evidence regarding economic and social sustainability (although see DeFries et al., 2017 for an example of a weak positive link).

Our results suggest that this may be due to two reasons: i) the very limited aspects of social sustainability that are considered within the certification schemes analysed; and ii) the limited inclusion of indicators which go above and beyond what is already required by national legislation. Colantonio (2009) argued that there is no consensus on the definition of social sustainability because the concept is being approached from diverging study perspectives and discipline-specific criteria and that this makes a generalised definition difficult to achieve. In accordance with this view, we find that any consideration of the social category (including the working definition that we provide in the introduction) is too vast, covering highly divergent issues related to local community, civil society, and workers' rights. Social sustainability has, in other words, become a residual category for all those intangible matters involving humans. Such a wide-reaching category has proven unfruitful in addressing the many challenges of both the aquaculture industry and other sectors, as the generality leaves the issues at hand, as well as the allocation of responsibilities, undetermined.

Consequently, we argue that we need to consider social sustainability in a different way. It may be that the reference model developed by the SustainFish project (Osmundsen et al., 2020a), which was undertaken as an interdisciplinary project, can provide a starting point to help address this, at least for seafood certification. In the SustainFish reference model, the 'social stuff' falls under two categories:

1 Governance – which pertains to most of the themes identified in this study, particularly in regard to employee rights and public relations
2 Culture – which relates much more to the company as social player and considers aspects such as community contributions, wellbeing, equity, social capital and respect for native culture.

It is the second of these categories that appears to be entirely missing from common considerations of the 'social stuff'. Importantly, 'social stuff' as explored here refers to what the industry understands as social sustainability (indeed, the term 'social stuff' arose from industry interviews undertaken by the authors). Being based on the definitions of CSR, TBL and SLO, this also echoes a more general understanding of what are (and are not) socially relevant issues. Clearly, the industry does not consider what we have termed 'cultural sustainability' to be important. However, for aquaculture companies to truly achieve 'social sustainability' certifiers should consider the inclusion of sustainable 'governance' **and** 'culture' requirements.

The lack of standard criteria that address social sustainability, particularly in the 'cultural' domain, could be related to the intangible, and difficult to quantify or measure, nature of social sustainability described in the introduction. There are, however, ways in which companies can be assessed on these issues. Indicators could include, for example: documentary evidence of native culture considered in site planning and operation, percentage of profit directed to community sponsorship, documentary evidence of opportunities for staff to undertake developmental training, or percentage gender split of those in senior positions.

Some companies do already contribute to what could be considered 'cultural' sustainability outside of certification schemes. For example, in their sustainability report 2018, Lerøy Seafood Group (a seafood production and distribution company based in Norway) provided a section on 'social impact' detailing issues relating to workers' rights, but also to social integration, health, supporting young people's activities, and their contributions to the United Nations Sustainable Development Goals (Lerøy Seafood Group ASA 2018). Aquaculture companies, like most private businesses, are aware of the value of having a positive public image, and apply highly diverse strategies in tending to their public image (Osmundsen et al., 2012). Such strategies range from focusing solely on fish production, to engaging in entrepreneurship, going into politics locally, local community alliances, and research and development partnerships (Osmundsen et al., 2012; Alexander et al., 2014).

Clearly companies have started to move beyond the role of employer and economic agent, which is already well-addressed by the schemes, towards the role as social agent. If this is to be enshrined in certification, this will have implications for the company. They can never again retract to a more comfortable role as mere economic agents. This will also have implications for how we understand the world. The inclusion of 'cultural' indicators in market instruments such as certification schemes could be viewed as a step forward in the project to shape the world in a way which makes it more adequate to the neoliberal model (Clarke, 2005; Larner, 2003). Or, such private regulatory initiatives embracing domains traditionally viewed as the responsibility of public regulation might also prove to yield worse outcomes (Overman and Van Thiel, 2016), spurring a counter pendulum movement back to the regulatory state safeguarding public interest. However, it is likely that, given the role of certification in moving towards environmental sustainability, the only way to do the same with social sustainability would be to include indicators relating to the SustainFish 'cultural' domain into certification schemes.

5. Conclusion

The social dimension of sustainability is the least developed pillar of sustainability, and the most neglected, when it comes to practical attempts to shape sustainable development. This is particularly the case when it comes to the social sustainability of resource-intensive industrial development and may be the reason why we have seen a shift from companies leading the charge to other economic/social agents taking control. However, as we have shown in this study, sustainability certification schemes have not (yet) taken the opportunity to further shape our understanding of what social sustainability means, or how it is practiced, at least regarding aquaculture. With the move to hybrid governance in this sphere, incorporating a stronger role for market instruments such as certification, now is the time for the 'social stuff' to be more fully incorporated into certification schemes. Food production done by, and for, humans in our shared environment is as much of a social challenge as any. Yet achieving sustainability is only feasible through a holistic understanding, and operationalisation, of sustainability.

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CRediT authorship contribution statement

Karen A. Alexander: Conceptualization, Methodology, Investigation, Visualization, Writing - original draft, Writing - review & editing. **Vilde S. Amundsen:** Conceptualization, Investigation, Data curation, Writing - review & editing. **Tonje C. Osmundsen:** Conceptualization, Writing - review & editing, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.envsci.2020.06.003.

References

Alexander, K.A., Abernethy, K.E., 2019. Determinants of Socially-Supported Wild-Catch Fisheries and Aquaculture in Australia. Fisheries Research and Development Corporation.

Alexander, K., Gatward, I., Parker, A., Black, K., Boardman, A., Potts, T., Thompson, E., 2014. An Assessment of the Benefits to Scotland of Aquaculture.

Alexander, K., Angel, D., Freeman, S., Israel, D., Johansen, J., Kletou, D., Meland, M., Pecorino, D., Rebours, C., Rousou, M., 2016a. Improving sustainability of aquaculture in Europe: stakeholder dialogues on Integrated Multi-trophic Aquaculture (IMTA). Environ. Sci. Policy 55, 96–106.

Alexander, K., Freeman, S., Potts, T., 2016b. Navigating uncertain waters: european public perceptions of integrated multi trophic aquaculture (IMTA). Environ. Sci. Policy 61, 230–237.

Alibašić, H., 2018. Sustainability and Resilience Planning for Local Governments: The Quadruple Bottom Line Strategy. Springer.

Amundsen, V.S., Osmundsen, T.C., 2018. Sustainability indicators for salmon aquaculture. Data Brief 20, 20–29.

Amundsen, V.S., Gauteplass, A.Å., Bailey, J.L., 2019. Level up or game over: the implications of levels of impact in certification schemes for salmon aquaculture. Aquac. Econ. Manag. 23, 237–253.

Anderson, J.L., Anderson, C.M., Chu, J., Meredith, J., Asche, F., Sylvia, G., Smith, M.D., Anggraeni, D., Arthur, R., Guttormsen, A., 2015. The fishery performance indicators: a management tool for triple bottom line outcomes. PLoS One 10, e0122809.

Andreassen, O., Karlsen, K.M., Robertsen, R., Solås, A.-M., 2016. Utvikling av et bærekraftsbarometer for norsk lakseoppdrett. Rapport 13, 2016.

Bailey, M., Packer, H., Schiller, L., Tlusty, M., Swartz, W., 2018. The role of corporate social responsibility in creating a Seussian world of seafood sustainability. Fish Fish. 19, 782–790.

Ballet, J., Dubois, J.-L., Mahieu, F.-R., 2011. La soutenabilité sociale du développement durable: de l'omission à l'émergence. Mondes en développement 89–110.

Béné, C., Oosterveer, P., Lamotte, L., Brouwer, I.D., De Haan, S., Prager, S.D., Talsma, E.F., Khoury, C.K., 2019. When food systems meet sustainability–Current narratives and implications for actions. World Dev. 113, 116–130.

Boutilier, R.G., Thomson, I., 2011. Modelling and measuring the social license to operate: fruits of a dialogue between theory and practice. Social Licence.

Burridge, L., Weis, J.S., Cabello, F., Pizarro, J., Bostick, K., 2010. Chemical use in salmon aquaculture: a review of current practices and possible environmental effects. Aquaculture 306, 7–23.

Bush, S.R., Roheim, C.A., 2019. The Shifting Politics of Sustainable Seafood Consumerism. The Oxford Handbook of Political Consumerism, pp. 331.

Bush, S.R., Belton, B., Hall, D., Vandergeest, P., Murray, F.J., Ponte, S., Oosterveer, P., Islam, M.S., Mol, A.P., Hatanaka, M., 2013. Certify sustainable aquaculture? Science 341, 1067–1068.

Carlson, K.M., Heilmayr, R., Gibbs, H.K., Noojipady, P., Burns, D.N., Morton, D.C., Walker, N.F., Paoli, G.D., Kremen, C., 2018. Effect of oil palm sustainability certification on deforestation and fire in Indonesia. Proc. Natl. Acad. Sci. 115, 121–126.

Carroll, A.B., 1999. Corporate social responsibility: evolution of a definitional construct. Bus. Soc. 38, 268–295.

Clarke, S., 2005. The neoliberal theory of society. Neoliberalism: A Critical Reader Vol. 50. pp. 59.

Colantonio, A., 2009. Social Sustainability: A Review and Critique of Traditional Versus Emerging Themes and Assessment Methods.

Costa-Pierce, B.A., Page, G.G., 2010. Sustainability Science in Aquaculture. Ocean Farming and Sustainable Aquaculture Science and Technology. Encyclopedia of Sustainability Science and Technology. Springer Science, NY, pp. 250–255.

Crowther, D., Seifi, S., 2018. Redefining Corporate Social Responsibility. Emerald Group Publishing Retrieved March, 4, 2019.

Custance, J., Hillier, H., 1998. Statistical issues in developing indicators of sustainable development. J. R. Stat. Soc. Ser. A Stat. Soc. 161, 281–290.

Dahlsrud, A., 2008. How corporate social responsibility is defined: an analysis of 37 definitions. Corp. Soc. Responsib. Environ. Manag. 15, 1–13.

Davidson, K.M., 2011. Reporting systems for sustainability: what are they measuring? Soc. Indic. Res. 100, 351–365.

Defries, R.S., Fanzo, J., Mondal, P., Remans, R., Wood, S.A., 2017. Is voluntary certification of tropical agricultural commodities achieving sustainability goals for small-scale producers? A review of the evidence. Environ. Res. Lett. 12, 033001.

Eakin, H., Connors, J.P., Wharton, C., Bertmann, F., Xiong, A., Stoltzfus, J., 2017. Identifying attributes of food system sustainability: emerging themes and consensus. Agric. Human Values 34, 757–773.

Elkington, J., 1998. Partnerships from cannibals with forks: the triple bottom line of 21st-century business. Environ. Qual. Manag. 8, 37–51.

Fao, 2018. The State of World Fisheries and Aquaculture 2018-Meeting the Sustainable Development Goals. Licence: CC BY-NC-SA 3.0 IGO. .

Foran, T., Butler, J.R., Williams, L.J., Wanjura, W.J., Hall, A., Carter, L., Carberry, P.S., 2014. Taking complexity in food systems seriously: an interdisciplinary analysis. World Dev. 61, 85–101.

Garriga, E., Melé, D., 2004. Corporate social responsibility theories: mapping the territory. J. Bus. Ethics 53, 51–71.

Graziano, M., Fox, C.J., Alexander, K., Pita, C., Heymans, J.J., Crumlish, M., Hughes, A., Ghanawi, J., Cannella, L., 2018. Environmental and socio-political shocks to the seafood sector: what does this mean for resilience? Lessons from two UK case studies, 1945–2016. Mar. Policy 87, 301–313.

Gupta, S.K., Racherla, U.S., 2016. Effect of ISO 14000 certification on sustainability: evidence from the Indian leather industry. J. Soc. Polit. Econ. Stud. 41, 34–50.

Henson, S., Humphrey, J., 2012. Private Standards in Global Agri-Food Chains. Private Standards and Global Governance: Economic, Legal and Political Perspectives. pp. 98–113.

Hicks, C.C., Levine, A., Agrawal, A., Basurto, X., Breslow, S.J., Carothers, C., Charnley, S., Coulthard, S., Dolsak, N., Donatuto, J., 2016. Engage key social concepts for sustainability. Science 352, 38–40.

Hoque, N., Rahman, A.R.A., Molla, R.I., Noman, A.H.M., Bhuiyan, M.Z.H., 2018. Is corporate social responsibility pursuing pristine business goals for sustainable development? Corp. Soc. Responsib. Environ. Manag. 25, 1130–1142.

Huemer, L., 2010. Corporate social responsibility and multinational corporation identity: Norwegian strategies in the Chilean aquaculture industry. J. Bus. Ethics 91, 265–277.

Jafar, A., 2019. Corporate Social Responsibility as an Effective Tool for Social Justice and International Solidarity: The Indian Context Vol. 9. pp. 92 No. 1 January-June 2019, 9.

James, P., 2014. Urban Sustainability in Theory and Practice: Circles of Sustainability. Routledge.

Joyce, S., Thomson, I., 2000. Earning a social license to operate: social acceptability and resource development in Latin America. CIM (Canadian Mining Metall.) Bull. 93, 49–53.

Katranidis, S., Nitsi, E., Vakrou, A., 2003. Social acceptability of aquaculture development in coastal areas: the case of two Greek Islands. Coast. Manag. 31, 37–53.

Kelly, R., Fleming, A., Pecl, G., Richter, A., Bonn, A., 2019. Social license through citizen science: a tool for marine conservation. Ecol. Soc. 24.

Kittinger, J.N., Teh, L.C., Allison, E.H., Bennett, N.J., Crowder, L.B., Finkbeiner, E.M., Hicks, C., Scarton, C.G., Nakamura, K., Ota, Y., 2017. Committing to socially responsible seafood. Science 356, 912–913.

Krause, G., Brugere, C., Diedrich, A., Ebeling, M.W., Ferse, S.C., Mikkelsen, E., Agúndez, J.A.P., Stead, S.M., Stybel, N., Troell, M., 2015. A revolution without people? Closing the people–policy gap in aquaculture development. Aquaculture 447, 44–55.

Kuhlman, T., Farrington, J., 2010. What Is Sustainability? Sustainability 2, 3436–3448.

Larner, W., 2003. Neoliberalism? SAGE Publications Sage UK, London, England.

Leith, P., Ogier, E., Haward, M., 2014. Science and social license: defining environmental sustainability of Atlantic salmon aquaculture in south-eastern Tasmania, Australia. Soc. Epistemol. 28, 277–296.

Manteaw, B., 2008. From tokenism to social justice: rethinking the bottom line for sustainable community development. Community Dev. J. 43, 428–443.

Mather, C., Fanning, L., 2019a. Is social licence "going rogue"? Geogr. J. 185, 498–504.

Mather, C., Fanning, L., 2019b. Social licence and aquaculture: towards a research agenda. Mar. Policy 99, 275–282.

Mauerhofer, V., 2008. 3-D sustainability: an approach for priority setting in situation of conflicting interests towards a Sustainable Development. Ecol. Econ. 64, 496–506.

Mercer-Mapstone, L., Rifkin, W., Louis, W., Moffat, K., 2017. Meaningful dialogue outcomes contribute to laying a foundation for social licence to operate. Resour. Policy 53, 347–355.

Mercer-Mapstone, L.D., Rifkin, W., Moffat, K., Louis, W., 2018. What makes stakeholder engagement in social licence "meaningful"? Practitioners' conceptualisations of dialogue. Rural. Soc. 27, 1–17.

Moffat, K., Lacey, J., Zhang, A., Leipold, S., 2016. The social licence to operate: a critical review. Forestry: Int. J. Forest Res. 89, 477–488.

Moffat, K., Zhang, A., 2014. The paths to social licence to operate: an integrative model explaining community acceptance of mining. Resour. Policy 39, 61–70.

Morgans, C.L., Meijaard, E., Santika, T., Law, E., Budiharta, S., Ancrenaz, M., Wilson, K.A., 2018. Evaluating the effectiveness of palm oil certification in delivering multiple sustainability objectives. Environ. Res. Lett. 13, 064032.

Nelsen, J., Scoble, M., 2006. Social License to Operate Mines: Issues of Situational Analysis and Process. Department of Mining Engineering. University of British Columbia, Vancouver.

Newell, P., Frynas, J.G., 2007. Beyond CSR? Business, poverty and social justice: an introduction. Third World Q. 28, 669–681.

Nhu, T.T., Schaubroeck, T., Henriksson, P.J., Bosma, R., Sorgeloos, P., Dewulf, J., 2016. Environmental impact of non-certified versus certified (ASC) intensive Pangasius aquaculture in Vietnam, a comparison based on a statistically supported LCA. Environ. Pollut. 219, 156–165.

Nilsen, M., Amundsen, V.S., Olsen, M.S., 2018. Swimming in a Slurry of Schemes: Making Sense of Aquaculture Standards and Certification Schemes. Safety and Reliability-Safe Societies in a Changing World.

Olsen, M.S., Osmundsen, T.C., 2017. Media framing of aquaculture. Mar. Policy 76, 19–27.

Orchard, S.E., Stringer, L.C., Quinn, C.H., 2015. Impacts of aquaculture on social networks in the mangrove systems of northern Vietnam. Ocean Coast. Manag. 114, 1–10.

Osmundsen, T.C., Olsen, M.S., 2017. The imperishable controversy over aquaculture.

