APPLYING THE SDGS IN A FRAMEWORK TO ASSESS BLUE ECONOMY
CAPACITY OF INDUSTRY OPERATORS IN CANADA

by

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Dalhousie University is located in Mi'kma'ki, the
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We are all Treaty people.

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ABSTRACT

Canada has committed to growing a blue economy grounded in sustainability but has not yet established a sustainability standard that industry operations must meet to be included in the blue economy. For the blue economy to be an effective, sustainable alternative to the regular ocean economy, an assessment framework that facilitates benchmarking and blue economy performance comparisons for ocean industry is needed to reduce the risk of bluewashing. This research uses the UN Sustainable Development Goals as a theoretical backdrop to generate industry blue economy aims and subsequent mechanisms that can assess a company's blue economy capacity i.e., their contribution to a socially equitable, environmentally sustainable, and economically viable blue economy. Ground-truthing methods corroborated that this framework is a needed tool for companies to improve their blue economy capacity and for regulators to make informed decisions on the development of Canada's blue economy.

LIST OF ABBREVIATIONS

AHP: Analytical Hierarchy Process

CBD: Convention on Biological Diversity

CSR: Corporate Social Responsibility

DFO: Department of Fisheries and Oceans Canada

EIA: Environmental Impact Assessment

ES: Ecosystem services

GRI: Global Reporting Initiative

HQP: Highly Qualified Personnel

MCDM: Multi-Criteria Decision-Making Approach

MPA: Marine Protected Area

OECD: Organization for Economic Cooperation and Development

OECM: Other Effective Area-Based Conservation Measures

OHI: Ocean Health Investment

SDGs: United Nations Sustainable Development Goals

SIA: Social Impact Assessment

SLO: Social License to Operate

UN: United N

Chapter 1. Introduction

1.1 Context

The blue economy is one of the fastest growing and profitable industries today (OECD, 2019) and Canada is taking a global lead on this stage. The blue economy, as defined by the World Bank in conjunction with the United Nations, is an ocean economy that seeks to "promote economic growth, social inclusion, and preservation or improvement of livelihoods while at the same time ensuring environmental sustainability" (World Bank, 2017).

Canada has committed to developing its blue economy but has not yet published a strategy for its growth. For the blue economy to be successfully developed in a manner different than the regular ocean economy, ocean health and social equity must be in its foundation (Cisneros-Montemayor et al., 2021, Bennett et al., 2021) A necessary start to this is clear criteria that can assess what activities and industrial operations could be considered "blue enough" i.e., those that meet a sustainability standard, to be included in the blue economy. Currently, Canada considers all ocean industries, regardless of their environmental sustainability or social equity to be in the blue economy (DFO, 2021). Without distinction between the regular ocean economy and a blue economy that integrates the protection of ocean and human well-being key tenets (Cisneros-Montemayor et al., 2021), it will be difficult to ensure the sustainability-focus necessary to secure private investment, establish government funds, attract innovation, and get buy in from diverse representation in both market and non-market stakeholders; all of which are listed as top priorities for Canada's blue economy by stakeholders (DFO, 2022).

A successful blue economy needs to intrinsically consider environmental sustainability and social equity alongside economic viability (Cisneros-Montemayor et al., 2021); these priorities must be reflected in the industry operations that are included. This research takes the view of "oceans as good business" (Voyer et al., 2018) and is based on the notion that ocean sectors can be included in the blue economy if they meet a sustainability standard. However, assessing and monitoring the trade-offs and

interdependencies between social, environmental, and economic priorities is complex. The UN Sustainable Development Goals are widely accepted as a response to this complexity and offer goals and targets that reflect the indivisible socio-ecological relationships (Fallah Shayan et al., 2022, Singh et al., 2018, Purvis et al 2019). It is important that Canada's sustainability priorities for the developing blue economy align with the global commitment to sustainability (the SDGs). This adherence to international norms can support access to finance, global markets, and support collaborative management of shared and connected resources by establishing a common aim (Niner et al., 2022).

A framework with clear inclusion criteria is needed to decrease the chances of unsustainable operations being included in the blue economy and diluting its effectiveness. This research uses the SDGs as a theoretical backdrop, from which a framework can be generated to assess an industry operation's blue economy capacity. In other words, the framework derives mechanisms from the SDGs that can assess a company's contribution to a socially equitable, environmentally sustainable, and economically viable blue economy i.e., its blue economy capacity.