Mar. Policy 76, 136–142.
Osmundsen, T., Størkersen, K., Fenstad, J., 2012. I storm og stille–havbruksbedriften som næringsaktør og politisk aktivist i norsk kystsoneforvaltning. In: Hersoug, B., Johnsen, J.P. (Eds.), Kampen om Plass på Kysten: Interesser og Utviklingstrekk i Kystsoneplanleggingen. Universitetsforlaget, Oslo, pp. 224.
Osmundsen, T.C., Amundsen, V.S., Alexander, K.A., Asche, F., Bailey, J., Finstad, B., Olsen, M.S., Hernández, K., Salgado, H., 2020a. The operationalisation of sustainability: sustainable aquaculture production as defined by certification schemes. Glob. Environ. Change 60, 102025.
Osmundsen, T.C., Olsen, M.S., Thorvaldsen, T., 2020b. The making of a louse-Constructing governmental technology for sustainable aquaculture. Environ. Sci. Policy 104, 121–128.
Overman, S., Van Thiel, S., 2016. Agencification and Public Sector Performance: a systematic comparison in 20 countries. Public Manag. Rev. 18, 611–635.
Owen, J.R., Kemp, D., 2013. Social licence and mining: a critical perspective. Resour. Policy 38, 29–35.
Parkes, G., Young, J.A., Walmsley, S.F., Abel, R., Harman, J., Horvat, P., Lem, A., Macfarlane, A., Mens, M., Nolan, C., 2010. Behind the signs—a global review of fish sustainability information schemes. Rev. Fish. Sci. 18, 344–356.
Pedersen, E.R., 2006. Making corporate social responsibility (CSR) operable: how companies translate stakeholder dialogue into practice. Bus. Soc. Rev. 111, 137–163.
Portney, K.E., 2015. Sustainability. MIT Press.
Prno, J., Slocombe, D.S., 2012. Exploring the origins of 'social license to operate'in the mining sector: perspectives from governance and sustainability theories. Resour. Policy 37, 346–357.
Quigley, R., Baines, J., 2014. How to Improve your Social Licence to Operate.
Rayner, J., Howlett, M., 2007. Caught in a staples vise: the political economy of Canadian aquaculture. Policy Soc. 26, 49–69.
Subasinghe, R., Soto, D., Jia, J., 2009. Global aquaculture and its role in sustainable development. Rev. Aquac. 1, 2–9.
Vallance, S., Perkins, H.C., Dixon, J.E., 2011. What is social sustainability? A clarification of concepts. Geoforum 42, 342–348.
Vifell, Å.C., Soneryd, L., 2012. Organizing matters: how 'the social dimension'gets lost in sustainability projects. Sustain. Dev. 20, 18–27.
Vince, J., Haward, M., 2019. Hybrid governance in aquaculture: certification schemes and third party accreditation. Aquaculture 201, 138–144.
Von Geibler, J., Liedtke, C., Wallbaum, H., Schaller, S., 2006. Accounting for the social dimension of sustainability: experiences from the biotechnology industry. Bus. Strategy Environ. 15, 334–346.
Whitmarsh, D., Palmieri, M.G., 2009. Social acceptability of marine aquaculture: the use of survey-based methods for eliciting public and stakeholder preferences. Mar. Policy 33, 452–457.
Whitmarsh, D., Wattage, P., 2006. Public attitudes towards the environmental impact of salmon aquaculture in Scotland. Eur. Environ. 16, 108–121.
Xia, B., Olanipekun, A., Chen, Q., Xie, L., Liu, Y., 2018. Conceptualising the state of the art of corporate social responsibility (CSR) in the construction industry and its nexus to sustainable development. J. Clean. Prod. 195, 340–353.
Ytrestøyl, T., Aas, T.S., Åsgård, T., 2015. Utilisation of feed resources in production of Atlantic salmon (Salmo salar) in Norway. Aquaculture 448, 365–374.
Zhang, A., Moffat, K., Lacey, J., Wang, J., González, R., Uribe, K., Cui, L., Dai, Y., 2015. Understanding the social licence to operate of mining at the national scale: a comparative study of Australia, China and Chile. J. Clean. Prod. 108, 1063–1072.

Paper C

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Virtually the Reality: Negotiating the Distance between Standards and Local Realities When Certifying Sustainable Aquaculture

Vilde S. Amundsen [1,2,*] and Tonje C. Osmundsen [2]

[1] Department of Sociology and Political Science, Faculty of Social and Educational Sciences, NTNU—Norwegian University of Science and Technology, 7491 Trondheim, Norway
[2] Studio Apertura, NTNU Social Research, Dragvoll allé 38 B, 7049 Trondheim, Norway; tonje.osmundsen@samfunn.ntnu.no
* Correspondence: vilde.amundsen@samfunn.ntnu.no

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Abstract: To account for the many challenges of increasingly global industries, remote regulation measures such as sustainability standards have become continuously more important as a means to ensure global accountability and transparency. As standard certification is assessed through audits, the legitimacy of these standards rests on uncritically evoked norms of auditing, such as independence and objectivity. In this paper, we seek to investigate the claim of these norms as a prerequisite for the audit process of sustainability standards. Based on interviews and fieldwork in the salmon aquaculture industry, we explore how it is possible to concurrently uphold the standard and account for the different conditions of the many local realities. Our findings point to the interactional character of audits, often downplayed for legitimacy purposes, and how this is vital to achieve both 'distance for neutrality' and 'proximity for knowledge production'. We argue for increased transparency concerning the human element of sustainability auditing, thus acknowledging the significance of reciprocal knowledge production when using standards as a route towards sustainability.

Keywords: sustainability; certification; standards; audit; objectivity; knowledge production

1. Introduction

As the aquaculture industry continues to grow, there has been a proliferation of private regulatory initiatives, such as sustainability standards, aimed at ensuring responsible and sustainable production [1,2]. These voluntary programs come in addition to national regulations, which are intended to enable aquaculture companies to both improve their production processes and display these improvements to consumers, retailers, and national authorities [3,4]. By demonstrating compliance with the indicator requirements of set standards, aquaculture companies can become certified according to numerous schemes that address various topics related to responsible production, e.g., animal welfare, food safety, environmental conservation, and social assurance [5]. Compliance is typically assessed through inspections and a thorough review of documentation conducted by a third-party auditor.

Many of these schemes operate internationally, applying the same set of requirements regardless of where an aquaculture company's production is located. The legitimacy of these standards is to a large degree based on certain assumed attributes of certification and the audit process, such as independence, objectivity, transparency, effectiveness, and generalizability [6,7]. However, as the many different and multifaceted local realities will not always fit into predetermined categories, standards cannot by any means be treated as complete representations of reality [8], as these attributes would suggest. This is especially pertinent in the case of sustainability standards due to the complexity and

overall lack of general consensus as to what sustainability is and how it can be accomplished [9,10]. Further complicating the matter is the uncertainty and complexity, or rather 'wickedness', of the many externalities of aquaculture production [11–13], which these standards are attempting to address.

Auditors navigate in a terrain where a central axis is drawn between maintaining a distance to the auditee to preserve neutrality, and proximity needed to acquire knowledge about the auditee's particular local context. Departing from this standpoint, we seek to investigate the claim of independence and objectivity as a prerequisite for the audit process of sustainability standards. Firstly, how is objectivity and independence enacted during the audit process when standards can never fully capture the complexities of reality? Secondly, what role does 'distance for neutrality' versus 'proximity for knowledge production' play in the meeting between auditor and auditee, and how, if possible, can these be balanced? These questions are explored through interviews and fieldwork, with findings illustrating the significance of the interactional character of audits and the need for more transparency concerning the human element of sustainability auditing. While this study focuses on salmon aquaculture, there is reason to believe that our findings are applicable beyond this industry, as many industries are experiencing an increase in similar certification pressures and audit processes [14].

2. Theoretical Background

We find ourselves in a time of certification where "all" things are to be labeled, measured, evaluated, and compared [14]. For aquaculture production, as with other global industries, there are numerous rationales for an increase in standardized means of regulation such as certification. With production scattered around the world, similar practices and protocols should allow for global accountability, transparency, and risk mitigation [15,16], promoting and facilitating trust between producers, suppliers, retailers, and consumers [17]. Another product of certification is increased traceability through standardized information systems, which in turn can improve food safety and general transparency [18].

While these private certifications are voluntary, many are increasingly becoming de facto mandatory due to commercial pressure and market access requirements [19]. The proliferation of standards and auditing of larger industries has been referred to as an 'audit explosion' [14], which is causing organizations to be transformed into more 'auditable' entities [20]. With roots in the financial sector, auditing involves making an organization's performance externally verifiable through systematic evaluation of its practices [6], which presupposes practices that are readily available for the external assessor. This entails converting complex realities into unambiguous measures, providing quantifiable targets through the superficiality of 'thin description', as coined by Theodore Porter [21].

This process of simplification is often subject to 'black-boxing', where all precursory discussions and disagreements are hidden from public view in order to legitimize the outcome [22,23]. This has in turn led to a naturalization of standards and their classifications, which entails becoming an accepted and taken-for-granted form of knowledge, endorsing the perception that their measures are to be considered objective [24]. The legitimacy and credibility of sustainability certification is further substantiated through the use of third-party auditors, as they represent an independent actor with no apparent stake in the process [25]. An auditor has a fault-finding approach, and is expected to unravel issues not compliant with the standard. Following this logic, the role of the auditor therefore depends on the existence of beliefs about impaired independence. Similarly, Cook et al. [6] find that certain norms of auditing, such as transparency, objectivity, and effectiveness, are evoked uncritically as necessary for achieving 'good' audits.

The common misconception that standards with third-party audits are independent and free of interpretation has been countered by two key arguments centered on the fact that while standards emanate from the idea of objectivity, they are both made and managed by people. Firstly, the audit process necessitates critical choices as to what is being measured and what constitutes compliance [14,26]. Those that develop sustainability standards have, to a large degree, the power to define what a sustainable industry looks like, as the choices they make concerning what issues to include and

exclude have ontological implications [27,28]. The standard owner's distinct purpose, proprietorship, and process of development will also be echoed in the focus of each standard [29]. In other words, the standardization of sustainability is a concretization and operationalization of the concept, i.e., an attempt to make a complex phenomenon tangible and obtainable [24].

Secondly, despite the intent of being applicable across sites, companies, and countries, a standardized list of requirements will never be entirely transferable [8,20]. Standards will necessarily provoke different local responses and adaptations in how they are implemented [30], and an auditor will have to translate the different company procedures and actions into the standardized template. Although this speaks to the importance of the auditor as an intermediary agent, the inescapable human element of the audit process tends to be downplayed to strengthen the certification's credibility as neutral and independent [31]. As Power [14] accurately points out, there is an important distinction to be made between organizational and operational independence, where the former speaks to the auditor's official engagement and the latter to the actual audit process. Power describes this process as both "interactive and judgmental" [14] (p. 40), pointing to the necessary negotiation that is needed to decide which are the criteria that compliance involves.

In this discussion of independence and objectivity lies the dilemma of degree of flexibility, i.e., the difficult balance of upholding the standard versus considering the local context. An overly stringent approach will lead to less certified companies and, in effect, the standard's label becoming less relevant. On the other hand, an overly lenient approach will water down the label and make it less trustworthy [7]. However, it is important to discourage a polarized understanding of the audit process, as it is not a question of whether independence and objectivity can or should be achieved. On the contrary, Cook et al. [6] argue that the audit process must be seen as an arena in which attributes such as these are enacted—constructed, negotiated, and reconstructed—through the interaction between auditor and auditee. The conceptualization and framing of what the audit is and will lead to, thereby, becomes a mutual engagement between the two parties [7,31].

How this mutual shaping of the audit unfolds will to a large degree depend on the auditor, and how they utilize their discretionary space. There is, however, limited research on how this discretionary space manifests in practice. Building on the above perspectives, this paper seeks to address this gap in the literature. We do this by framing the question in terms of distance versus proximity, where the former allows a greater degree of neutrality and the latter opportunities for knowledge production. This spectrum does not just refer to the actual distance between auditor and auditee, which can range from remote assessments of documentation to physical on-site inspections. It also concerns the degree of involvement and interaction during an audit, e.g., comprehensiveness of observations, manner of communication, encouragement of discussions and negotiations, and the possibility for building rapport between auditor and auditee.

Some degree of neutrality is crucial, not just for legitimacy of the standard but for the commensurability of those certified. A certification label will have little value if there is no generalizability. On the other hand, aquaculture is a complex industry and there is much debate as to how it can become more sustainable. We therefore argue that the process of sustainability certification must serve the additional purpose of creating learning opportunities. By advising companies on how they can best comply with the standard requirements, the auditee can improve its operations in the process [31]. Similarly, auditors can gain crucial insight from those with the practical expertise and experience, which, in addition to aiding the auditor in their work, can serve as input to the standard owners in the continual revision of standards [7]. We observe the necessity of a more in-depth understanding of the reciprocal process in knowledge exchange in sustainability auditing, which can facilitate a continual improvement of the processes involved.

3. Materials and Methods

To obtain a comprehensive understanding of the audit process for sustainability certification, we have examined it from several viewpoints, seeking the perspectives of both the auditor and auditee.

Our analysis is conducted for salmon, one the most important aquaculture species as measured by production growth and value [32]. We have concentrated on the salmon aquaculture industries in Norway, Chile, and Scotland, in regards to choice of both schemes and informants, as these are three of the largest producers of salmon. We attended audits for three different certification schemes in two different companies. The first fieldwork took place at an audit for Aquaculture Stewardship Council (ASC) pertaining to four salmon aquaculture sites, which lasted five days. There were three re-certifications and one new, where the latter required additional information pertaining to social assurance and therefore a second auditor. The second audit we attended was for two food safety standards—International Featured Standards (IFS) and BRC Global Standards (BRC)—at a processing facility, where we attended two of four days. While this audit concerned the processing of salmon, these food safety standards are not species-specific. Both audits primarily involved reviewing documentation to demonstrate compliance with the many standard criteria. The former also involved the inspection of two of the sites and interviews with the staff at the site up for initial certification, while the latter included several inspections of the processing plant and surrounding areas. Those in charge of the quality department attended the full audits, and were responsible for presenting the necessary documentation and answering the auditor's questions. Managers from other departments were present at different times, depending on the topic at hand.

The fieldwork entailed participant observation [33], consisting of observations of the documentation review process and ensuing discussions, accompanying the auditor on site inspections, attending staff interviews, and conducting informal interviews [30,34] with auditors and company employees to obtain more in-depth explanations and reflections concerning the audit. On request of the companies, recording devices were not used. The notes from the fieldwork were transcribed and anonymized. They were subsequently coded according to topic using N-VIVO.

We also conducted 24 in-depth interviews with some of the major salmon aquaculture producers and accredited certification agencies in Norway, Chile, and Scotland. The interviews with producers were with managers and quality department employees from salmon aquaculture companies: ten in Norway, six in Chile, and one in Scotland. The single interview in Scotland speaks to the difficulty we faced in gaining access to aquaculture companies there. The scope of the interviews included the respondents' experiences with certification, from the decision to work towards a specific certificate through to the implementation process and its effects. Two auditors from, respectively, Norway and Chile were also interviewed, mainly concerning the audit process, in addition to the three auditors we spoke with in the field. Each interview lasted approximately 1–1.5 hours, and were all recorded, transcribed, anonymized, and translated by the authors and other project members. Each respondent was given a unique identification code (e.g., N1–C1), with the first part denoting country (e.g., N1–**, N for Norway, C for Chile, and S for Scotland), and the second representing the company (e.g., **–C1). As with the fieldwork notes, the interviews were subsequently coded according to topic in N-VIVO.

In order to gain a thorough understanding of the different sustainability certifications, we also categorized the indicators in eight of the most prevalent standards according to 28 different topics. This work has resulted in a searchable database of 1916 indicators, with a total of 2830 categorizations. See Amundsen & Osmundsen [5] for details.

4. Results

4.1. Objectivity and Independence

Auditors work within a set framework defined by the standard owners, which typically are independent organizations. The auditors we interviewed stress the countless exams they need to pass in order to be allowed to perform audits for specific standards. Their reports are reviewed, and they are themselves audited by the accreditation bodies to ensure consistency. Most auditors are described by the respondents as meticulous and diligent in following the standards. This corresponds with our

observations from the field, where the auditors spent much time examining the documentation they were presented with, ensuring that it was adequate to comply with the requirement in question.

The importance of being, and being perceived as, neutral and objective is emphasized by both Norwegian and Chilean auditors. When describing their own roles, they refer to their Code of Ethics, emphasizing that these have rules regarding impartiality and confidentiality, restrictions concerning the receiving of gifts or owning shares in listed companies, etc. Furthermore, they stress that they are not permitted to perform training for individual companies or in any way enter the role of consultant. To maintain some distance between auditor and auditee, several of the schemes require that a company changes auditor every three to five years, depending on the scheme. The impression of independence seems particularly important in Chile, as explained by a Chilean auditor: "Our [commitment] is only related to presenting the findings. The [rest is up to] the consultancy or the company. Because we are not in charge of implementing the improvements in each company. Only showing what and where the findings are. Nothing more. To be independent" (Auditor C1–C3). Even so, several of the producers state that the audit process does function as a learning process for them. As one explains, "by all means, suggestions for improvements are present in the revisions. And particularly if you have auditors who are experienced and who have been around to other sites. They might tell you, 'in other places they do this and that' without mentioning any [company] names" (Producer N2–C1).

4.2. Discretionary Space

Although there is much focus on objectivity, the final decision of whether a company is given non-compliance falls on the auditor, as the company's activities will not always fit into the standard's predefined boxes. Despite specifications in the standards on what constitutes compliance, there is, for example, more than one way to set up a risk analysis, a common requirement in sustainability standards. This provides the auditor with some flexibility, or discretionary space, in regards to how criteria compliance is evaluated, which suggests that despite the strive for objectivity and complete transferability, who the auditor is will matter. In attempting to bridge this gap between global ideals and local realities, many respondents emphasize the importance of good communication between the auditor and producer. As one producer states, "We can send [the auditors] out [to the production sites] on their own, but our experience is that communication is key. It is not a given that they are able to ask [the workers] in a way that those who are asked understand the question and what they want to know. So, we are there to guide them. Mostly things are in order, but if they misunderstand the question we will get a non-compliance and that generates work for us" (Producer N5–C2). This respondent and others also point to communication issues that may occur with foreign auditors, in cases where site workers are not comfortable speaking English.

For the producers, communication does to a large degree also involve being given room to explain and negotiate when they do not agree with either the auditor's assessment or the standard itself. Not all the producers are comfortable entering into negotiations, but at times feel they have to. One of the producers explains that, "[Sometimes] you can notice that they have their own agenda once they arrive. That, 'here we will find something on 'this''. Because they have a preconceived notion that there is something to find, and then they also find it. But then, we have to be tough and have the courage to oppose it. Through the years, there have been many weird requirements that have proven not very smart, even if one auditor thinks so. Because they have a lot power" (Producer N1–C1). While this respondent refers to the unequal distribution of power between an auditor and a producer in these negotiations, most of our respondents emphasize that they will attempt to negotiate with the auditors when necessary. The auditors, similarly, underline the significance of communication and good dialogue in the audit process. As one auditor puts it, "Communication is extremely important. Sometimes I may be more flexible and less stringent in how I formulate the reports. But that is also a risk, because I am also being audited. All the reports are submitted for review. So, I don't have much leeway, so to speak" (Auditor N1–C5).

4.3. Negotiations and Strategies

Negotiations between auditors and producers can manifest in various ways, both with different intentions and outcomes. The more common intention of the producers is to convince the auditor that they are in compliance with a requirement, when the auditor has stated otherwise. This can involve explaining why their practices work well or are necessary in their local context, or questioning what the standard is actually asking for. One producer states that, "When you do what I do [being responsible for audits of the company], I can promise you that you learn to quarrel on all the definitions, you can earn much leeway that way" (Producer N1–C1). Our findings show that the interpretation of definitions and requirements is an issue that most producers are aware may provide some flexibility. Another strategy to prove compliance is by presenting scientific evidence supporting the company's practices. As one producer explains, "We've had cases with for example stocking densities in hatcheries and been able to provide evidence that 'look, if we take it up to this level instead of that level, it's still okay.' So the way the [standard] would look at that, if it's welfare neutral, okay. If it's welfare positive, of course! But if it's welfare negative, then forget it, it's not going to happen. And that's how they would look at it" (Producer S1–C1).

As standards for salmon aquaculture often are developed with production in countries like Norway, Canada, and Scotland in mind, and with less regard for the particularities of production in, for instance, Chile, these producers may struggle to comply with specific requirements. A Chilean producer explains, "There are requirements that are difficult to meet and are not in line with what we want to do because the production realities of the northern hemisphere are different from our own [. . .] For example, there are bacterial diseases where 90% of the antibiotics is used only to control that disease, which in the northern hemisphere is different since they do not have any significant bacterial diseases. [Therefore they] use less antibiotics compared to us" (Auditor C1–C4). If the auditor agrees that the chosen practices are suited for the local conditions but cannot grant compliance, the auditor can utilize various means of discretion, depending on the scheme. For example, some standard reports have designated spaces where the auditor can give further explanatory descriptions, such as how external factors might have given poor results on an environmental survey. An auditor can also contact standard owners or accreditation bodies on behalf of the producers to obtain an exemption for a specific site. For instance, some standards require that all pens have smolt from a certified supplier but exemptions have in some cases been given for sites that have proven satisfactory traceability systems. Respondents say that in these cases, some auditors might refuse, while others will approve the request. A company can also request that changes be made in the actual standard, as part of the amendments in the updated version. The auditor will, in this case, give non-compliance but report the change request back to the standard owner. The company can then provide scientific evidence that supports its request.

4.4. Influential Factors

Both the producers and auditors point to several factors that affect the possibility for negotiation. According to the producers, auditors with little experience are more likely to get hung up on "insignificant details" as they do not wish to deviate from the standard. As one producer explains, "On the negative side of things, it is very demanding to work with these revisions. And these auditors are not always very pragmatic. They get hung up on details which, I think, are not very relevant" (Producer N7–C2). Experienced auditors, on the other hand, are accredited with the ability to see how various practices can have the same effect, thereby allowing different solutions. One of the producers explains the difference between auditors with and without experience: "An experienced auditor—there is a big difference between that and an unexperienced one. Those who are auditing for the first time, for example for a big and difficult standard, then you have to be prepared to work through the night. Because they are never finished. They are so afraid to make mistakes, so they dig into unimportant details. While those who are more experienced, they understand the process and even if [the standard] asks for a specific thing, other things might accomplish the exact same thing. In a different way, they

have a better understanding for our processes, and it doesn´t have to be exactly this way or that way. It might give the same effect and be just as good" (Producer N3–C1).

Related to experience, the auditor's familiarity with the site and company is another factor said to aid discussions and negotiations. Both producers and auditors point to how those being audited are often calmer when they know the auditor, making it easier to discuss good solutions. While auditors cannot function as consultants, they can contribute to the learning process for the producers by explaining the origin and intent of a requirement that might seem nonsensical and give suggestions on how to comply with it. One of the auditors explains that, "So we try to discuss, you know, see if we can come up with a . . . I wouldn't say middle ground, but you know what I mean. We of course experience this all the time. 'But we do it like this.' 'Yes, I understand that, and that's good, and you are definitely on the right track. But maybe a bit more like this, because [the standard] wants it like that, because because', and so forth" (Auditor N1–C5). Furthermore, familiarity with the company is also said to enable the auditor to see improvement and understand how a company does things and why, which can help expedite the audit process.

Another factor that is said to affect negotiation is the level of the auditor's technical expertise, in this case in aquaculture. While most certification schemes require relevant education and practical experience in the industry, many respondents point to the unpredictability of auditors for customer standards. These standards are, unlike certification schemes, developed by the producers' customers, usually retailers, and are described by most respondents as exceedingly more specific in their requirements and often more stringent. Many criticize these standards for their nonsensical requirements, often a result of the standard having been poorly adapted from livestock production. Similarly, the customer standard auditors' lack of industry knowledge is cause of much frustration. As one informant explains, "We get people here that have barely ever seen a salmon before" (Producer N1–C6). The lack of industry expertise is said to impede discussions and inhibit any possibility for negotiations when they disagree with the auditor's assessment, a frustration exemplified by several respondents. For instance, a processing facility was closed with immediate effect due to a fish having a muscle twitch after slaughter, which the auditor said was proof that the fish was still alive. Another processing facility was required to have a designated person distribute band aids, and collect and register them at the end of each workday. A site was given non-compliance because a fish farmer was smoking on the boat during a delivery, despite the company's protests that the animals were underwater and could therefore not be affected by the smoke. Another site was asked to install camera surveillance of their employees, despite it being illegal in Norway. What these examples demonstrate is the extreme variation in the producers' experiences of audits, from very professional to the absolute absurd.

5. Discussion

While our study has focused on salmon aquaculture, our impression is that many of our findings are applicable to other contexts, both other species of aquaculture and other industries (see [3,6,7], for example, from, respectively, the banana industry, forestry, and general environmental auditing). Effective auditing is not premised on whether the auditor operates objectively and independently. Rather, as our findings show, it is premised on the concurrent need to uphold the standard and consider the standard requirements against local conditions. The auditor has a clearly defined role, which entails that deviating from the standard will lead to repercussions. With this role follows a parallel responsibility of translating local practices into the standard's predetermined categories. Consistent with the standardization literature, our study illustrates the difficult nature of this as a consequence of geographical, judicial, and organizational differences, among others. In performing these responsibilities, the auditor is subject to cross-pressure, here manifested as distance versus proximity. The interaction between auditor and auditee is crucial in the balancing of the required distance and necessary proximity of auditing. As established by Cook et al. [6], it is through this interaction that objectivity is enacted rather than achieved. Departing from this view, we have identified

specific manners in which this enactment can occur, through negotiations, means of discretion, and experience and expertise of the auditor.

In order to better comprehend the concurrence of distance and proximity, the output of audits must be seen separately from the process. If a certification label is to have any value, the final reports must be based on a standardized template to allow some degree of transferability and commensurability. On the other hand, the process in which reality is translated into these templates is necessary to establish relevance, and to understand relevance requires proximity. The parallel responsibilities and cross-pressures of auditors can be understood in terms of a double role conflict. Similarly to the civil servants described by Jacobsen [35], auditors are expected to be neutral while also being loyal to the standard currently at hand. Furthermore, auditors are expected to utilize their professional expertise while also setting aside their professional discipline to remain loyal to the standard. According to Jacobsen, this is a necessary dilemma that is not to be resolved since the legitimacy of the entire system relies on the concurrent presence of these contradictory values.

This entails seeing auditors as more than just neutral instruments and thereby recognizing their competency, which underscores the empirical contributions of our findings. By acknowledging the importance of the human element of auditing, it is possible to identify measures that can improve the audit process. Most importantly, this points to the implications of the auditor's qualities and qualifications. As stated by one of the respondents of Eden [7] (p. 1023), "auditing is very much a skill." A good audit process requires an auditor with experience in the field and available means of discretion to uphold the standard while also taking into account the many different local realities. Furthermore, increased transparency concerning the interactional character of auditing will strengthen the appreciation of the specific contributions of both auditor and auditee. This will in turn make it easier to capitalize on the knowledge and expertise of both parties.

As regards the theoretical contributions of our findings, the justification and call for recognition of the knowledge coproduction of audits has implications for how we deal with standards as a route towards sustainability. While sustainability as a collective goal has proven valuable in unifying efforts to meet the challenges of today, its complexities and necessary compromises must be openly recognized to ensure continual progression. Here there may be lessons learned from qualitative research and the inductive nature of grounded theory, as opposed to the quantitative approach associated with auditing. Through in-depth interaction with the auditees, the auditor can engage in qualitative analysis to discover the unknown actualities of the industry. As illustrated by producers presenting scientific evidence to back their claim in a negotiation, the auditees may often have access to more up-to-date knowledge. Therefore, the reciprocal nature of this knowledge production is crucial.

Because 'sustainability' as a goal gives rise to certain expectations, initiatives that use it as a brand or product must be challenged and explored. This paper calls for reflection on the constitution and fundamental characteristics of sustainability standards. These are, to a large degree, based on set metrics that producers must meet, as a way of making the companies 'auditable' entities. Following Tlusty and Thorsen [36], we argue that there needs to be a larger emphasis on continual improvement, recognizing sustainability as a process rather than end destination. This allows for a more accurate representation of the concept, which in turn can facilitate a more open and dynamic approach. As we have shown, continual improvement is dependent on close communication and interaction between auditor and auditee. This can serve to both increase the relevance of existing standards and ensure that what is being measured and assessed actually is a vision of sustainability.

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References

1. Roheim, C.A.; Bush, S.R.; Asche, F.; Sanchirico, J.N.; Uchida, H. Evolution and future of the sustainable seafood market. *Nat. Sustain.* **2018**, *1*, 392–398. [CrossRef]
2. Alfnes, F.; Chen, X.; Rickertsen, K. Labeling farmed seafood: A review. *Aquac. Econ. Manag.* **2018**, *22*, 1–26. [CrossRef]
3. Aasprong, H. Recreating the Banana Grower: The Role of Private Certification Systems in the Windward Islands Banana Industry. *Cult. Unbound J. Curr. Cult. Res.* **2012**, *4*, 721–745. [CrossRef]
4. Tikina, A.V.; Innes, J.L. A framework for assessing the effectiveness of forest certification. *Can. J. For. Res.* **2008**, *38*, 1357–1365. [CrossRef]
5. Amundsen, V.S.; Osmundsen, T.C. Sustainability Indicators for Salmon Aquaculture. *Data Brief* **2018**. [CrossRef] [PubMed]
6. Cook, W.; van Bommel, S.; Turnhout, E. Inside environmental auditing: effectiveness, objectivity, and transparency. *Curr. Opin. Environ. Sustain.* **2016**, *18*, 33–39. [CrossRef]
7. Eden, S. Being Fieldworthy: Environmental Knowledge Practices and the Space of the Field in Forest Certification. *Environ. Plan. D Soc. Space* **2008**, *26*, 1018–1035. [CrossRef]
8. Busch, L. *Standards: Recipes for Reality*; MIT Press: Cambridge, UK, 2011; ISBN 978-0-262-01638-4.
9. Busch, L. Climate Change: How Debates over Standards Shape the Biophysical, Social, Political and Economic Climate. *Int. J. Sociol. Agric. Food* **2011**, *18*, 167–180.
10. Moore, F.C. Toppling the Tripod: Sustainable Development, Constructive Ambiguity and the Environmental Challenge. *Cons. J. Sustain. Dev.* **2011**, *5*, 141–150.
11. Osmundsen, T.C.; Almklov, P.; Tveterås, R. Fish farmers and regulators coping with the wickedness of aquaculture. *Aquac. Econ. Manag.* **2017**, 1–21. [CrossRef]
12. Abate, T.G.; Nielsen, R.; Tveterås, R. Stringency of environmental regulation and aquaculture growth: A cross-country analysis. *Aquac. Econ. Manag.* **2016**, *20*, 201–221. [CrossRef]
13. Abate, T.G.; Nielsen, R.; Nielsen, M. Agency rivalry in a shared regulatory space and its impact on social welfare: The case of aquaculture regulation. *Aquac. Econ. Manag.* **2018**, *22*, 27–48. [CrossRef]
14. Power, M. *The Audit Society: Rituals of Verification*; Reprinted; Oxford Univ. Press: Oxford, UK, 2010; ISBN 978-0-19-829603-4.
15. Bailey, M.; Bush, S.R.; Miller, A.; Kochen, M. The role of traceability in transforming seafood governance in the global South. *Curr. Opin. Environ. Sustain.* **2016**, *18*, 25–32. [CrossRef]
16. Bush, S.R.; Belton, B.; Hall, D.; Vandergeest, P.; Murray, F.J.; Ponte, S.; Oosterveer, P.; Islam, M.S.; Mol, A.P.J.; Hatanaka, M.; et al. Certify Sustainable Aquaculture? *Science* **2013**, *341*, 1067–1068. [CrossRef] [PubMed]
17. Bush, S.R. Understanding the potential of eco-certification in salmon and shrimp aquaculture value chains. *Aquaculture* **2018**, *493*, 376–383. [CrossRef]
18. Groeneveld, R.; Bush, S.R.; Bailey, M. Private governance of ocean resources. In *Handbook on the Economics and Management of Sustainable Oceans*; Nunes, P., Svensson, L., Markandya, A., Eds.; Edward Elgar Publishing: Cheltenham, UK, 2017; pp. 416–428, ISBN 978-1-78643-072-4.
19. Maertens, M.; Swinnen, J. Private standards, global food supply chains and the implications for developing countries. In *Private Standards and Global Governance. Economic, Legal and Political Perspectives*; Marx, A., Maertens, M., Swinnen, J., Wouters, J., Eds.; Leuven Global Governance; Edward Elgar Publishing Limited: Cheltenham, UK, 2012; pp. 153–171.
20. Shore, C.; Wright, S. Audit Culture Revisited: Rankings, Ratings, and the Reassembling of Society. *Curr. Anthropol.* **2015**, *56*, 421–444. [CrossRef]
21. Porter, T.M. Thin Description: Surface and Depth in Science and Science Studies. *Osiris* **2012**, *27*, 209–226. [CrossRef]
22. Asdal, K. Enacting things through numbers: Taking nature into account/ing. *Geoforum* **2008**, *39*, 123–132. [CrossRef]
23. Strassheim, H.; Kettunen, P. When does evidence-based policy turn into policy-based evidence? Configurations, contexts and mechanisms. *Evid. Policy A J. Res. Debate Pract.* **2014**, *10*, 259–277. [CrossRef]
24. Merry, S.E. Measuring the World: Indicators, Human Rights, and Global Governance. *Curr. Anthropol.* **2011**, *52*, S83–S95. [CrossRef]