1.2 Thesis Organization

Understanding the history and progress of sustainable development, and therefore the SDGs, is necessary to understand the theoretical and conceptual frameworks which will underpin progress towards a sustainable blue economy. Chapter 2 will provide background of the history and progress of sustainable development and associated international frameworks at the macro level. Section 2.3 showcases examples from the literature that integrate the SDGs into sustainability assessments and discusses what can be brought forward into the development of the blue economy. Chapter 3 provides an overview of existing national and international norms that influence the development of Canada's environmentally sustainable, socially equitable and economically viable blue economy. Chapter 4 presents the development of a new framework which uses the SDGs to assess the blue economy capacity of industry operators in Canada. This includes the process for selecting SDG targets that are relevant to Canada's blue economy (4.1), and the derived blue economy aims for industry and the synthesized enabling mechanisms

(4.2). Chapter 5 ground-truths the framework through analyzing its application with two blue economy companies to determine understand how applicable the framework is to corporations (Yonto and Schuch 2020). The findings from this work are discussed including application constraints. Chapter 6 provides conclusions and recommendation for next steps.

1.3 Research Questions

1. How does the history and progress of sustainable development and the SDGs influence Canada's emerging blue economy?
2. Which SDG targets are relevant to Canada's blue economy?
3. What are the mechanisms industry operators should use to enable relevant SDG targets and therefore enable a successful blue economy?
4. Do blue economy industry operators implement the mechanisms developed by this framework?

Chapter 2. Review of Sustainable Development and Assessment Frameworks

2.1 Historical Background

This section starts with the Brundtland Report in 1987 and the advent of environmental protection, then will move to the introduction of social factors into sustainable development from the United Nations Conference on Environmental Development (1992), and finally comment on the creation of the United Nations Sustainable Development Goals (2015) which frame today's progress towards sustainable development. This section will also comment on how industry has adapted sustainable development for its use.

The first major internationally recognized milestone in framing sustainability, the Brundtland Report (1987), defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This concept came to the West at this point in history because "basic economic needs" had been met following a post-war era; Western society now set its sight on increasing quality of life (Purvis et al., 2019). At this stage, sustainable development mostly focused on the protection of the natural environment in a way that could maintain, not necessarily increase, the current availability of natural resources for the future (Tsalis et al., 2020). This version of sustainable development prioritized economic growth because poverty was seen as a significant cause for environmental degradation (Purvis et al., 2019). The rationale was that with a stronger the economy, there would be less poverty, and therefore a healthier the environment. Because of this view, industry was seen as the driver of success for a sustainable future. However, at that time, the protection of the environment was seen as the responsibility of those industries that had an obvious and direct impact on natural resources e.g., extraction. According to Vollero et al., (2016), this onus on resource intensive companies still exists as energy companies today experience increasing pressure from stakeholders to switch to

sustainable alternatives. The goals outlined in the Brundtland Report became the basis for the first type of sustainability frameworks: environmental impact assessments.

The next major milestone was the United Nations Conference on Environmental Development in 1992, where social factors were introduced into the definition of sustainable development. At that time, equality was measured as the equal distribution of goods and services regardless of differences (Purvis et al., 2019). The addition of social factors along with environmental and economic factors introduced the "triple bottom line "concept for industry (Elkington, 1998), also known as the "three pillars" of sustainable development (Tsalis et al., 2020). When illustrated, the three pillars do not overlap but are depicted as the structural foundation to sustainable development. It is now more common to see these three dimensions illustrated in a Venn diagram where the three dimensions overlap each other in an equal amount with the centre representing a perfectly balanced version of sustainable development (Purvis et al., 2019).

While more interactive than the three separate pillars, both approaches assume a "win-win-win" scenario and do not accurately portray the interconnectedness and trade-offs among the three dimensions (Purvis et al., 2019). This version of sustainable development became more palatable and interesting to other institutions outside of government, especially for-profit (Carroll and Shabana 2010). The addition of the social lens saw the merging of government sustainable development priorities with Corporate Social Responsibility (CSR) and the advent of sustainability (Reinhardt and Stavins 2010) Sustainable development entered the for-profit world through CSR; and the term sustainability is now in corporate vernacular. Sustainability became a goal for both the private and public sector (Reinhardt and Stavins 2010).

However, sustainable development is the public sector's method for achieving sustainability as they look at large national implementors such as "qualitative improvement of well-being" (Jeronen 2013); now industry had to extrapolate what sustainability means in a for-profit world from its origin in government. Sustainability assessments have a long history in industry, with early efforts focused on environmental impact assessments (EIAs) and social impact assessments (SIAs) in the 1970s and 1980s

(Bond and Morrison-Saunders 2011). The aim of these assessments was to identify and mitigate potential negative impacts of industrial activities on the environment and local communities (Bond and Morrison-Saunders 2011). In the 1990s, sustainability assessments began to shift towards a more comprehensive approach that considered environmental, social, and economic factors, in recognition of the interconnectedness of sustainability issues (Cashmore 2004). This shift was driven by a growing awareness of the importance of sustainable development, as well as increased pressure from stakeholders such as governments, NGOs, and consumers for companies to adopt more sustainable practices (Cashmore 2004). The late 1990s and early 2000s saw the development of several frameworks and tools for sustainability assessments, such as the Global Reporting Initiative (GRI) Sustainability Reporting Guidelines and the ISO 14001 environmental management standard. These frameworks and tools provided a standardized approach to sustainability assessments, making it easier for companies to assess and report on their sustainability performance and for stakeholders to compare performance across industries and locations. Standardized assessments such as the GRI and ISO contribute to increased transparency and accountability among companies and lead to improvements in sustainability performance (Almas et al., 2020, Hogevold et al. 2016).