25. Hatanaka, M.; Busch, L. Third-Party Certification in the Global Agrifood System: An Objective or Socially Mediated Governance Mechanism? *Sociol. Rural.* **2008**, *48*, 73–91. [CrossRef]
26. Turnhout, E.; Neves, K.; de Lijster, E. 'Measurementality' in Biodiversity Governance: Knowledge, Transparency, and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (Ipbes). *Environ. Plan. A: Econ. Space* **2014**, *46*, 581–597. [CrossRef]
27. Busch, L. Standards and Their Problems: From Technical Specifications to World-Making. In *Transforming the Rural*; Research in Rural Sociology and Development; Emerald Publishing Limited: Bingley, UK, 2017; Volume 24, pp. 97–114.
28. Miller, P. Governing by Numbers: Why Calculative Practices Matter. In *The Blackwell Cultural Economy Reader*; Amin, A., Thrift, N., Eds.; Blackwell Publishing Ltd.: Oxford, UK, 2004; pp. 179–189. ISBN 978-0-470-77427-4.
29. Nilsen, M.; Amundsen, V.S.; Olsen, M.S. Swimming in a slurry of schemes: making sense of aquaculture standards and certification schemes. In *Safety and Reliability—Safe Societies in a Changing World*; Haugen, S., Barros, A., van Gulijk, C., Kongsvik, T., Vinnem, J.E., Eds.; Taylor & Francis Group: London, UK, 2018; pp. 3149–3156, ISBN 978-0-8153-8682-7.
30. Vigneau, L.; Humphreys, M.; Moon, J. How Do Firms Comply with International Sustainability Standards? Processes and Consequences of Adopting the Global Reporting Initiative. *J. Bus. Ethics* **2015**, *131*, 469–486. [CrossRef]
31. Jensen, C.B.; Winthereik, B.R. Audit Loops and Audit Implosion. In *Redescribing Relations, Strathernian Conversations on Ethnography, Knowledge and Politics*; Lebner, A., Ed.; Berghahn Books: New York, NY, USA, 2017; pp. 155–181.
32. Asche, F.; Cojocaru, A.L.; Roth, B. The development of large scale aquaculture production: A comparison of the supply chains for chicken and salmon. *Aquaculture* **2018**, *493*, 446–455. [CrossRef]
33. Spradley, J.P. *Participant observation*; Waveland Press: Long Grove, IL, USA, 2016; ISBN 978-1-4786-3208-5.
34. Briggs, C.L. *Learning How to Ask: A Sociolinguistic Appraisal of the Role of the Interview in Social Science Research*; Studies in the social and cultural foundations of language; Cambridge University Press: Cambridge, UK; New York, NY, USA, 1986; ISBN 978-0-521-32225-6.
35. Jacobsen, K.D. Lojalitet, nøytralitet og faglig uavhengighet i sentraladministrasjonen [Loyalty, Neutrality and Professional Autonomy in the Central Administration]. *Tidsskr. Samf.* **1960**, *1*, 231–248.
36. Tlusty, M.F.; Thorsen, Ø. Claiming seafood is 'sustainable' risks limiting improvements. *Fish Fish.* **2017**, *18*, 340–346. [CrossRef]

Paper D

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Level up or game over: the implications of levels of impact in certification schemes for salmon aquaculture

Vilde Steiro Amundsen[a,b], Asle Årthun Gauteplass[b], and Jennifer Leigh Bailey[a]

[a]Department of Sociology and Political Science, Faculty of Social and Educational Sciences, NTNU - Norwegian University of Science and Technology Trondheim, Norway; [b]Studio Apertura, NTNU Samfunnsforskning, Trondheim, Norway

ABSTRACT

Certification schemes are becoming increasingly important within aquaculture management, but the indicators that are used by these schemes are subject to considerable debate. Many have questioned their actual impact on improving the industry, and whether they effectively address the many externalities of aquaculture production. In this paper, we study the choice of indicators in eight major certification scheme standards for salmon aquaculture and examine to what degree they manage to address impacts beyond individual production sites. We find that, in accordance with the criticism, the majority of indicators pertain only to the site-level. However, indicators related to traceability, and to coordination and sharing of information among producers can elevate local concerns to a higher level of impact. We, therefore, argue that among all the certification scheme standards considered here, these types of indicators should be emphasized to a larger extent.

KEYWORDS

Aquaculture; sustainability; certification; levels of impact

Introduction

Global aquaculture production has increased rapidly in recent decades due to the immense technological and scientific advances in a short period of time (Asche, 2008; Kumar & Engle, 2016). Because of the rapid growth and strong potential for further growth, aquaculture is often considered a vital piece of the puzzle in fighting the pending world food shortage (Kobayashi et al., 2015). Aquaculture may also contribute to increased income and food security (Belton, Bush, & Little, 2018), generate positive socio-economic effects (Ceballos, Dresdner-Cid, & Quiroga-Suazo, 2018), and there is increasing evidence that it is a more sustainable production technology

CONTACT Vilde Steiro Amundsen vilde.amundsen@samfunn.ntnu.no Department of Sociology and Political Science, Faculty of Social and Educational Sciences, NTNU - Norwegian University of Science and Technology, Dragvoll, Building 9, Level 5, Trondheim 7491, Norway.

compared to the production of other animal proteins (Froehlich, Runge, Gentry, Gaines, & Halpern, 2018).

Aquaculture is, however, an industry characterized by complexity and much controversy. It is the environmental risks associated with aquaculture that tend to dominate the media debate (Olsen & Osmundsen, 2017). These can include emission of untreated effluents, the spread of disease, and potentially unsustainable fishing for raw materials for feed (Jonell, Phillips, Rönnbäck, & Troell, 2013). Studies show that there is a preference for wild fish relatively to farmed, presumably due to the environmental impact of aquaculture (Roheim, Sudhakaran, & Durham, 2012; Uchida, Onozaka, Morita, & Managi, 2014). The industry is also associated with damaging socio-economic impacts such as conflicting interests concerning marine space and resources, inadequate food safety, and social disruption (Hai, Visvanathan, & Boopathy, 2018). While there is much debate concerning how to deal with the challenges, the aquaculture industry is constantly evolving through the discovery of new potential solutions (Klinger & Naylor, 2012). Despite clear evidence that government mandated regulations do work in some cases (Tveteras, 2002), the rapid development of the industry has left regulatory authorities largely lagging behind, being reactive rather than proactive (Peel & Lloyd, 2008).

As a response to the challenges associated with aquaculture and to promote the more sustainable practices, there has been a rise in private governance as part of the "sustainable seafood movement" (Bush & Roheim, 2018). This entails different local and global actors, such as NGOs and retailers, developing sustainability standards intended to ensure a safe product that has been produced in an environmentally and socially responsible manner. Such standards are made up of indicators with corresponding requirements, with which the aquaculture companies need to comply in order to obtain and maintain the certification. The standards vary in focus, depending on its scheme's purpose, process of development, and proprietorship (Nilsen, Amundsen, & Olsen, 2018). It has been shown that standards such as these can, for instance, overcome consumer preference of wild fish over farmed (Bronnmann & Asche, 2017). Fish farmers also try to provide more credible ecolabels using organic labeling (Asche, Larsen, Smith, Sogn-Grundvag, & Young, 2015; Ankamah-Yeboah, Nielsen, & Nielsen, 2016).

These certification schemes frequently act as more stringent regulatory agents than national authorities (Washington & Ababouch, 2011). However, Bush et al. (2013, p. 1067–1068), among others, argue that aquaculture certification "takes an enterprise-level approach" with the result that important environmental externalities are "rarely effectively considered." They also argue that the social externalities of aquaculture, which are

believed by many to be extensive and significant, are seldom included. Certification schemes, for example, may disadvantage small producers of the global south and undermine the sovereignty of governments of the global south by moving the locus of decision-making beyond their shores (Busch, 2017).

This paper explores whether certification schemes for salmon aquaculture, with their focus on site and firm-level criteria and compliance, actually can make the industry more sustainable on a wider scale. To assess this, we draw upon a thorough examination of over 1900 sustainability indicators from eight salmon certification scheme standards commonly used by producers in Norway, Chile and Scotland. Our findings show that indicators in these schemes do primarily pertain to individual production sites, predominantly addressing issues concerning the site and the company operating there. However, it is necessary to differentiate between the level of *criteria* with which the companies need to comply and the level of the targeted *impact* of these criteria. Taking this distinction into account, we find that a majority of the indicators address broader scale impacts, including many of the indicators with site-level criteria. We will here discuss how site-level indicators manage to target a wider level of impact through additional requirements that seek to include externalities of the production.

Theoretical background

The intention of certification is to use the communication between buyers and sellers as a means to move the aquaculture industry in a more sustainable direction. Within the literature on ecolabel economics, certification is treated as a signaling game, a tradition that can be traced back at least to the seminal contributions to information economics by Akerlof (1970) and Spence (1973). This literature views consumers as facing a type of adverse selection problem, where the true properties of the goods they wish to buy are hidden from them. A key function of certification is then to provide consumers with better information, enabling them to make better-informed choices. The signaling effect of certification does not only involve end-consumers, however, as many certification schemes operate only at the business-to-business level, without consumer-facing labels. Thus, certification involves the industry itself, buyers, retailers, researchers, government and the general public, underlining the importance of the reliability of the information provided by these schemes.

Efforts to reduce the footprint of aquaculture production necessitate that negative externalities associated with aquaculture production are addressed. This is the general purpose of the various indicators and certification schemes considered here. In the present context, we understand negative

externalities as undesirable effects of aquaculture production that are not fully accounted for by the market. Externalities take various forms, and some have more widespread consequences than others. Salmon aquaculture, when practiced as open cages in marine waters, potentially directly affects its surroundings in several ways, which can include impacts on habitats, wild species, water quality, chemical emissions, and the spread of resistance to antibiotics (Osmundsen, Almklov, & Tveteras, 2017; Tlusty, 2012). Which of these challenges are most pertinent can vary across countries, regions and even fjords. Other more global impacts of salmon farming include energy use, biotic resource use, greenhouse gases, acidifying and eutrophying emissions (Pelletier et al., 2009). The magnitudes of these externalities are often both difficult to measure and highly controversial. It is perhaps even harder to understand the social and economic externalities generated by any given fish farm or enterprise, such as the potential negative impacts on indigenous peoples, as aquaculture production may hinder traditional livelihoods (Gerwing & McDaniels, 2006). As Raynolds (2004, p. 728) puts it, commodities are enmeshed in a "complex web of material and nonmaterial relationships connecting [...] social, political and economic actors."

Some externalities can be confined to the specific production site, such as fish welfare, which may not be adequately addressed by the producer if the market is not willing to pay for it. Frequently, however, externalities range over several levels, such as sea lice which are troublesome both for the producers themselves, nearby producers, and society as a whole as it may pose a threat to the wild salmon stock. One can argue that this is not an externality at the site-level if the producer fully acknowledges the effect of sea lice on his own profitability and thus acts accordingly. To avoid discussions as to whether a certain undesirable side-effect is to be considered an externality or not in the strict sense, we generally refer to these phenomena as "impacts." The scale at which these concerns are mainly felt is referred to as an "impact level," and our intention is to evaluate whether or not local indicators, as measured at site or firm-level, are adequate correctors of impacts that extend beyond a given production facility or firm.

According to Bush et al. (2013), only local effects of aquaculture production are taken into account by the various certification schemes, as it is often individual production sites that are certified. This entails that compliance with the standard indicators occurs on each aquaculture site (or processing facility), which necessarily prompts indicators that can be measured and met on a site-level. Similarly, Belton, Murray, Young, Telfer, and Little (2010) argue that certification schemes are neglecting vital issues such as unsustainable resource use further upstream in the value chain because

they only focus on the localized impacts at the farm-level. Furthermore, because private production units are certified, there is no guarantee that the cumulative environmental effects of several farms in one production area are addressed (Boyd & McNevin, 2012).

With requirement compliance being at the site or firm-level, individual decisions on actions such as de-lousing and fallowing can have a limited effect if not coordinated with a larger area. The same goes for the handling of viruses and emergency slaughtering following disease outbreaks (Pettersen, Osmundsen, Aunsmo, Mardones, & Rich, 2015). Furthermore, by focusing on issues pertaining to the specific farms, externalities that are not directly associated with the farm activities, such as the use of unsustainably produced feed, transport, and processing further down the production chain, may not be adequately accounted for (Bosma, Anh, & Potting, 2011). Also, according to Bush et al. (2013), the environmental impact on surrounding agriculture or natural ecosystems are less then perfectly addressed by certification schemes, thus confirming that these schemes take a too particularistic approach. Similarly, Bruce and Laroiya (2007) argue that increasing returns to scale in environmental protection often implies that the sum of site-level impacts is not equal to the impact on society as a whole.

All these contributions point to the same issue, namely that certification schemes and the set of indicators included in these, take a narrow approach to sustainability, and that site-level criteria are not adequate in addressing broader scale impacts. This, in turn, speaks to the reliability, or lack thereof, of the information provided by these standards, as they claim to promote a more sustainable aquaculture industry by certifying responsible production.

Materials and methods

In exploring the reliability of the information provided by certification through assessing the degree to which aquaculture schemes capture externalities, we examined the content of selected certification scheme standards for salmon aquaculture. While a part of the criticism of aquaculture certification points to criteria and compliance being on site-level and thus limiting its ability to address broader scale impacts, a standard that applies to specific sites may still have indicators that target impacts beyond the site-level. In order to explore whether certification is indeed making the industry more sustainable, we, therefore, examined the specific indicators that make up different standards.

There exists a myriad of labels that salmon farmers can choose from (Alfnes, Chen, & Rickertsen, 2018), of which we have selected eight of the major certification schemes and their standards for salmon aquaculture in

Table 1. Chosen certification schemes and standards.

Certification scheme	Standard	Version	Intent/ambition
Aquaculture Stewardship Council (ASC)	Salmon	v1.0	Minimize or eliminate the key negative environmental and social impacts of salmon farming, while permitting the industry to remain economically viable
GLOBALG.A.P.	Aquaculture/GRASP	v5.0/v1.3	Economically, ecologically, socially and culturally responsible agriculture (and aquaculture)
Friend of the Sea (FOS)	Marine Aquaculture	v1.1	Conserve the marine environment while ensuring sustainable fish stocks for generations to come
International Featured Standards (IFS)	Food	v6.0	Quality assurance and food safety
BRC Global Standards (BRC)	Food Safety	v7.0	Food safety, quality and operational criteria in food manufacturing
Royal Society for the Prevention of Cruelty to Animals (RSPCA)	Farmed Atlantic Salmon	*09/2015*	Animal welfare, sustainability, traceability, biosecurity
Global Aquaculture Alliance (GAA)	BAP Salmon	v2.3	Food safety, social welfare, environmental, animal health and welfare
Scottish Salmon Producers' Organization (SSPO)	Code of Good Practice - Seawater Lochs	*02/2015*	Balance between industry activities and regulatory detail or bureaucracy, assurance of quality, high minimum standard and continuous improvement

Norway, Chile and Scotland as our data material (see Table 1 for summary). The Aquaculture Stewardship Council (ASC) proclaims to certify environmentally and socially responsible seafood in general. For the ASC Salmon Standard, the certificate is valid for 3 years, with farms audited annually. Global Good Agriculture Practice (GLOBALG.A.P.) is similarly an "all-around" scheme that claims to cover food safety and traceability, environment, workers' health, safety and welfare, and animal welfare. GLOBALG.A.P. certifies companies, with a select number of farms being audited annually. Friend of the Sea (FOS) stresses the safeguarding of the marine environment and its resources. Their certificates are valid for 3 years, with on-site audits every 18 months. The International Featured Standards' (IFS) Food Standard emphasizes food safety and quality assurance. The certificate applies to processing facilities and is valid for 1 year. BRC Global Standards (BRC) is a brand and consumer protection organization, with a standard emphasizing food safety and quality issues, similar to IFS. Audits are performed at processing facilities, with the frequency depending on performance. Royal Society for the Prevention of Cruelty to Animals (RSPCA) emphasizes animal welfare, with members being subject to annual assessments, in addition to annual unannounced audits. The Global Aquaculture Alliance (GAA) standard, Best Aquaculture Practices (BAP), claims to address four pillars of responsible aquaculture: food safety, social welfare, environmental, animal health and welfare. Salmon farms are

audited annually, when possible. The Scottish Salmon Producers Organization's (SSPO) standard, Code of Good Practice, is a national standard that claims to provide general good practice across all aspects of fish production. On-site audits are performed annually.

A total of 1916 indicators were coded according to both "level of *criteria*" and "level of targeted *impact*." "Criteria" refers here to the specific requirement set for each indicator, while "targeted impact" represents the issues that are addressed through these requirements. For "level of criteria," the indicators were coded as either "site-level," "beyond site-level" or both. "Site-level" signifies compliance at the site and immediate surrounding area only, "beyond site-level" concerns company senior management or external parties such as feed producers and suppliers, and "both site-level and beyond" requires compliance both on and outside the site, as with various collaborations with neighboring sites.

For "level of targeted impact", the indicators were coded as either "site-level," "beyond site-level" or both. "Site-level" has a targeted impact on the site only (e.g., fish welfare), "beyond site-level" addresses external issues only (e.g., food safety), and "both site-level and beyond" has a targeted impact both on and outside the specific site (e.g., disease control).

All indicators that were coded as having a targeted impact beyond site-level were further categorized according to a more specific level, as either "impact surrounding site," "broader impact" or both. "Impact surrounding site" includes impacts on the surrounding environment and the local community. "Broader impacts" goes beyond the surrounding area, including national and global issues.

Additionally, we utilized the codification of these 1916 indicators according to 28 different topics relevant for making the aquaculture industry sustainable, as provided by Amundsen and Osmundsen (2018). Based on this work, we were able to identify which groups of indicators pertain to issues directly affecting the site and the company, and which address broader scale impacts of aquaculture production. To explore the relationship between these different levels, we focused on groups of indicators addressing multiple levels, i.e., indicators with potentially both a lower site-level impact and a wider level of impact. Through the examination of these indicators, we identified several common characteristics among them, providing valuable insight into how the level of impact can be elevated, even with site-specific standards and indicators.