However, most tools did not consider nature-society systems as they mainly focused on the external environmental and economic impacts of supply chains (Ness et al., 2007). Instead, social dimensions were assessed internally and measured through indicators like a diversity index (Ness et al., 2007). In response to these critiques, more recent sustainability assessment frameworks have sought to integrate social sustainability more fully into their assessments. For example, the Social Sustainability Assessment Tool (SSAT) developed by the Sustainability Consortium integrates social indicators into a comprehensive sustainability assessment framework that includes environmental and economic indicators (Vermeulen et al., 2015). This approach recognizes the importance of social sustainability in achieving overall sustainability goals and provides a more holistic framework for sustainability assessments.

While sustainability was blossoming in the private sector, sustainable development continued to be refined in the public sector through the advent of the SDGs. The most recent and significant milestone in progressing sustainable development is the United Nations Transforming Our World: the 2030 Agenda for Sustainable Development (United Nations 2015). This Agenda breaks down the three dimensions of sustainable development into 17, integrated, Sustainable Development Goals (SDGs) with targets and indicators (Fig. 1)
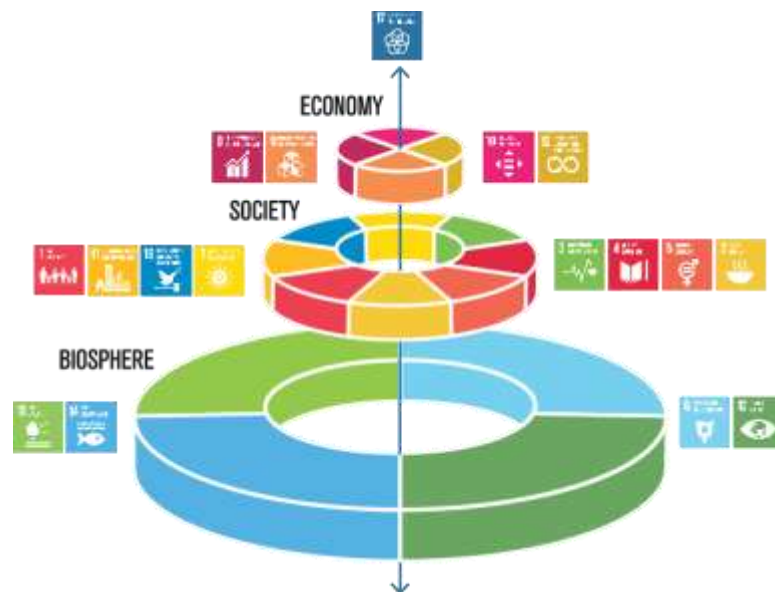
Figure 1. The SDG wedding cake shows how the Goals can be categorized by environmental, social, and economic priorities. (Source: Azote Images for Stockholm Resilience Centre, Stockholm University).

There is now an internationally accepted framework and indicators for guiding sustainable development progression at the national and international level making integration into the private sector a necessary next step (Tsalis et al., 2020). The authors of the Global Reporting Initative, the most widely used framework for sustainability reporting by companies (KPMG 2017), have recognized this and have recently started to link the GRI to be used to report on specific SDGs and their targets (GRI Universal Standards 2021). There is also a push to align CSR methods with the SDGs (Shayan et al., 2021) making corporate sustainability initiatives more effective. However, there are numerous obstacles preventing easy and effective deployment of the SDGs due to the

flawed concept of sustainable development they are built upon (Nash et al., 2020). The SDG indicators have been criticized for lack of interconnectedness meaning that the impact of progress or lack of progress towards one SDG cannot be sufficiently linked to the impact on another SDG (Nash et al., 2020). This is remnant of how sustainable development's three dimensions, environmental, social and economic interact with eachother. Without understanding the trade-offs among SDGs, progress tracking frameworks are at risk of promoting palliative, short-term target attainment that diminishes over time (Nash et al., 2020). To address this, SDG targets need to be adapted to a context (Niner et al.,). An assessment framework that can contextualize the SDGs to the blue economy in Canada is needed. There is currently no sustainability standard that blue economy companies must adhere to. For the blue economy to be successful, both sustainable development of the blue economy and blue economy sustainability need to align with the SDGs. The SDGs can offer a bridge between government and industry efforts, ensuring a concerted effort towards an effective blue economy.