Findings

By studying the specific indicators of the eight sustainability standards, we can investigate the reliability of the information provided by the

Table 2. Indicators coded according to level of criteria and targeted impact.

	ASC	GLOBAL G.A.P.	FOS	IFS	BRC	RSPCA	GAA	SSPO	Total
Total number of indicators	152	267	52	278	255	468	137	307	1916
Site-level criteria	96	198	43	190	203	263	104	228	1325
Site-level impact	26	91	7	0	0	212	51	125	512
Impact beyond site-level	38	56	28	190	203	22	29	33	599
Both site-level and beyond	32	51	8	0	0	29	24	70	214
Beyond site-level criteria	41	2	7	26	4	108	1	35	224
Site-level impact	1	0	0	3	0	99	0	16	119
Impact beyond site-level	35	2	5	19	4	2	1	0	68
Both site-level and beyond	5	0	2	4	0	7	0	19	37
Both site-level and beyond criteria	15	67	2	62	48	97	32	44	367
Site-level impact	0	13	0	0	0	90	6	2	111
Impact beyond site-level	6	32	2	62	48	3	14	3	170
Both site-level and beyond	9	22	0	0	0	4	12	39	86

certification schemes. As argued in much of the literature above, we indeed find that the various indicators to a large degree cover issues pertaining to the activities of each individual aquaculture site or processing facility. However, this mainly concerns the level of criteria, i.e., the level where compliance is required. As seen in Tables 2 and 3, a clear majority of the indicators, 1325 of 1916 in total, have criteria on site-level only, but most of these indicators nevertheless have a targeted impact that goes beyond site-level (1174 when including the ones that target wider impacts only, and the ones that target both site-level and wider impacts, see Table 3). We also find that most of these indicators have a targeted impact that goes beyond the area surrounding the site, to include national and global challenges. Among the indicators targeting the conditions at the production site, these involve issues such as fish welfare and local sampling water and sediment quality. Concrete examples include SSPO's #5.2 "*Each farm should have access to a veterinary surgeon experienced in fish health to advise on fish health matters and medicine usage, and who is available to attend at short notice*" and RSPCA's #E3.6 "*Biofouling must not be allowed to build up on enclosure nets.*"

Of the 1174 indicators with a targeted impact going beyond site-level, many address issues pertaining to the area surrounding the site, both the surrounding environment and the local community. For example, all six of the schemes that audit fish farms (all except the IFS and BRC standards) include indicators related to escapees, which can cause harm to local wild salmon stocks. These indicators include minimizing escapees, dealing with them, training staff to prevent them, and reporting them. Other indicators with targeted impact level surrounding the site concern the potential spread of disease, coordination with neighboring sites and conflict resolution with the local community. Concrete examples include FOS' #3.1 "*The average yearly percentage of fish escape assessed is not higher than 0.5% of the total of bred fish*" and GAA's #4.9 "*Production cycles, fallowing and nutrient*

Table 3. Summary of coding.

Level of criteria	1916
Criteria site-level only	1325
Criteria beyond site-level	224
Criteria both site-level and beyond	367
Level of targeted impact	1916
Impact site-level only	742
Impact beyond site-level	837
Impact both site-level and beyond	337

monitoring shall be coordinated with the other neighboring BAP applicants or certified farms, or with members of an established AMA [Area Management Agreement]."

Among the indicators that target impacts beyond the site level, we also find that many of them operate on a broader level than just the surrounding area, and are directed towards suppliers and other actors along the value chain, global consumers and the global environment. From Table 4 we find that 791 indicators at least partly address issues beyond both the site and surrounding areas. These typically relate to issues concerning food safety, traceability and record-keeping of activities, and general transparency. Concrete examples include IFS' #4.18.1 "*A traceability system shall be in place which enables the identification of product lots and their relation to batches of raw materials, packaging in direct contact with food, packaging intended or expected to be in direct contact with food. The traceability system shall incorporate all relevant receiving processing and distribution records. Traceability shall be ensured and documented until delivery to the customer*" and ASC's #4.4.1 "*Presence and evidence of a responsible sourcing policy for the feed manufacturer for feed ingredients that comply with recognized crop moratoriums and local laws.*" It is important to note that the great majority of these indicators are found in the two food safety standards, BRC and IFS. If these standards had not been included, the number of indicators under this category would go from 791 to 261.

While our findings indicate that these sustainability standards do in fact address more impacts of a broader scale than much of the criticism suggests, they still have pronounced limitations in this regard. For instance, a deficiency observed in our analysis is that certification schemes almost exclusively pay attention to environmental and resource impacts in the sea and not land-based resources. Due to the controversy surrounding the use of wild pelagic fish as a raw material in fish feed, there has been an increase in the use of non-marine ingredients, such as soy protein. Despite its potential severity, the environmental impacts of this rising demand, e.g., deforestation, are only addressed in the ASC standard. Similarly, emissions from transport services related to both feed and fish are not easily accounted for. Indeed, as noted by Bush et al. (2013), none of the major aquaculture sustainability schemes consider the environmental cost of

Table 4. Of those indicators with targeted impact beyond site-level.

Total	1174
Impact surrounding site	383
Impact broader than surrounding site	654
Impact both surrounding site and broader	137

transportation and distribution. Of the eight, the ASC standard is the only one that has indicators on GHG emissions, but these do, at this time, only request records of annual GHG assessments, with no set limit on emission. The idea is that by acquiring assessment data, ASC can later add a requirement related to the maximum amount of GHG emissions allowed.

By examining the groups of indicators that target multiple levels, we see that many indicators with site-level compliance are "lifted up" to a higher level of impact by some form of governance, such as traceability, transparency, sharing of information, and coordination between other aquaculture sites or other marine resource users. For example, indicators related to introduced or amplified parasites and pathogens in the ASC standard focus on participation in an Area-Based Management (ABM) scheme. Similar arrangements can be found in other standards, under names such as Area Management Agreements (GAA and RSPCA), Area Management Plan (GLOBALG.A.P.) and Farm Management Area (SSPO). Another example is feed indicators that not only involve the safety of the feed for the fish (fish health and welfare) but also traceability concerning food safety for consumers and source of marine raw materials to ensure responsible environmental management of small pelagic fisheries. Looking at the commonalities between these multi-level indicators, we have identified two key characteristics that allow a higher level of targeted impact: *traceability* and *coordination and sharing of information*:

Traceability

In the present context, we define "traceability" as the ability to track the history of any substance through all its stages of production, processing and distribution, i.e., a new form of informational governance (Bailey, Bush, Miller, & Kochen, 2016). Traceability is thus important in order to assess the environmental and social footprint of aquaculture products from cradle to plate. In addition, traceability is central to ensuring that the end product is a safe and healthy food commodity. The potentially excess use of marine products further down the food chain is also addressed by the traceability criterion. Traceability indicators operate across the whole value chain, across sectors, regions and countries, and can thus be said to answer some of the criticism to sustainability indicators considered here. We also

find that traceability is prevalent within all certification schemes that we have examined.

As regards to indicators related to food safety, traceability is a key requirement. For instance, three of the standards (BRC, IFS and GLOBALG.A.P.) have strict indicator requirements concerning product withdrawals and recall procedures, necessitating extensive documentation and searchable records that ensure an effective response in the event of safety issues or product defects. Traceability for food safety also involves indicators related to dangerous toxins in fish feed or medicinal residues from treatment of the fish, which can be found in ASC, GAA, GLOBALG.A.P. and SSPO.

Coordination and sharing of information

A popular objection to sustainability indicators on a firm or site-level is that they do not address the issue of firms making individual decisions without coordinating with other agents operating in the same area. Many interdependencies exist between producers that operate in the same area, and area-based management is thus central to the sustainability of the aquaculture industry. Highly suboptimal outcomes have been demonstrated in situations where agents fail to cooperate. Coordination and information sharing is important not only among producers in the same area, but also for the industry as a whole, and for increased trust and transparency between the industry and other central stakeholders such as regulating authorities and the general public.

Our findings show that the ASC, GAA, RSPCA, GLOBALG.A.P. and SSPO standards all have indicators related to coordination and collaboration. These indicators include, among others, coordination of production cycles, stocking, fallowing, nutrient monitoring, and fish health management activities, and information-sharing in the event of discharge, unexplained increased mortality or diseases that must be notified to the OIE (World Organization for Animal Health). The IFS and BRC standards do not have any indicators on coordination and collaboration, as they pertain to processing facilities, leaving just the FOS standard without any across-site coordination or collaboration indicators.

Discussion

As argued in much of the certification literature, it is challenging to capture broader scale impacts when operating with site and enterprise-level standards. Our findings indicate, however, that this can to some extent be accomplished in many cases by "lifting up" site-level criteria using some

form of governance characteristic. We have identified *traceability* and *coordination and sharing of information* as prevalent requirements in the certification schemes examined here, enabling site-level certification to have a more far-reaching impact. These indicators have the potential to counteract much of the criticism that has been posed towards certification schemes and sustainability standards for being too near-sighted.

Traceability is emphasized in all of the standards considered here, in many different forms. A substantial share of the indicators with broader targeted impacts relates to various facets of food safety, a key aspect of responsible aquaculture. These include proper species identification, prevention of harmful residue from chemical treatment of the fish, identification of allergens, and hindering of product contamination or tampering. In addition to helping ensure a safe product, traceability is crucial to perform corrective measures in case of unsafe food leaving the plant and to provide the consumer with the correct product information.

When attempting to address the broader scale impacts of aquaculture, it is important to consider improvement across the entire value chain. This includes, for example, using traceability to ensure responsible sourcing of raw materials for feed, considering the controversies surrounding both the use of wild pelagic fish and the use of soy protein as main ingredients. As this example illustrates, however, assessment of the many environmental externalities of aquaculture is characterized by much complexity. Achieving full traceability of the environmental impact of aquaculture is a difficult task, particularly due to the immense data requirements involved in identifying these global effects. Conducting comprehensive life cycle assessments of the whole production process is neither viable by existing methods, nor required by any certification scheme. Bosma et al. (2011), in a partial life cycle analysis of catfish farming, found that environmental effects from feed are given some attention by existing certification standards, but not the impact of processing and distribution. This corresponds to our findings.

Coordination and sharing of information are crucial in addressing the negative impacts of aquaculture that go beyond site-level. The type of strategic dynamic that frequently occurs among individual agents may lead to particularly adverse effects. Prisoner's dilemma types of situations arise when actors do not cooperate and view sustainability as a zero-sum game. If not all firms in the same area adhere to the same certification scheme, more responsible behavior by some agents may induce less responsible behavior by others. Area-based management is a strategy for achieving coordination and sharing of information, as it obligates different sites and companies to engage in, e.g., limiting disease outbreaks and ensuring biosecurity through a collaborative effort. Coordination and transparency among

neighboring sites do have their limitations due to proprietary issues, as companies will seek to safeguard the information that might give them a competitive advantage. However, its many advantages suggest that coordinated efforts should be emphasized to a larger extent.

Sharing of information as an approach to minimize externalities of aquaculture does not only apply between neighboring sites but also in regards to general transparency, which is demanded both by regulatory authorities and the general public. Sharing of information can be in the form of publicly available information, such as sea lice levels in the ASC standard, or information that is available on request. These requirements help ensure complete and thorough documentation and record-keeping, while also promoting increased accountability of the aquaculture companies. This can in turn help expose larger disease outbreaks, keep the public safe from potential safety hazards and facilitate better dialog with stakeholders and the local community. Transparency is also important in regards to food safety, due to the necessity of proper labeling of ingredients and allergens.

Traceability and coordination/sharing of information are both contingent on a key feature of standardization: documentation. The proliferation of certification has, therefore, led to increased emphasis on reporting and record-keeping. The question as to whether it is worth the extra financial costs and manpower is difficult to answer. Nevertheless, as these two characteristics exemplify, site and enterprise-level standards can target broader scale impacts by "lifting up" site-level criteria and compliance.

Concluding remarks

Sustainability certification has the potential to provide benefits at all levels in the supply chain. For consumers, more information about the sustainability properties of various commodities allows better-informed choices. For producers, the reputational benefit that comes with certification may have a substantial financial value. For retailers, certification schemes offer an opportunity to outsource reputational risk. Whether such schemes actually do help to make the industry more sustainable is, however, a more difficult question to answer (Roheim, Bush, Asche, Sanchirico, & Uchida, 2018).

In this paper, we explored the content of eight prominent certification scheme standards for salmon aquaculture, with particular focus on the level of impact that the standard indicators target. By doing so, we intend to add some analytical clarity hitherto missing in the debate about aquaculture, and provide insight into the reliability of the information that is given to consumers, retailers, government, etc., through certification.

In certain cases, the individual efforts of different sites can efficiently address externalities from production, e.g., preventing fish from escaping the cages will necessarily lead to an overall reduction in escapees. For certification to have a substantial impact on the industry, however, broader scale impacts need to be addressed. Our findings indeed suggest that many of the indicators are directed toward specific sites and production facilities, thus being local in nature. However, by applying a distinction between the level of criteria and level of targeted impact, we see that certain broader scale impacts of aquaculture are indeed addressed. We also find that indicators related to traceability and coordination/sharing of information are promising in elevating local concerns to a wider scale.

When discussing sustainability, it is important to keep in mind the obscurity that characterizes this concept. Despite its prevalence, there lacks a common consensus as to what it actually means and how it can be accomplished. Further complicating the matter, the complexity of the aquaculture industry and the ecological systems within which the industry finds itself is the cause of much disagreement as to what a "sustainable aquaculture industry" might actually look like. There is no blueprint to follow due to contradicting findings within the scientific community, in addition to the many contradicting needs and interests of the various stakeholders affected by the industry.

Some of the standards recommend practices that diverge, and occasionally are even contradictory. An example is the use of acoustic deterrent devices (ADD), which are used to scare away predators. The ASC standard forbids the use of these, while the SSPO standard states that they "*should be used where and as permitted*," and the RSPCA standard requests them at "*[a]ny site that is recognized as having a high risk of attack or has suffered an attack in the past*." This represents one of many difficult value questions that have no clear answer, or rather an answer that depends on what one wishes to safeguard – the fish or surrounding marine mammals. As exemplified here, the lacking consensus as to which activities are more "sustainable" makes it difficult to say for certain which measures have the biggest impact. With the many different considerations present, tradeoffs are essential in the process towards a "sustainable aquaculture industry."

Despite its many benefits, we need to acknowledge and fully understand the limitations of certification. These standards are not likely to fully transform a sector that struggles with fundamental environmental, economic and social problems. Many of the externalities of aquaculture seem to go beyond the reach of certification, such as those that require international cooperation and problems that cross different production sectors, such as transport. It is, however, important to keep in mind that certification is only a part of a global governance regime, and it needs to be regarded as

such. Regulating such a complex industry is necessarily a concerted effort, meaning that certification must function as a complement to government regulations. Furthermore, the industry itself has a responsibility as a contributory actor in this governance regime. When we can acknowledge both strengths and limitations of the different regulation efforts, both private and public, this can potentially enable better collaboration between them in making the aquaculture industry more sustainable, whatever that may entail.

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ORCID

Vilde Steiro Amundsen http://orcid.org/0000-0003-2104-3408

References

Akerlof, G. A. (1970). The market for "lemons": Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, *84*(3), 488. doi:10.2307/1879431

Alfnes, F., Chen, X., & Rickertsen, K. (2018). Labeling farmed seafood: A review. *Aquaculture Economics and Management*, *22*(1), 1–26. doi:10.1080/13657305.2017.1356398

Amundsen, V. S., & Osmundsen, T. C. (2018). Sustainability indicators for salmon aquaculture. *Data in Brief*, *20*, 20–29. doi:10.1016/j.dib.2018.07.043

Ankamah-Yeboah, I., Nielsen, M., & Nielsen, R. (2016). Price premium of organic salmon in Danish retail sale. *Ecological Economics*, *122*, 54–60. doi:10.1016/j.ecolecon.2015.11.028

Asche, F. (2008). Farming the Sea. *Marine Resource Economics*, *23*(4), 527–547. doi:10.1086/mre.23.4.42629678

Asche, F., Larsen, T. A., Smith, M. D., Sogn-Grundvag, G., & Young, J. A. (2015). Pricing of eco labels with retailer heterogeneity. *Food Policy*, *53*, 82–93. doi:10.1016/j.foodpol.2015.04.004

Bailey, M., Bush, S. R., Miller, A., & Kochen, M. (2016). The role of traceability in transforming seafood governance in the global South. *Current Opinion in Environmental Sustainability*, *18*, 25–32. doi:10.1016/j.cosust.2015.06.004

Belton, B., Bush, S. R., & Little, D. C. (2018). Not just for the wealthy: Rethinking farmed fish consumption in the Global South. *Global Food Security*, *16*, 85–92. doi:10.1016/j.gfs.2017.10.005

Belton, B., Murray, F., Young, J., Telfer, T., & Little, D. C. (2010). Passing the panda standard: A TAD off the mark? *AMBIO*, *39*(1), 2–13. doi:10.1007/s13280-009-0009-4

Bosma, R., Anh, P. T., & Potting, J. (2011). Life cycle assessment of intensive striped catfish farming in the Mekong Delta for screening hotspots as input to environmental policy and research agenda. *The International Journal of Life Cycle Assessment*, *16*(9), 903–915. doi:10.1007/s11367-011-0324-4

Boyd, C. E., & McNevin, A. A. (2012). An early assessment of the effectiveness of aquaculture certification and standards. In *Steering Committee of the State-of-Knowledge Assessment of Standards and Certification, toward sustainability: The roles and limitations of certification*. Washington, DC: RESOLVE, Inc.

Bronnmann, J., & Asche, F. (2017). Sustainable seafood from aquaculture and wild fisheries: Insights from a discrete choice experiment in Germany. *Ecological Economics*, *142*, 113–119. doi:10.1016/j.ecolecon.2017.06.005

Bruce, C., & Laroiya, A. (2007). The production of eco-labels. *Environmental and Resource Economics*, *36* (3), 275–293. doi:10.1007/s10640-006-9028-9

Busch, L. (2017). Standards and their problems: From technical specifications to world-making. In *Transforming the Rural* (Research in Rural Sociology and Development, Volume 24) (pp. 97–114). Bingley, UK: Emerald Publishing Limited. doi:10.1108/S1057-192220170000024005

Bush, S. R., Belton, B., Hall, D., Vandergeest, P., Murray, F. J., Ponte, S., … Kusumawati, R. (2013). Certify sustainable aquaculture? *Science*, *341*(6150), 1067–1068. doi:10.1126/science.1237314

Bush, S. R., & Roheim, C. A. (2018). The shifting politics of sustainable seafood consumerism. In M. Bostrom, M. Micheletti, & P. Oosterveer (Eds.), *The Oxford Handbook of Political Consumerism*. Oxford, UK: Oxford University Press. doi:10.1093/oxfordhb/9780190629038.013.16

Ceballos, A., Dresdner-Cid, J. D., & Quiroga-Suazo, M. Á. (2018). Does the location of salmon farms contribute to the reduction of poverty in remote coastal areas? An impact assessment using a Chilean case study. *Food Policy*, *75*, 68–79. doi:10.1016/j.foodpol.2018.01.009

Froehlich, H. E., Runge, C. A., Gentry, R. R., Gaines, S. D., & Halpern, B. S. (2018). Comparative terrestrial feed and land use of an aquaculture-dominant world. *Proceedings of the National Academy of Sciences*, *115*(20), 5295–5300. doi:10.1073/pnas.1801692115

Gerwing, K., & McDaniels, T. (2006). Listening to the salmon people: Coastal first nations' objectives regarding salmon aquaculture in British Columbia. *Society & Natural Resources*, *19*(3), 259–273. doi:10.1080/08941920500460864

Hai, F. I., Visvanathan, C., & Boopathy, R. (Eds.), (2018). *Sustainable aquaculture*. Cham, Switzerland: Springer International Publishing. doi:10.1007/978-3-319-73257-2

Jonell, M., Phillips, M., Rönnbäck, P., & Troell, M. (2013). Eco-certification of farmed seafood: Will it make a difference? *Ambio*, *42*(6), 659–674. doi:10.1007/s13280-013-0409-3

Klinger, D., & Naylor, R. (2012). Searching for solutions in aquaculture: Charting a sustainable course. *Annual Review of Environment and Resources*, *37*(1), 247–276. doi:10.1146/annurev-environ-021111-161531

Kobayashi, M., Msangi, S., Batka, M., Vannuccini, S., Dey, M. M., & Anderson, J. L. (2015). Fish to 2030: The role and opportunity for aquaculture. *Aquaculture Economics & Management*, *19*(3), 282–300. doi:10.1080/13657305.2015.994240

Kumar, G., & Engle, C. R. (2016). Technological advances that led to growth of shrimp, salmon, and tilapia farming. *Reviews in Fisheries Science & Aquaculture*, *24*(2), 136–152. doi:10.1080/23308249.2015.1112357

Nilsen, M., Amundsen, V. S., & Olsen, M. S. (2018). Swimming in a slurry of schemes: Making sense of aquaculture standards and certification schemes. In S. Haugen, A.

Barros, C. Van Gulijk, T. Kongsvik., & J. E. Vinnem (Eds.), *Safety and reliability – Safe societies in a changing world* (pp. 3149–3156). London, UK: Taylor & Francis Group.

Olsen, M. S., & Osmundsen, T. C. (2017). Media framing of aquaculture. *Marine Policy*, *76*, 19–27. doi:10.1016/j.marpol.2016.11.013

Osmundsen, T. C., Almklov, P., & Tveteras, R. (2017). Fish farmers and regulators coping with the wickedness of aquaculture. *Aquaculture Economics & Management*, *21*(1), 163–183. doi:10.1080/13657305.2017.1262476

Peel, D., & Lloyd, M. G. (2008). Governance and planning policy in the marine environment: Regulating aquaculture in Scotland. *Geographical Journal*, *174*(4), 361–373. doi:10.1111/j.1475-4959.2008.00304.x

Pelletier, N., Tyedmers, P., Sonesson, U., Scholz, A., Ziegler, F., Flysjo, A., … Silverman, H. (2009). Not all salmon are created equal: Life cycle assessment (LCA) of global salmon farming systems. *Environmental Science & Technology*, *43*(23), 8730–8736. doi:10.1021/es9010114

Pettersen, J., Osmundsen, T., Aunsmo, A., Mardones, F., & Rich, K. (2015). Controlling emerging infectious diseases in salmon aquaculture. *Revue Scientifique Et Technique de L'oie*, *34*(3), 923–938. doi:10.20506/rst.34.3.2406

Raynolds, L. T. (2004). The globalization of organic agro-food networks. *World Development*, *32*(5), 725–743. doi:10.1016/j.worlddev.2003.11.008

Roheim, C. A., Bush, S. R., Asche, F., Sanchirico, J., & Uchida, H. (2018). Evolution and future of the sustainable seafood market. *Nature Sustainability*, *1*(8), 392–398. doi:10.1038/s41893-018-0115-z

Roheim, C. A., Sudhakaran, P. O., & Durham, C. A. (2012). Certification of shrimp and salmon for best aquaculture practices: Assessing consumer preferences in Rhode Island. *Aquaculture Economics & Management*, *16*(3), 266–286. doi:10.1080/13657305.2012.713075

Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, *87*(3), 355. doi:10.2307/1882010

Tlusty, M. F. (2012). Environmental improvement of seafood through certification and ecolabelling: Theory and analysis: Modelling seafood improvement. *Fish and Fisheries*, *13*(1), 1–13. doi:10.1111/j.1467-2979.2011.00404.x

Tveteras, S. (2002). Norwegian salmon aquaculture and sustainability: The relationship between environmental quality and industry growth. *Marine Resource Economics*, *17*, 121–132.

Uchida, H., Onozaka, Y., Morita, T., & Managi, S. (2014). Demand for ecolabeled seafood in the Japanese market: A conjoint analysis of the impact of information and interaction with other labels. *Food Policy*, *44*, 68–76. doi:10.1016/j.foodpol.2013.10.002

Washington, S., & Ababouch, L. (2011). *Private standards and certification in fisheries and aquaculture: Current practice and emerging issues.* Rome, Italy: Food and Agriculture Organization of the United Nations.

Paper E

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Becoming certified, becoming sustainable? Improvements from aquaculture certification schemes as experienced by those certified

Vilde Steiro Amundsen [a,b,*], Tonje Cecilie Osmundsen [b]

[a] Department of Sociology and Political Science, Faculty of Social and Educational Sciences, NTNU - Norwegian University of Science and Technology, 7491, Trondheim, Norway

[b] Studio Apertura, NTNU Samfunnsforskning, Dragvoll allé 38 B, 7049, Trondheim, Norway

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ABSTRACT

While the effectiveness of sustainability certification has been studied through many different approaches, an understudied dimension is the behavioral changes made within the companies that become certified. Following neo-institutional and organizational learning theory, the potential of certification as a means of improvement is premised on companies actually internalizing new principles. Based on interviews and fieldwork conducted within the aquaculture industry, we explore if, and how, the responsible practices advocated by certification schemes are incorporated in the day-to-day activities of the companies. Our findings speak to the difficulties of applying standardized measures to regulate a global and complex industry, at times creating a need for compromises and adaptation of the certification principles. An important contribution of this paper is the identification of key facilitators for behavioral change, as the current limited understanding of the behavioral dimension of certification effectiveness gives little guidance on how to realize the full potential of sustainability standards. Based on this, we argue that certification schemes oriented towards continuous improvement and flexibility are better suited for promoting behavioral change.

1. Introduction

Sustainability certifications have proliferated within numerous industries due to a growing focus on sustainability among governments, businesses, interest groups, and consumers [1]. These are private regulatory initiatives that come in the form of voluntary certifications, which aquaculture companies can obtain by demonstrating compliance with a set list of criteria, usually assessed by a third-party auditor. In a continuously globalized market, these certifications are intended to facilitate improved resource management, increased traceability, and global commensurability and accountability [2,3].

Aquaculture is an industry that has seen a significant increase in certification schemes [4]. It is a growing industry that is considered vital in addressing global food security, especially in the wake of stagnating fisheries production [5]. It is considered by many a more sustainable food alternative, due to its lower environmental impact relative to other animal proteins [6]. However, the industry has also received much criticism for its unsustainable practices. This relates to issues such as disease, waste and emission, privatization of marine commons, disregard for local communities, and unsustainable feed production [7–10]. In addition to pressure from environmental groups and civil society, there has also been an increase in consumer and retailer demand for certified products [3,11]. By communicating the attainment of certification, companies can enhance the perception external audiences have of their business [12].

In this paper, we explore this phenomenon as a means towards improving the practices of the aquaculture industry. Although sustainability certification is continuously gaining ground, there is much uncertainty concerning its actual implications. The question of whether sustainability certification is effective has been studied using many different approaches, based on different understandings of what effectiveness constitutes. Many of these studies have considered the standards themselves, and, while this is a valuable source of evidence, it is important to keep in mind that these are studies of certification's *potential* rather than *actual* effectiveness [13]. A dimension of certification effectiveness that has been given little attention, and which speaks more to its actual effectiveness, is the *behavioral changes* made within companies that obtain these standards [14]. This concerns whether

* Corresponding author. Department of Sociology and Political Science, Faculty of Social and Educational Sciences, NTNU - Norwegian University of Science and Technology, 7491, Trondheim, Norway

E-mail addresses: vilde.amundsen@samforsk.no (V.S. Amundsen), tonje.osmundsen@samforsk.no (T.C. Osmundsen).

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companies adopt sustainability standards merely as checklists, with the sole intent of complying with the necessary requirements, or if they actually internalize the responsible practices promoted by the certification schemes.

The internalization of responsible practices and principles is here examined from a neo-institutionalist perspective, combined with organizational learning theory, which has proven fruitful in studies on organizations' transition to sustainability [15,16]. It provides a framework for understanding how larger societal forces can instill values and shape interests within organizations through their institutionalization, but also how these forces can encounter resistance in the organizations, in the form of deep structure barriers [17,18].

2. Theoretical background

2.1. Sustainability certification

Sustainability standards are developed through a variety of collaborative efforts by retailers, NGOs, and the industry, depending on the scheme. As private, marked-based regulatory mechanisms, sustainability certification is a voluntary form of governance [19]. Aquaculture companies decide which, if any, certifications to pursue, with different standards addressing different issues and covering different sections of the production process [3,20]. Each certification standard is made up of a list of indicators and corresponding requirements that are meant to ensure responsible practices, thereby serving as a means to operationalize sustainability [21]. Business-to-consumer schemes provide labels on the finished product to differentiate between those certified and non-certified, while business-to-business schemes serve to convey information to wholesale buyers, such as retailers [22].

The aquaculture industry, like other resource-intensive sectors, has seen a substantial increase in demand for sustainability certification [23]. The value of getting certified lies in the authoritative endorsement of the company made by a third party [24]. Such endorsements serve as signals of quality and provide assurance that the company has implemented practices that meet the requirements outlined by the certifying agency. By obtaining various certifications, aquaculture producers seek to reduce risk related to consumer and general public concerns, increase trust, and secure themselves against the supposed lacking capacity of national regulatory frameworks to govern the industry [2,22,25]. Adopting certain certifications can also provide companies with competitive advantages such as permanence, access to markets, and price premiums [26,27]. Due to the increased pressure to become certified, certification schemes are, in certain cases, becoming *de facto* mandatory [20]. This underlines the significance of sustainability certification's role in regulating the aquaculture industry, making it an important unit of analysis.

Sustainability certification has been criticized for having limited potential for improving the aquaculture industry, thereby creating a false sense of security through labeling products as 'sustainable' [28]. This is based on claims of inadequate stringency and the employment of a too narrow take on sustainability [3,21,29]. Furthermore, their ability to capture broader scale externalities has been questioned by many, as compliance, to a large degree, is assessed on site-level and rarely includes externalities of distribution, feed production, or transportation [3,4]. Although attempts to achieve a broader reaching impact with site-level certification are being made, sustainability certification does have its limitations in this regard [30]. These certifications have also been criticized for being technocentric, applying the same requirements across a global industry with little consideration for local differences, thereby not addressing the actual issues at hand [29]. Also, the nature of the standard requirements has been called into question, as it has been shown that utilizing set metrics for compliance discourages continuous improvement [31,32].

2.2. Certification effectiveness

When discussing sustainability and how to work towards it, it is important to acknowledge that this is an ambiguous concept, as there are differing opinions as to what it constitutes. This is especially true in the case of sustainability in aquaculture, where there are numerous issues to be dealt with, many with conflicting solutions [21,33,34]. The aquaculture industry is characterized by complexity, as it involves biological production activity based in an open environment with direct interaction with local habitat and wildlife [7,35]. This complexity is source to the 'wicked problem' of governing aquaculture, referring to the uncertainty, lack of comprehensive knowledge, and disagreement among researchers concerning how to improve the industry [36]. Precisely because of this complexity, the effectiveness of initiatives such as sustainability certification is difficult to ascertain.

In their comprehensive review of research on voluntary sustainability certification schemes, Tröster and Hiete [14] identify four success dimensions, inspired by Young [37], and Tikina and Innes [38]: *problem-solving* (mitigation of issues addressed), *behavioral effectiveness* (behavioral changes in the company), *process effectiveness* (market diffusion), and *constitutive effectiveness* (stakeholder acceptance). While acknowledging the significance of all four dimensions, we find that they speak to very different understandings of effectiveness. We argue that it is necessary to distinguish between effectiveness in regard to the schemes' impact on making an industry more sustainable, and in regard to the success of a specific scheme. With emphasis on the former, the problem-solving dimension is of vital importance, as it refers to whether a certification scheme is capable of solving the problem it was developed to address [14]. As is argued in this paper, the success of this dimension is very much related to the dimension of behavioral effectiveness, which we also consider of great importance. In the studies reviewed by Tröster and Hiete, the behavioral effectiveness dimension is given limited consideration, something that is reflected in the inadequate descriptions found in the literature on what it actually involves. While Tröster and Hiete assume that this dimension is considered indirectly in studies concerned with the problem-solving of certification, we do not find this association a given, thereby warranting a more explicit study of behavioral changes in organizations.

2.3. Behavioral changes through internalization

Importantly, while this dimension is referred to as behavioral *effectiveness* by Tröster and Hiete, and others, we choose to utilize behavioral *change*. This is because we find that the former gives a misconstrued impression of what improving the industry involves, as it carries connotations of a specific goal to be attained. As has been argued, making the aquaculture industry more sustainable is a complicated endeavor, with very few certainties. Necessary behavioral changes made in companies to fully incorporate more responsible principles and practices are, consequently, difficult to determine. For that reason, an important intent of this study is providing content to the concept of behavioral change in organizations, and exploring how these manifest in day-to-day practices.

Despite being understudied, behavioral changes within organizations is still considered to be critical for the effectiveness of certification schemes, as the changing of existing practices has been shown pivotal for actual improvements to take place [14,39]. However, organizations cannot be assumed to be passive adopters of new practices that are introduced from external parties [39,40]. Aquaculture companies, similar to companies in other resource-intensive industries, have been accused of adopting improvement measures such as sustainability certifications, only to serve as window-dressing [41]. This entails a lack of internalization of new principles, in an act of adoption rather than adaption. To better understand this response to external ideas and practices, we employ insight from neo-institutional theory.

According to this perspective, organizations are influenced by the

prevailing norms and beliefs of their environment, which constrain, shape, and channel behavior [16,42]. Organizations conform to these dominant notions of their environment as they depend on social approval from relevant audiences, to obtain the support and resources they need to survive and prosper [39]. What this means is that while organizational environments are subject to change through the influence of larger societal shifts, such as the current 'transition to sustainability', the institutionalization of new rules or norms is not a given, as it may fail and even reinforce prevailing rules [16,43]. New practices and technologies must challenge established and experience-based practices, changes that can also reduce the organization's efficiency [44].

According to Meyer & Rowan [45], 'decoupling' the formal structures and the actual day-to-day activities is a common strategy to avoid completely conforming to external forces, thus creating a potential disparity between policies and practice. Similarly, Nyberg & Wright [46] find that the development of new roles, e.g. sustainability manager, is more likely a form of compromise that the organization creates as a response to external criticism, as a way of incorporating 'sustainability' on their own terms. In other words, changes made in the organization do not necessarily imply fundamental behavioral changes taking place. Moving from 'identity management' to genuine 'identity development', therefore, entails that the new rules, norms, and values become part of the organizational culture, leading not just to new responsibilities and roles, but altered awareness as well [16,39].