2.2 Examples that integrate the SDGs into sustainability assessments

The following section provides four examples that distilled the SDGs from the global level and contextualized them at the industry, local and sector level. These examples have informed this research's creation of a framework to assess blue economy capacity in industry. Lisowski et. al (2020) selected relevant environmental SDG indicators to assess the European automobile industry. Environmental impact, direct impact and automobile impact were the three criteria used to narrow down relevant SDG indicators. The SDGs are comprised of 17 goals, 169 targets and 247 indicators. First, environmental SDG indicators were chosen because Lisowski et. al 2020 based their framework in a sustainability hierarchy that states a healthy environment is a prerequisite for a successful economy and society. The indicators were then narrowed to include those that measured direct environmental change because they could be linked to causative action. Finally, the authors selected those indicators that dealt with the inputs and outputs along an automobile's life cycle e.g., the extraction of raw materials, productions, use etc. The indicators were then categorized into "doing good" or "avoiding harm". Out of the 247 SDG indicators, 124 dealt with environmental impact, 45 of which were classified as

direct impact, and of those, 31 dealt with automobile impact. Of the 31, 28 were classified as "avoiding harm" and 3 were classified as "doing good".

Tremblay et al., (2021) created a framework to help prioritize SDG targets at the local, city level, in this case, Quebec City, Canada. While not an industry example, this study highlights the challenges and strategies unique to taking the global priorities of the SDGs and applying them at a more granular level. The authors emphasize it is unrealistic for non-global actors to achieve all SDG targets, so prioritization is essential. Targets must first be localized and contextualized, while maintaining integrated systems thinking; meaning that the targets needed to be relevant to Quebec City but also need to align with regional and national sustainability goals. They did so by inviting participants to workshops for the purpose of ranking the priority of the target based on its significance to Quebec City and its current performance. Participants included city employees from across sectors. To increase participants' understanding of the SDG target, the authors "adapted the wording of the target without changing the original meaning" (Tremblay et al., 8) e.g., switching the word "national" with "city". The authors also considered limitations around governance in their analysis and framed their results of target achievement at either the locally exclusive level, the nationally exclusive level, or a combination of both. Interestingly, SDG 14, Life Below Water, was the only one without data on its performance by Quebec City and was considered to be governed almost exclusively at the national level. While effective, the authors acknowledged that this method may not be suitable for the private sector as there is a much larger scope for contextualization and organization governance.

In the study by MacNeil et al., (2021b), the authors address gaps in the GMEP, a sustainability assessment framework for ports, by proposing a new framework that integrates GRI disclosures. As a compliment to the SDGs, the GRI offers an internationally acceptable structure for reporting and improving on sustainability performance that is adaptable to all sectors. The study builds from previous research that identified where the GMEP targets do not directly link to relevant UN SDGs (MacNeil et al., 2021a). The authors selected GRI Standards to create direct links between SDG

targets that are either indirectly linked or not linked to GMEP PI's (MacNeil et al., 2021b). To identify relevant Standards, SDG indicators acted as a top-down selection criteria to ensure that each GRI Standard would directly contribute to achieving a specified target to be included in the framework. Certain GRI Standards pertaining to social standards were excluded because they were considered redundant in a Canadian context where pre-existing legislation already guaranteed their fulfillment. The resulting framework described specific port activities to fulfill the relevant Standard's requirements and created direct linkages to 36 relevant SDG targets.

Bui et. al (2017) proposed an indicator-based sustainability assessment framework for the mining sector at global and national scales. Although this study did not use SDG indicators, they created their own that were influenced by the SDGs. The objective was to find out what actions should/should not be taken to effectively improve sustainability. The authors used an Analytical Hierarchy Process (AHP), a type of multi-criteria decision-making approach (MCDM), because MCDM is considered to be the best method to structure an unstructured and complex sustainability problem. In this assessment framework, indicators on the sustainability of the mining sector were identified from previous studies at the company and product level and the significance of these indicators to sustainability were assessed using AHP. According to the authors, these indicators should be easy to measure, cost effective, accommodate changing conditions, scientifically sound and based on functional ecological relationships. Indicators were created for three criteria: economic, environmental, and social performance. The indicators' significances were assessed in each respective category as well as across all three categories. The framework incorporated data from stakeholder consultations to determine indicator significance. Understanding the significances of these indicators can help decision makers understand which ones to prioritize to improve sustainability (Bui et al., 2017).

Lisowski et al., 2020 and Tremblay et al., 2021 use methods that determine sustainability goal priorities from the SDGs and MacNeil et al., (2021 b) and Bui et al., 2017 use

methods to assess sustainability performance using the SDGs. There are lessons that can be learned from each study and taken forward into this research's framework to assess blue economy capacity in industry.

In the study by Lisowski et al., 2020, the authors base their methods in a sustainability hierarchy where environmental capital is considered the most critical and therefore the priority that economic and social goals are dependent on. We have seen a similar hierarchy in the past where the early versions of sustainable development prioritized economic concerns (Tsalis et al., 2020). Using a hierarchy that places either economic, social, or environmental goals as a prerequisite to achieving the other two does not properly acknowledge the co-dependent and interconnected nature of these three dimensions or the SDGs (Purvis et al., 2019). This is emphasised in a study by Singh et al., 2018, where the authors found that the SDGs are largely complementary and dependent on one another by using SDG 14, Life Below Water, as an example. Their framework illustrated the possibility that ecological goals can be supported by social and economic concerns and may even rely on them for success (Singh et al., 2018).