What this tells us in regard to certification is that becoming certified does not necessarily result in more sustainable behavior. According to Tlusty and Tausig [32], companies risk 'backsliding' to noncompliance after having passed the initial audit, by not fully internalizing the principles of the certification. Kumar et al. [47] similarly find that the implementation of new technologies in aquaculture occurs as a dynamic process, with numerous factors influencing both the intensity and extent of adoption. In accordance with this, it is argued within organizational learning theory that the implementation of new principles must be understood as a process, as well as a result of the process [48]. In their seminal work on learning theory, Argyris and Schön [49] explain that it is not sufficient that individual employees learn new skills for organizational learning and change to occur, as the diffusion of this knowledge is in no way a given. For actual changes to occur, the acquisition of new knowledge must further be embedded in routines, practices, plans, and actions, thereby becoming organizational knowledge. According to Elkjaer [48], this occurs both through the acquisition of knowledge and skills, *and* participation in the community of practice, the former referring to the individual's obtainment of explicit expertise and the latter to the reciprocal learning occurring in interaction with others. Elkjaer [48] explains that the individual and the organization cannot be seen separately, "as both are products and producers of human beings and knowledge. The content of the learning process is the development of experience, which may lead to relevant organizational knowledge." In this lies the significance of actual behavioral changes taking place for new principles to be maintained over time, underlining the necessity of exploring whether responsible practices from certification are in fact internalized in the companies becoming certified.

3. Methods and materials

This study looks at the application of standardized measures as a means towards making the aquaculture industry more sustainable. Responding to the existing gap in the literature, we focus on behavioral changes made in organizations adopting sustainability standards. Former research has asserted that there is much pressure on the industry from buyers demanding certified product and production, but there are limited studies that have explored the perspective of the industry itself. The originality of the study presented here is, therefore, the investigation into the experiences of those certified and their reports on what certification signifies for their organization and work practices.

We conducted in-depth interviews with managing directors, quality directors, operational managers, environmental coordinators, and certification managers in selected salmon aquaculture companies in Norway, Chile, and Scotland; 22 in total. We spoke with representatives in ten different companies in Norway, six in Chile, while only one in Scotland due to difficulties gaining access. Our choice of companies was limited to those with familiarity with certification, as our research interests lie primarily in the industry's experience with these schemes. The interviews focused on the producers' perceptions of different schemes and their reflections on the process from deciding to work towards becoming certified through to the implementation and implications of the standards. We also interviewed two auditors from Norway and Chile, concerning their experience with the certification schemes and the audit process. Each interview lasted approximately 1–1.5 h, and was recorded, transcribed, and translated by the authors and other project members. The interviewees were anonymized using unique identification codes (e.g. N1–C1), where the first part denotes country (e.g. N1–**, N for Norway, C for Chile, and S for Scotland), and the second denotes company (e.g. **–C1). The transcribed interviews were subsequently coded in N-VIVO according to theme.

Furthermore, we attended audits for three different certification schemes in two different companies in Norway. The first audit was for the certification Aquaculture Stewardship Council (ASC), with four sites being subject to review, which lasted five days. The second audit was a combined review for International Featured Standards (IFS) and BRC Global Standards (BRC[1]), which both concern food safety at processing facilities. We attended two of the four days. In addition to observing the audit procedures and following the auditors on site visits, we conducted informal interviews with auditors and employees. Recording devices were not used, as per the companies' request. Notes from the fieldwork were transcribed, anonymized, and coded according to theme in N-VIVO.

This study was initially intended to include a comparative analysis of national contexts, which our data material reflects. However, due to unequal access to informants in the three countries, the available data is not sufficient for a full comparative study. There are, however, several insightful comparisons that can be made, as highlighted in the Results section.

While the study includes all the standards that the companies interviewed have adopted, we focused particularly on the following eight schemes: Aquaculture Stewardship Council, GLOBALG.A.P., Global Aquaculture Alliance - Best Aquaculture Practices, BRC Global Standards, International Featured Standards, Scottish Salmon Producers' Organisation, Royal Society for the Prevention of Cruelty to Animals, and Friend of the Sea. These are eight of the most prevalent certification schemes for salmon aquaculture in Norway, Chile, and Scotland. While not all refer to themselves as sustainability standards, we have deliberately included schemes covering a wide range of issues as we advocate a broad definition of sustainability (for discussion, see Ref. [21]). Importantly, while this study does focus on eight specific schemes, this is not a comparative analysis of these standards, as they do not address the same challenges or the same segments of the production chain, making a leveled comparison neither feasible nor desirable.

The interviews conducted in this study were based on in-depth knowledge of the above-mentioned schemes, as the authors have examined these schemes and their standards used by the salmon aquaculture industry. We have categorized the 1916 indicators in these standards according to 28 different topics, in order to gain insight into the type of criteria that accompany these certifications. The 2830 categorizations from this work are available in a searchable database. See Ref. [50] for details.

[1] BRC Global Standards became BRCGS after the research was conducted and is, therefore, referred to as BRC throughout this paper.

4. Results

4.1. Improvements from certification

Certification is described by both producers and auditors as something that keeps the companies on their toes, as it provides both management and employees with an incentive to do things properly. Respondents in both Norway and Chile, furthermore, describe the schemes as more stringent than their respective national regulations. As a Norwegian producer explains,

> *I usually say that it's like ascending stairs. First, you comply with the [national] regulatory requirements. That's a minimum, a definite minimum. Then come the ISO standards that to some degree are based on the regulatory requirements. They expect you to comply with those, or you have to comply with those, but then you have to do that little extra bit that takes you up to the next step. And then come the specific standards such as GlobalG.A.P. and ASC and BRC. […] They have more specific requirements, more explicit demands that are not in the ISO standards. When you have achieved those, then come the buyers' demands. Then if we have any internal requirements, they come on top of that. You just keep going* (Producer N5–C2).

Several respondents describe certification as having expanded the focus areas of the industry, meaning that new issues and concerns related to aquaculture are given needed attention. Some of the issues mentioned include employee welfare, specific environmental impacts, waste and chemical management, fish welfare, and the local community and society at large. Several Chilean producers speak of an increased focus on social issues, with better overtime pay for employees and general increased social responsibility for the local community. In Norway, respondents point to how the health and safety of employees has improved as a result of increased awareness through certification. Also, the ASC's requirements concerning engagement with community stakeholders are said to have made the companies more mindful of local actors, proving especially valuable in areas where the aquaculture industry faces resistance. Several hold that while they have always been concerned with maintaining good relationships with their local community, the requirements demand regularity in their interaction and a system in place to answer grievances.

4.2. Standardizing practices

A vital part of understanding how sustainability standards are implemented is exploring how the aquaculture companies work to achieve compliance and, with that, what kinds of changes the standards are promoting. A key feature of most of the certifications discussed here is that they comprise globally standardized criteria, meaning that the same requirements are applied across different companies and countries. This entails using specific metrics, often with detailed descriptions on how to be in compliance with each criterion. Many producers are positive to the specific metrics in the standards, saying that they reduce uncertainty concerning how to comply with the criteria, thereby providing the producers with more predictability. However, the metrics for certain criteria are perceived as random, a source of much frustration for both producers and auditors. For instance, the ASC standard has set the maximum lethal incidents involving predators at nine over the prior two years. According to both Norwegian and Chilean auditors, the number of lethal incidents will depend on the amount of birds or other predators in the area. They claim that having such a specific requirement, rather than letting the companies demonstrate improvement, encourages underreporting. Another example is having both lower and upper parameter boundaries, when the intent of the criteria is to keep the levels below a certain amount, as described by a Norwegian producer:

> *For smolt, the standard says we have to score between 130 and 150 on a chloride test, and there is no explanation for why they have the lower limit. 'Isn't it better with 128?', the site workers ask. No one has been able to explain why not. But that's what it says, which means that 128 will get you a noncompliance* (Producer N1–C3).

The application of specific criteria metrics is also criticized for discouraging continuous improvement, as it can give rise to a checklist mentality. This is also reflected in how many of the producers speak about sustainability as an end-goal, rather than in terms of steady progress. A Norwegian producer advocates for more emphasis on improvement in the certification schemes, contrasting them to customer standards, which are standards that are created and often also assessed by specific buyers:

> *That's one of the good things with [this customer standard], you get requirements like 'after a certain amount of time, you need to get here'. They keep pushing you to keep things moving. And that's the thing with sustainability, you can't just make a manual that's valid for ten years*" (Producer N2–C8).

4.3. Changing practices

In regards to necessary changes in practice, a few of the producers interviewed argue that changes made as a result of certification are more of an 'initial grief', meaning that there is limited improvement necessary after the required adjustments are made. However, the majority state that they need to make significant changes in the organization, at least within the departments working with certification. According to both producers and auditors, it is not sufficient to prepare for audits just prior to them. Certification is described as a constant process, which must be incorporated in the day-to-day activities. This entails changing internal procedures to comply with the standard criteria, as well as introducing new routines for continual reporting, often required by the schemes. Several of the companies interviewed, particularly larger companies, have established new positions and departments for certification within the organization.

An example of a major change many companies have made as a result of certification is the implementation of new internal systems and processes, to accommodate the many traceability and transparency requirements in the standards. These requirements concern issues such as improved food safety, traceability of input such as feed, documentation of suppliers and their practices, public records of disease management, and collaboration with neighboring sites. Changes mentioned include improved routines and procedures through the consolidation of documentation processes, standardization and structuring of documentation management, and in general the creation of better and more efficient systems. A Norwegian producer describes the importance of this,

> *You have to have a quality system that lets people know about the improvements. And not to mention structuring things so that if they don't follow the procedures, there is a process to identify measures to get the job done correctly. So that lays the foundation for very good systems and routines* (Producer N7–C2).

Respondents also stress that the documentation requirements not only allow them to demonstrate responsible practices that are a result of the certification process, but also document good practices and procedures that were already present in the company. This is, however, considered futile by some, as this entails spending time and resources on practices that are already in place. For instance, Norwegian producers see the indicators related to workers' rights in standards such as GLOBALG.A.P. and ASC as, to a large extent, unnecessary in the Norwegian context. As mentioned, the criteria in the standards are standardized, with the same requirements being applied globally. According to several Norwegian producers, the strict labor laws in the country make these social indicators redundant in Norway:

> *There is a lot more focus [in the standards] on things that we in Norway consider a given, relative to the regulations we follow. While this is of course not a given in other countries. So for us, GLOBALG.A.P. is more of a documentation issue, which it always has been, rather than something we need to strive to achieve* (Producer N2–C8).

Several respondents question the value of such extensive reporting in general, and whether this actually does contribute to making the industry more sustainable. Some claim that the increased demand for documentation has led to less focus on the fish: "*There is a lot of additional work [with certification], but not the wrong kind of additional work. At the same time, at one point you will reach the limit. Soon I'll have to document which boot I put on first*" (Producer N8–C2). There is also some skepticism as to what is done with all the submitted documentation, whether all of it is actually read and processed by the standard owners. While many respondents speak of the numerous documentation requirements with some resignation, others do, however, argue that this is not too difficult as long as there are good reporting systems in place.

4.4. Embracing sustainability

While respondents from all three countries acknowledge the importance of sustainable production and conduct, and several describe the ambitions of their company to be the most sustainable producer in the market, many still speak of sustainability and what it entails in a superficial manner, e.g. referring to the importance of 'the social stuff'. Still, many producers stress the importance of internalizing the responsible practices from the standards. Some point to how this must apply to the entire organization, not just those working with certification. As explained by a Chilean producer,

> *The approach to certification should be based on the fact that the company believes in it. Certification cannot be an aspect that depends on a department, because when it is like that, like a checklist, it does not work properly. It must be like a culture. Everyone has to know it, find it useful, work as a team, not just do it to comply [with the standard]. When done correctly, when it is internalized, when you're working as a team and learning from it, continuous improvement is made in all areas* (Producer C1–C6).

Particularly the Chilean producers emphasize the importance of making certification and the work towards more sustainable practices part of the culture of the organization. Norwegian respondents also express the necessity of improving attitudes throughout the company, emphasizing the need to include all employees in not just understanding *how* but *why* they work towards different certifications. They do, however, also speak of the difficulty of conveying the importance of certification and the changes it brings forth to the production workers. This is attributed to the fact that these employees do not work directly with the standards and that the audits mainly take place at the office and not onsite.

4.5. Mitigating certification pressure

Many producers express frustration with the substantial resources associated with obtaining and maintaining different certifications. Financial costs can include necessary improvements to comply with requirements, the certification and label fee, the auditor's fee and travel/accommodation, and personnel. In terms of manpower, many companies have deemed it necessary having employees working fulltime with certification, especially larger companies. This work includes aiding site managers with the standard requirements, creating new procedures and systems, preparing for and carrying out audits, collecting and submitting documentation, and communicating with auditors and standard owners. With auditors visiting on behalf of certification schemes, as well as national regulatory authorities and buyers, many producers speak of an overload of audits. Furthermore, many describe the substantial pressure that follows the adoption of *numerous* certifications. While many standards are described as being very similar in the issues they address, companies still find it necessary to obtain multiple certifications. Different markets and individual buyers request different certifications, and since a large quantity of the fish produced in Norway, Chile, and Scotland is exported, market access is highlighted by most respondents as a key driver for adopting additional schemes.

For those working directly with certification, many express a need to be strategic when implementing new standards, to alleviate the pressure. For instance, for schemes that certify on site-level, companies may choose to prioritize sites that are closest to being in compliance with the standard criteria. An approach to limit spending and other resources on certification is combining audits for similar standards, which is possible for certain standards. This also depends on the auditor, most importantly that they are accredited for all relevant standards. Some producers voice a need for better alignment between certification schemes and national regulations, in order to limit the amount of reporting and number of audits. Others prefer that public and private governance remain separate, to ensure exhaustive scrutiny of the industry.

Another strategy for mitigating the pressure of certification is communicating and negotiating the terms of compliance. While the standards' criteria, to a large degree, have specific requirements that must be fulfilled to achieve compliance, there is some room for interpretation. Several producers stress the importance of negotiating with the auditor or standard owners if they disagree with any of the requirements or the auditor's decisions. Particularly respondents from larger companies describe strategies they sometimes employ, such as explaining how their current practices are necessary due to local conditions or providing scientific evidence that their practices accomplish the criterion's aim even though they may not be in direct compliance with the specified requirement. For more in-depth findings on negotiations in certification audits from this data material, see Ref. [51].

In dealing with the pressures of certification, the size of the adopting company is said to be influential. Producers in smaller certified companies point to flexibility as their major advantage, claiming that it is easier for smaller organizations to make company-wide changes. Respondents in larger certified companies say that their major advantage is having a separate quality department, with employees working fulltime with certification. As described above, audits and audit preparations are portrayed as extremely time-consuming, especially when there are numerous sites that seek to obtain and maintain certification from numerous schemes. Another advantage mentioned by respondents in larger companies is more power and influence when negotiating with the certification schemes or auditors, in cases where the producers disagree with the standard requirements or the auditor's assessments. This is also confirmed by respondents in smaller companies, who state they have limited resources to engage with the certification bodies.

5. Discussion

The findings of this study confirm the pressure to become certified, and provide evidence of the experiences of those adopting these certifications. Resonating with former research on how norms and ideas travel [e.g. 43], the findings demonstrate that these companies experience a demand to become certified from their environment. Certification has, in many circumstances, obtained the status of 'obligatory passage points' [52] for an industry heavily dependent on international markets, and predictable contracts for high volumes of fresh produce. Becoming increasingly *de facto* mandatory, certification can function as a barrier to trade for those sites and companies that struggle to obtain these certifications. This relates to the challenges of applying a standardized governance regime in the attempt to improve a global industry. According to the producers in this study, factors such as size and capacity of the organization can leave some at a major disadvantage, though our respondents disagree as to whether it is advantageous to be small or large. Due to the substantial resources needed to obtain and maintain a

certification, producers will often select to certify those sites that are more likely to be in compliance with the criteria. *Who* becomes certified is therefore of central significance, despite the proclaimed neutrality of certification.

As for those that do become certified, the majority of the companies we spoke with reported significant changes made due to certification, such as improved waste management, risk assessments, and mitigation plans and measures. Many of the changes made can be attributed to the inclusion of new and strengthening of existing focus areas, such as the welfare of the fish, the importance of responsible chemical storage, and the industry's potential effects, both positive and negative, on local communities. Also, better systems for documentation and reporting suggest major improvements in the areas of traceability and transparency. For many companies, making these changes involves going beyond the establishment of new roles and areas of responsibility for employees, to include new job categories and in certain cases new departments. While this does suggest increased focus on sustainability issues, it does not necessarily indicate the presence of organizational changes, as changes may be confined to those given these responsibilities. Furthermore, similarly to what Meyer and Rowan [45] and Nyberg and Wright [46] describe, the organizations we spoke with juggle and navigate external expectations by employing various strategies to mitigate the pressure from certification. Compromises can, for instance, be formed through the decoupling of formal structures and day-to-day activities, hindering certification principles and practices from becoming internalized as organizational knowledge.