In contrast, Tremblay et al., 2021, used methods to prioritize SDG targets at the local level across environmental, social, and economic priorities without a hierarchy. The authors acknowledged that undertaking was most likely only possibly through participatory methods across many stakeholders. Both Lisowski and Tremblay considered governance limitations for their respective scope and stated this as a key strategy to prioritize and localize SDGs. This tactic can be seen in other studies such as Drees et. al (2021) who stated that adapting the SDGs at industry and local levels helps to identify how targets interact with each other so to not sacrifice long term sustainability for short term gain.

To measure sustainability, both Bui et al., (2017) and MacNeil et al., (2021b) used existing indicators for their respective industries. Bui et al., (2017) integrated environmental, social and economic indicators from previous studies into their framework. MacNeil et al., (2021 b) revised an existing framework (GMEP) by

integrating disclosures from the GRI. Both research teams selected indicators based on relevance, but both frameworks require self-reporting by those being assessed. The efficacy of corporate self-reporting has been explored by Cho et al., 2020 and Tsalis et al., 2020. While corporate self-reporting has increased (Cho et al., 2020), it is yet to be seen if the quality of results is significant enough to determine SDG progress. An example from Tsalis et. al (2020) found that among 20 Greek firms, all of them fail to comprehensively report on their strategy to respond to the SDGs. The quality of self-reporting sustainability assessments increases when materiality, choosing sustainability goals the company can have the greatest impact on and vice versa, is considered (Cho et al., 2020)

It is challenging to create meaningful contribution to the SDGs without assessment frameworks that localize and contextualize targets and indicators (Tremblay et al., 2021) However, there are not many frameworks that apply the SDGs beyond the national level or in industry. This is in part because the SDGs have not been around for very long and because sustainability reporting and assessments remain largely voluntary (Cho et al., 2020). Often, organizations and decision makers will choose reporting strategies that work best for them, leading to inconsistencies in the quality and style of reporting across industries (Cho et al., 2020). Research suggests that the only way to create meaningful progress towards the SDGs is from a bottom-up approach where targets and indicators are localized and contextualized (Tremblay et al., 2021, Niner et al., 2022).

The four examples presented here, while outside of the ocean sector, have methods that can be applied to it. Most examples found in the ocean sector that contextualized the SDGs were at the national level and concerned sustainable development more than industry sustainability (Niner et al., 2022, Lee et al., Singh et al., 2018). There is a lack of literature that applies the SDGs to the ocean industry as a way to assess sustainability and inform the creation of the blue economy.

Chapter 3. Sustainability in Canada's Blue Economy

As noted previously, the push for sustainable development is often driven by the need to manage extractive industries such as fisheries and oil and gas (Vollero et al., 2019). Similarly, the origins of the blue economy first started in the public sector when at the 2012 Rio +20 conference ocean priorities for "sustainable consumption and production patterns" were discussed. It is important to note here the difference of the blue economy and the regular ocean economy. For the purposes of this research, the blue economy intrinsically considers environmental sustainability and social equity alongside economic viability; the ocean economy does not (Voyer et al., 2018). As well, this research uses a lens that views "oceans as good business" (Voyer et al., 2018) and is underpinned by the supposition that ocean sectors can be included in the blue economy if they meet a sustainability standard. The blue economy can be compared to the pre-existing green economy as they share the same philosophy of shifting existing economic practices into more sustainable ones (Sarwar 2022). In the green economy, the growing demand on industry to become sustainable has driven companies to incorporate environmental and social goals and achievements into their marketing strategies (Markham et al., 2015). As this demand has continued to grow, so too does the phenomenon of greenwashing (Markham et al., 2015) When a company with poor socio-ecological performance markets itself as such for economic gain (greenwashing), the effectiveness of green economy diminishes (Markham et al., 2015). Because the green economy did not originate with a universally accepted guiding framework, corporate sustainability initiatives are often individualistic and piecemeal (Cho et al., 2020). This research is based on the notion that the blue economy can be developed using learning from the green economy's pitfalls; it also has the advantage of using the SDGs for its development.

The sustainable development of Canada's blue economy needs to ensure internationally agreed norms cannot be ignored (Niner et al., 2022). These sustainable development priorities should be what influences the blue economy's sustainability priorities in

industry. In a study by Niner et al., (2022), the authors created a typology for blue economy national aims by analysing policies from around the world and then through a participatory workshop, classified how these aims interact with the UN Sustainable Development Goals. Their study included Canada's Ocean Act and Ocean Strategy. The authors found that Canada's policies covered the following national blue economy aims that aligned with the SDGs: competitive edge, diversification, operational safety, attract investment, governance, livelihoods, capacity & skills, science, environmental protection, and literacy (Niner et al., 2022); despite these polices being over 20 years old. These aims are high-level government priorities that need to be contextualized for operation or there is a risk of ignoring their intersectionality and developing a blue economy that is contrary to the goals of sustainability (Niner et al., 2022). As described in the following sections, a successful blue economy incorporates the three dimensions of sustainable development and must be environmentally sustainable, socially equitable and economically viable (Cisneros-Montemayor et al., 2021).

3.1 Environmentally Sustainable

Canada's plan to establish an environmentally sustainable blue economy is influenced by the Convention on Biological Diversity (CBD). This international convention consists of 193 parties and its three main objectives are 1.) the conservation of biological diversity 2.) the sustainable use of the components of biological diversity 3.) the fair and equitable sharing of benefits arising out of the utilization of generic resources (CBD, 1993). In 2010, Canada committed to the CBD's Aichi Targets with Target 11 pertaining to the ocean as states "by 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape" (CBD, 2010). Canada and the world ultimately fell short in achieving this goal (Lemieux 2019).

In 2022, the CBD Parties have agreed on a new commitment to a Global Biodiversity Framework that includes protecting 30% of lands and waters by 2030 (Gov't Canada

2022). Canada's other international commitments to an environmental sustainability blue economy include The High Level Panel for a Sustainable Ocean Economy which commits Canada to sustainable development and the protection of the ocean and its resources for future generations as well as achieving the goals and outcomes outlined in SDG 14: Life Below Water and the United Nations Decade of Ocean Sciences by 2030. Canada has a variety of mechanisms to achieve marine conservation goals with the primary ones being a network of Marine Protected Areas (MPAs) and other effective area-based conservation measures (OECMs) (Hutchings et al., 2012.). As these ambitious commitments all prioritize conservation, there is possible conflict with blue economy goals for economic viability and social equity (Schram et al., 2019). Another critique of large national and international environmental agreements is that they commonly fail to meet their goals (Schram et al., 2019). While protected areas are one of the most important environmental commitments, an environmentally sustainable blue economy cannot exist without protected areas that also consider economic viability through sustainable management of natural assets and social equity by understanding and connecting people to ocean health (Hutchings et al., 2012)

3.2 Economically Viable

Before a jurisdiction can successfully measure the economic progress of the blue economy, it is first necessary to identify what industrial sectors are included and the metrics that govern this decision (Kildow 2021). According to the Organization for Economic Cooperation and Development (OECD), ocean sectors that provide global market values include marine transportation and ports, offshore mineral resources, living resources, marine construction, marine research and education, ocean-related professional and technical services, utilities, marine tourism and recreation, ship and boat building and maintenance, and ocean-related government programs (OECD 2016). These sectors can be categorized into either living or non-living (Teh et al., 2021). Living sectors e.g., fishing and tourism require a healthy ocean to continue being economically viable. Non-living ocean sectors e.g., transportation and minerals do not rely on ocean health; the ocean is just a medium for their operations (Teh et al., 2012).

Some sectors such as marine research and education and ocean-related government programs are not always considered in ocean economic assessments because they are not directly or physically linked to the ocean. In Canada the three marine sectors that contribute the most to GDP are fishing and seafood, oil and gas, and shipping. Lesser understood *non-use values* and other social benefits gained from ocean assests are being assesed for economic contribution by only a few countries such as those in The European Union and the Partnerships in Environmental Management for Southeast Asia (PEMSEA) (Teh et al., 2012). Non-use values include the value gained by an environment's continued, healthy existence (existence values) or the understanding that environmental resources need to be left for future generations (bequest values) (Pascual et al., 2010). Because of the difficulty in establishing metrics for non-use values, economic assessments can report that the non-living sectors drive more economic gain than living sectors when (Teh et al., 2012).

3.3 Socially Equitable

The SDGs have accelerated interest in the sustainable use of the oceans and offer a framework for connecting ocean wealth to ocean health (Kildow 2021). The SDGs and the OECD Report: "The Ocean Economy in 2030" have made it clear that the success of the blue economy cannot happen independently from environmental sustainability and social equity (OECD, 2019) by showcasing the interdependences between the three dimensions (Singh et al., 2018). Social equity is the more elusive condition for the blue economy but without it the blue economy could never be considered sustainable (Bennett et al., 2018). There is mounting literature on how social equity is the lynch pin for the success of other two conditions (Cisneros-Montemayor et al., 2019 and Bennet et al., 2018). To create an equitable blue economy, it is necessary to address the existing inequities of the current ocean economy. While there are international and national norms that steer the environmental and economic development of Canada's blue economy, there is less groundwork for addressing social inequities (Cisneros-Montemayor et al., 2022). With the pressure on rapid blue growth, we risk pushing the agenda forward without full understanding of the complex dimensions of social equity (Alexander et al., 2022). It is necessary to develop the blue economy in a way that creates strong ties between social

equity, environmental sustainability, and economic viability where it is impossible to achieve one without the others (Nash et al., 2020, Cisneros-Montemayor et al., 2022) The current definition of sustainability developed as outlined by the SDGs, is equity-centered as it states, "no one is left behind". (UN, 2015, Cisneros-Montemayor et al., 2022).