Despite hesitation and ambiguity in the producers' reflections on what sustainable production involves, the findings do indicate a growing awareness of the externalities of aquaculture and the effects of their production practices. A crucial element to this is producers recognizing the inadequacy of simply window-dressing their behavior. While the possibility to communicate sustainability is central to their motivation to adapt to the certification regime, this is also seen as futile without fully embracing the changes within and across the organization. However, the respondents reveal the difficulty of justifying the importance of certification to the organization at the sharp end, as there is a gap between the focus of production workers and those in the administration/marketing departments. To what extent there is a gap in the perception of the certification criteria's pertinence and applicability has not been sufficiently revealed by our findings, but the mere existence of such a gap represents a challenge for sustainability certifications as their fundamental claim is improvement of production practices. This relates back to the discussion of whether the existence of behavioral change in the organization can be inferred from studies of the problem-solving capacity of certification. Our findings suggest that this cannot be assumed. However, this does not mean that initial results from specific changes such as waste management and mitigation plans, cannot have implications for an organization's ability or willingness to undertake behavioral changes. As described above, 'problem-solving' and 'behavioral change' as two dimensions of certification effectiveness are very much interrelated. More importantly, our focus on the latter does not suggest that we undervalue the significance of the former.

The crucial role of documentation and reporting warrants further reflection, as it concerns one of the major changes that has come as a result of the certification pressure. The value of improved documentation lies in creating procedures that are scrutinized, and which become systematic and explicit, as opposed to taken-for-granted behavior and actions that may be haphazard and arbitrary. As such, increased focus on documentation may represent improvements in production practices. The downside may be found, as confirmed by the respondents, in much time and resources being spent on writing down and reporting on the 'real' job. Furthermore, extensively reporting the status quo may also leave less time devoted to improvements. Also, frustrations with demanding documentation requirements suggest that the increased documentation pressure does, to some extent, affect the degree of perceived relevance of certification scheme criteria. The emphasis on reporting begs the question as to whether this actually is a step towards a more sustainable industry, or merely a resource-draining activity that suits the audit format of regulation. While the data material does not offer an unequivocal answer, the documentation and audit overload reported by the majority of the respondents, both producers and auditors, does point to an unfortunate trend.

In terms of impact, respondents confirm that the control they are subjected to through certification transcends that of national regulatory authorities. This appears to be the case even in Norway, where aquaculture regulation has been hailed as the most stringent and 'complete'. However, we find reason to question whether certification can push companies to *continuously* improve, corresponding with much of the certification literature. The use of set metrics in standards can lead to the specific demands being treated as the required minimum in a race to the bottom, thereby limiting improvement. While some respondents call for more improvement-based requirements, others claim that certification does provide an incentive to find more responsible methods of production. This indicates at least a potential for utilizing certification as a learning mechanism and not just an end-goal, though with room for refinement. Furthermore, the continual update of standards does suggest at least a potential for regular progress. However, as argued by several respondents, a checklist mentality serves little purpose in dealing with the 'wickedness' of governing the aquaculture industry. With all its complexity, sustainability is not a static process and goals must, therefore, be continually adjusted.

Limited flexibility of standards may not only hinder continuous improvement, but also the occurrence of behavioral changes within the organization. As asserted in neo-institutionalist theory, company employees cannot be considered passive adopters of external principles and practices, illustrating both the need for and potential benefits of compromise and adaptation of certification principles. A way to form compromises in the implementation of a new sustainability standard is to redefine the terms, adapting certain elements of the standard to fit the local setting, through negotiation with auditors and standard owners. As this interactional character of the audit process has been shown to also facilitate important reciprocal knowledge production, it is argued to be necessary when applying standards as a means towards improving the industry [51].

While compromises and adaptations of external principles and practices are to be expected, and may also serve a role in facilitating behavioral changes within the organization, this warrants a discussion about whether this impedes improvements towards sustainability. This is an empirical question, which underlines the importance of exploring and understanding the behavioral dimension of certification effectiveness. As discussed above, this dimension is understudied, and there is limited knowledge as to how it manifests in organizations. Furthermore, as behavioral changes often occur as incremental changes embedded in routines and practices, as argued by organizational learning theory, they are difficult to capture. However, in this study, we have identified several key facilitators for behavioral change in the organization. These include incorporating responsible practices as routines in the day-to-day, embracing new focus areas, implementing structures that promote continuous improvement, raising awareness of the importance of sustainability, and making changes in the entire organization and not just for those responsible for certification. While this study's findings do not speak to whether specific certification schemes provide or support these facilitators, they do suggest that standards oriented towards continuous improvement, as well as flexibility in terms of both criteria and assessment, are better suited for promoting behavioral change.

6. Conclusion

Saying anything decisively about whether sustainability certification for aquaculture adequately promotes the necessary behavioral changes in the adopting companies, i.e. whether it can function as a means towards improving the industry as a whole, would necessitate more data.

However, this paper serves as an important contribution to understanding potential implications of certification and the experiences of those certified. Furthermore, it provides much needed content to the behavioral dimension of certification effectiveness, which, in turn, can inform future studies on the topic. Taking these findings further, an interesting issue to explore for future research is the question of whether the internalization of responsible practices is, or should be, a doing of the schemes in what they demand, or of the companies becoming certified. Preferably, this is supported by both parties. For the schemes, this is a matter of both promoting *and* not impeding favorable behavioral changes in the companies, for instance by providing specific solutions with room for local discretion. For the companies, this rather concerns having good incentives for making significant changes, so as to compensate for the transaction costs of such changes. In any case, these are important issues that warrant further exploration.

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Declaration of competing interest

The authors declare no conflict of interest.

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CRediT authorship contribution statement

Vilde Steiro Amundsen: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing - original draft. **Tonje Cecilie Osmundsen:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing - review & editing.

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References

[1] L. Busch, Standards and their problems: from technical specifications to world-making, in: Transforming the Rural, Emerald Publishing Limited, 2017, pp. 97–114, https://doi.org/10.1108/S1057-192220170000024005.
[2] C.E. Boyd, A.A. McNevin, An early assessment of the effectiveness of aquaculture certification and standards, in: Toward Sustainability: the Roles and Limitations of Certification, RESOLVE, Inc, Washington, DC, 2012.
[3] S.R. Bush, B. Belton, D. Hall, P. Vandergeest, F.J. Murray, S. Ponte, P. Oosterveer, M.S. Islam, A.P.J. Mol, M. Hatanaka, F. Kruijssen, T.T.T. Ha, D.C. Little, R. Kusumawati, Certify sustainable aquaculture? Science 341 (2013) 1067–1068, https://doi.org/10.1126/science.1237314.
[4] F. Alfnes, X. Chen, K. Rickertsen, Labeling farmed seafood: a review, Aquacult. Econ. Manag. 22 (2018) 1–26, https://doi.org/10.1080/13657305.2017.1356398.
[5] M.C.M. Beveridge, S.H. Thilsted, M.J. Phillips, M. Metian, M. Troell, S.J. Hall, Meeting the food and nutrition needs of the poor: the role of fish and the opportunities and challenges emerging from the rise of aquaculture, J. Fish. Biol. (2013) n/a, https://doi.org/10.1111/jfb.12187. -n/a.
[6] H.E. Froehlich, C.A. Runge, R.R. Gentry, S.D. Gaines, B.S. Halpern, Comparative terrestrial feed and land use of an aquaculture-dominant world, Proc. Natl. Acad. Sci. Unit. States Am. 115 (2018) 5295–5300, https://doi.org/10.1073/pnas.1801692115.
[7] A.H. Buschmann, F. Cabello, K. Young, J. Carvajal, D.A. Varela, L. Henríquez, Salmon aquaculture and coastal ecosystem health in Chile: analysis of regulations, environmental impacts and bioremediation systems, Ocean Coast Manag. 52 (2009) 243–249, https://doi.org/10.1016/j.ocecoaman.2009.03.002.
[8] G. Krause, C. Brugere, A. Diedrich, M.W. Ebeling, S.C.A. Ferse, E. Mikkelsen, J. A. Pérez Agúndez, S.M. Stead, N. Stybel, M. Troell, A revolution without people? Closing the people–policy gap in aquaculture development, Aquaculture 447 (2015) 44–55, https://doi.org/10.1016/j.aquaculture.2015.02.009.
[9] D. Tecklin, Sensing the limits of fixed marine property rights in changing coastal ecosystems: salmon aquaculture concessions, crises, and governance challenges in southern Chile, J. Int. Wildl. Law Pol. 19 (2016) 284–300, https://doi.org/10.1080/13880292.2016.1248647.
[10] T. Ytrestøyl, T.S. Aas, T. Asgård, Utilisation of feed resources in production of atlantic Salmon (Salmo salar) in Norway, Aquaculture 448 (2015) 365–374, https://doi.org/10.1016/j.aquaculture.2015.06.023.
[11] F. Alfnes, Selling only sustainable seafood: attitudes toward public regulation and retailer policies, Mar. Pol. 78 (2017) 74–79, https://doi.org/10.1016/j.marpol.2017.01.012.
[12] B. Cashore, Legitimacy and the privatization of environmental governance: how non-state market-driven (NSMD) governance systems gain rule-making authority, Governance 15 (2002) 503–529, https://doi.org/10.1111/1468-0491.00199.
[13] A. Kalfagianni, P. Pattberg, Fishing in muddy waters: exploring the conditions for effective governance of fisheries and aquaculture, Mar. Pol. 38 (2013) 124–132, https://doi.org/10.1016/j.marpol.2012.05.028.
[14] R. Tröster, M. Hiete, Success of voluntary sustainability certification schemes – a comprehensive review, J. Clean. Prod. 196 (2018) 1034–1043, https://doi.org/10.1016/j.jclepro.2018.05.240.
[15] A. Ball, R. Craig, Using neo-institutionalism to advance social and environmental accounting, Crit. Perspect. Account. 21 (2010) 283–293, https://doi.org/10.1016/j.cpa.2009.11.006.
[16] A. Genus, Governing sustainability: a discourse-institutional approach, Sustainability 6 (2014) 283–305, https://doi.org/10.3390/su6010283.
[17] A. Genus, Sustainability transitions: a discourse-institutional perspective, in: H. G. Brauch, Ú.O. Spring, J. Grin, J. Scheffran (Eds.), Hexagon Series on Human and Environmental Security and Peace, Springer International Publishing, 2016, pp. 527–541.
[18] W.R. Scott, Organizations: Rational, Natural, and Open Systems, fourth ed., Prentice Hall, Upper Saddle River, N.J, 1998.
[19] L. Busch, Standards: Recipes for Reality, MIT Press, Cambridge, Mass, 2011.
[20] G.H. Stanton, Food safety-related private standards: the WTO perspective, in: A. Marx, M. Maertens, J. Swinnen, J. Wouters (Eds.), Private Standards and Global Governance. Economic, Legal and Political Perspectives, Edward Elgar Publishing Limited, Cheltenham, UK, 2012, pp. 235–254.
[21] T.C. Osmundsen, V.S. Amundsen, K.A. Alexander, F. Asche, J. Bailey, B. Finstad, M. S. Olsen, K. Hernández, H. Salgado, The operationalisation of sustainability: sustainable aquaculture production as defined by certification schemes, Global Environ. Change 60 (2020) 102025, https://doi.org/10.1016/j.gloenvcha.2019.102025.
[22] S. Washington, L. Ababouch, Private Standards and Certification in Fisheries and Aquaculture: Current Practice and Emerging Issues, Food and Agriculture Organization of the United Nations, Rome, 2011.
[23] B.E.C. Aguayo, J. Barriga, Behind certification and regulatory processes: contributions to a political history of the Chilean salmon farming, Global Environ. Change 39 (2016) 81–90, https://doi.org/10.1016/j.gloenvcha.2016.04.005.
[24] M. Hatanaka, L. Busch, Third-party certification in the global agrifood system: an objective or socially mediated governance mechanism? Sociol. Rural. 48 (2008) 73–91, https://doi.org/10.1111/j.1467-9523.2008.00453.x.
[25] P. Vandergeest, S. Ponte, S.R. Bush, Assembling sustainable territories: space, subjects, objects, and expertise in seafood certification, environment and planning A. https://doi.org/10.1177/0308518X15599297, 2015, 47, 1907, 1925.
[26] J. Bronnmann, F. Asche, Sustainable seafood from aquaculture and wild fisheries: insights from a discrete choice experiment in Germany, Ecol. Econ. 142 (2017) 113–119, https://doi.org/10.1016/j.ecolecon.2017.06.005.
[27] A. Lloret, Modeling corporate sustainability strategy, J. Bus. Res. 69 (2016) 418–425, https://doi.org/10.1016/j.jbusres.2015.06.047.
[28] M.F. Tlusty, Ø. Thorsen, Claiming seafood is 'sustainable' risks limiting improvements, Fish Fish. 18 (2017) 340–346, https://doi.org/10.1111/faf.12170.
[29] C.E. Boyd, A.A. McNevin, Aquaculture, Resource Use, and the Environment, John Wiley & Sons, Inc, Hoboken, New Jersey, 2015.
[30] V.S. Amundsen, A. Gauteplass, J. Bailey, Level up or Game over: the Implications of Levels of Impact in Certification Schemes for Salmon Aquaculture, Aquaculture Economics & Management, 2019, pp. 1–17, https://doi.org/10.1080/13657305.2019.1632389.
[31] P. Samerwong, S.R. Bush, P. Oosterveer, Implications of multiple national certification standards for Thai shrimp aquaculture, Aquaculture 493 (2018) 319–327, https://doi.org/10.1016/j.aquaculture.2018.01.019.
[32] M.F. Tlusty, H. Tausig, Reviewing GAA-BAP shrimp farm data to determine whether certification lessens environmental impacts, Rev. Aquacult. 7 (2015) 107–116, https://doi.org/10.1111/raq.12056.
[33] J. Bailey, Looking for sustainable solutions in salmon aquaculture, Etikk i Praksis - Nordic Journal of Applied Ethics 8 (2014), https://doi.org/10.5324/eip.v8i1.1801.
[34] M. Kaiser, S. Stead, Uncertainties and values in European aquaculture: communication, management and policy issues in times of "changing public perceptions, Aquacult. Int. 10 (2002) 469–490, https://doi.org/10.1023/A:1023963326201.
[35] J. Chu, J.L. Anderson, F. Asche, L. Tudur, Stakeholders' Perceptions of Aquaculture and Implications for its Future: A Comparison of the U.S.A. and Norway, Mar. Resour. Econ. 25 (2010) 61–76, https://doi.org/10.5950/0738-1360-25.1.61.
[36] T.C. Osmundsen, P. Almklov, R. Tveterås, Fish Farmers and Regulators Coping with the Wickedness of Aquaculture, Aquaculture Economics & Management, 2017, pp. 1–21, https://doi.org/10.1080/13657305.2017.1262476.
[37] O.R. Young, International Governance: Protecting the Environment in a Stateless Society, Cornell University Press, Ithaca, 1994.

[38] A.V. Tikina, J.L. Innes, A Framework for Assessing the Effectiveness of Forest Certification, Can. J. For. Res. 38 (2008) 1357–1365, https://doi.org/10.1139/X08-011.
[39] K.A. Røvik, Moderne Organisasjoner: Trender I Organisasjonstenkningen Ved Tusenårsskiftet, Fagbokforlaget, 1998.
[40] Y. Rydin, Indicators as a Governmental Technology? The Lessons of Community-Based Sustainability Indicator Projects, Environ. Plann. Soc. Space 25 (2007) 610–624, https://doi.org/10.1068/d72j.
[41] L. Vigneau, M. Humphreys, J. Moon, How Do Firms Comply with International Sustainability Standards? Processes and Consequences of Adopting the Global Reporting Initiative, J. Bus. Ethics 131 (2015) 469–486, https://doi.org/10.1007/s10551-014-2278-5.
[42] W.R. Scott, Institutions and Organizations, SAGE, Thousand Oaks, 1995.
[43] B. Czarniawska, B. Joerges, Travels of Ideas, in: B. Czarniawska, G. Sevón (Eds.), Translating Organizational Change, Walter de Gruyter, Berlin; New York, 1996, pp. 13–48.
[44] F.W. Geels, Technological Transitions as Evolutionary Reconfiguration Processes: A Multi-Level Perspective and a Case-Study, Res. Pol. 31 (2002) 1257–1274, https://doi.org/10.1016/S0048-7333(02)00062-8.
[45] J.W. Meyer, B. Rowan, Institutionalized Organizations: Formal Structure as Myth and Ceremony, Am. J. Sociol. 83 (1977) 340–363, https://doi.org/10.1086/226550.
[46] D. Nyberg, C. Wright, Corporate Corruption of the Environment: Sustainability as a Process of Compromise, Br. J. Sociol. 64 (2013) 405–424, https://doi.org/10.1111/1468-4446.12025.
[47] G. Kumar, C. Engle, C. Tucker, Factors Driving Aquaculture Technology Adoption, J. World Aquacult. Soc. 49 (2018) 447–476, https://doi.org/10.1111/jwas.12514.
[48] B. Elkjær, Organizational Learning: The 'Third Way, Manag. Learn. 35 (2004) 419–434, https://doi.org/10.1177/1350507604048271.
[49] C. Argyris, D.A. Schön, Organizational Learning II: Theory, Method, and Practice, Addison-Wesley Pub. Co, Reading, Mass, 1996.
[50] V.S. Amundsen, T.C. Osmundsen, Sustainability Indicators for Salmon Aquaculture, Data in Brief (2018), https://doi.org/10.1016/j.dib.2018.07.043.
[51] V.S. Amundsen, T.C. Osmundsen, Virtually the Reality: Negotiating the Distance between Standards and Local Realities When Certifying Sustainable Aquaculture, Sustainability 11 (2019) 2603, https://doi.org/10.3390/su11092603.
[52] M. Callon, Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay, Socio. Rev. 32 (1984) 196–233, https://doi.org/10.1111/j.1467-954X.1984.tb00113.x.

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