3.4 What is Needed

For Canada's blue economy to be an effective, sustainable alternative to the regular ocean economy, there must be clear inclusion criteria for industry. These criteria need to be rooted in the Sustainable Development Goals and acknowledge the interdependencies between social equity, environmental sustainability and economic viability. The intention of this research is to create a framework that could offer the criteria necessary to decrease the chances of blue washing; like green washing blue washing refers to either intentionally or unintentionally including unsustainable operations in the blue economy due to the lack of clear inclusion criteria – diluting the blue economy's effectiveness at being a sustainable alternative to the regular ocean economy. This framework should set a sustainability benchmark based on local context and be rooted in internationally agreed norms.

Chapter 4. Framework Development

4.1 SDG Target Selection

The Sustainable Development Goals comprise of 17 goals, 169 targets and 247 indicators that address the 3 enabling conditions for a successful blue economy, social equity, environmental sustainability and economic viability (Cisneros-Montemayor et al., 2021). The gaols can be organized according to these three dimensions (Fig 1.) Using these enabling conditions as a theoretical backdrop, it is possible to identify which SDGs can enable a successful blue economy in Canada. Stepwise criteria were developed to determine which SDG targets are relevant to Canada's blue economy industry operations (Fig 2). First, it is first necessary to localize and contextualize targets (Niner et al., 2022, Tremblay et al., 2021). This gives way to the first two criteria for SDG selection: the target must be relevant to Canada's ocean (localization) and the target must be within the governance of industry to obtain (contextualization). Because of this context, the third criterion is that the SDG target must identifiably enable economic viability (Fig 2). Or in other words, there must be clear economic incentive to pursing the SDG target.

Is the SDG target relevant to Canada's ocean? (localization)

Is the SDG target within the governance of industry to obtain? (contextualization)

Does the SDG target enable economic viability for industry operators? (economic incentive)

Does the SDG reflect the core identity of the goal to which it belongs? (scope)

Does the SDG target span rather than focus the issue? (scale)

Figure 2. Stepwise criteria used to determine which SDG targets are relevant to industry in Canada's blue economy.

Many companies still view sustainability initiatives from a cost-centred rationale and the lack of economic incentive prevents action (Capgemini Research Institute 2022). This is unsurprising as the models of sustainable development have historically viewed industry growth as the solution to social and environmental problems (Purvis et al., 2019). It is not feasible for industry to address environmental and social concerns at the expense of economic viability (Capgemini Research Institute 2022). This would negatively impact the blue economy's success. The purpose of this third criterion is to show that localized and contextualized efforts toward environmental sustainability and social equity through relevant SDG targets have a clear economic benefit.

Due to the SDG's design, selected targets inherently enable environmental sustainability and or social equity as can be seen in Table 1. This addresses the concern that economically focused development of the blue economy forgoes equitable outcomes for the sake of industrial expansion (Cisneros-Montemayor et al., 2021). The remaining criteria (Fig 2) are adapted from Niner et al., 2022 which state the chosen target must reflect the core identity of the SDG to which they belong and that selected targets should span rather than focus the issue. One target for 13 of the SDGs was identified as relevant to Canada's blue economy. Four SDGs 11,13, 15 and 17 were not chosen because they are either not relevant to Canada's ocean and or not within the governance of industry. For example, SDG 13's targets for climate action are framed for national implementation by government institutions and cannot be contextualized to industry without losing its core identity. Instead, SDG targets 2.1 and 7.2 address climate action within the context of Canada's blue economy. The unchosen SDGs are still important for implementing a successful blue economy and emphasize the need for collaboration between government and industry. Following the advice from Tremblay et al., (2021), some of the wordings of the targets were adapted without changing the original meaning to provide greater contextualization on how the target is relevant to Canada's blue economy.

Table 1. SDG targets relevant to Canada's ocean industry and how they enable a socially equitable, environmentally sustainable and economically viable blue economy.

SDG target	Social	Environmental	Economic
1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	Directly enables social equity (Cisneros Montemayor et al., 2021, Bennett et al., 2018)	Access and ownership of ocean spaces and resources empowers local actors to protect their environment (Bennett et al., 2018)	Increases likelihood of SLO by ensuring that industry operations do not negatively impact access to and ownership over coastal land, and coastal and ocean resources (Voyer and Leeuwen 2019)
2.4: By 2030, ensure sustainable sea-food production systems and implement resilient maricultural practices in Canada that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, ocean acidification, sea level rise other disasters, and that progressively improve ocean health		Directly impacts ocean health	Seafood and fishing generate 21.8% GDP of Canada's marine economy (Gov't of Canada 2021)

SDG Target	Social	Environmental	Economic
4.7 By 2030, ensure that all workers in Canada's ocean industry acquire the knowledge and skills needed to promote sustainable ocean development, including, among others, through education of ocean literacy for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	Improved understanding of ocean literacy is essential to achieving social equity (Kelly et al., 2021)	Improved understanding of ocean literacy is essential to achieving environmental sustainability (Kelly et al., 2021)	Investing in a workforce of HQP enables economic viability (Montgomery and Ramus 2011)
5.5: Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in blue economy operations	Directly enables social equity	Gender equity is integral to achieving environmental sustainability in the ocean (Alarcon and Cole 2019)	Gender equity is beneficial to corporate profits and earnings (Herring 2009)
6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes		The health of all water related ecosystems is intrinsically linked (Beger et al., 2010)	Investing in activities that protect and restore ocean assets increases an operation's economic viability (Barbier et al., 2011)
7.2: By 2030, increase substantially the share of renewable energy in the Canadian ocean energy mix		Ocean health is directly and negatively impacted by the continued use of fossil fuels (Doney et al., 2009)	Ocean energy (oil and gas) makes up 20.8% of Canada's marine GDP (Gov't of Canada 2021)

SDG Target	Social	Environmental	Economic
8.4: Improve progressively, through 2030, Canadian resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production		Over consumerism and production directly and negatively impact ocean health (Orecchia and Zoppoli 2007, Singh and Devi 2019)	Investing in activities that protect and restore ocean assets increases an operation's economic viability (Barbier et al., 2011)
9.1 Develop quality, reliable, sustainable and resilient ocean trading infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all		Directly ocean health (Hossain et al., 2019)	Transportation and associated infrastructure generate 20.8% of Canada's marine GDP
10.4: Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality in Canada's blue economy	Directly impacts social equity		voluntary reporting of social governance retains HQPs and therefore increases economic viability (Montgomery and Ramus 2011).
11.7: By 2030, provide universal access to safe, inclusive and accessible, ocean spaces, in particular for women and children, older persons and persons with disabilities	Directly impacts social equity	Access and ownership of ocean spaces and resources empowers local actors to protect their environment (Bennett et al., 2018)	Increases likelihood of SLO by limiting the impact of operations by locally communities directly impacted (Voyer and Leeuwen 2019)

SDG Target	Social	Environmental	Economic
12.6 Encourage ocean companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle		Directly impacts ocean health	Transparent reporting increases likelihood of SLO (Elalfy et al., 2021)
14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans		Directly impacts ocean health	Investing in activities that protect and restore ocean assets increases an operation's economic viability (Barbier et al., 2011)
16.7: Ensure responsive, inclusive, participatory and representative decision-making at all levels in Canada's blue economy	Directly impacts social equity	Gender equity is integral to achieving environmental sustainability in the ocean (Alarcon and Cole 2019, Nash et al., 2020))	Gender equity is beneficially to corporate profits and earnings (Herring 2009)

Using target 12.6 as an example, it can be seen how it meets all the criteria to be relevant to Canada's blue economy industry. It meets the first criterion (Fig 2) by addressing the unsustainable consumption and production patterns that are prevalent in Canada's ocean industry and that negatively impact ocean health (Singh and Devi 2019). Adopting sustainable practices and integrating sustainability reporting is within the ability of industry operators to achieve, satisfying the second criterion. By working towards Target 12.6, operators increase their likelihood of achieving and maintaining social license to operate which economically benefits them, addressing the third criterion. 12.6 was chosen over the other targets for goal 12 because it is most applicable to industry and its focus supports the other targets in this goal. Targets 12.2, 12.3, and 12.4 focus on reducing waste, sustainably managing natural resources, and decreasing pollutants; industry can contribute to these goals by integrating sustainability information into their

reporting cycle, making 12.6 a more spanning target than the others and fulfilling the fifth criterion. The economic viability column in Table 1 showcases how the target provides an economic incentive for pursing that SDG target. The remaining two columns describe how the target addresses the other two enabling conditions for a successful blue economy, social equity and environmental sustainability. Target 16.7 impacts social equity directly by addressing inclusive decision making in the blue economy. By doing so, it helps achieve a healthy ocean by empowering those most impacted by decisions made about the blue economy and acknowledging the interconnectedness of human and ocean health (Alarcon and Cole 2019, Nash et al., 2020).

4.2 Blue Economy Industry Aims and Enabling Mechanisms

The proposed framework is meant to measure blue economy capacity in industry; therefore, each of the SDG targets chosen can be linked to an economic incentive that benefits the industry operator who works to achieve them. These incentives can be categorized into four Blue Economy Aims (Fig. 3).
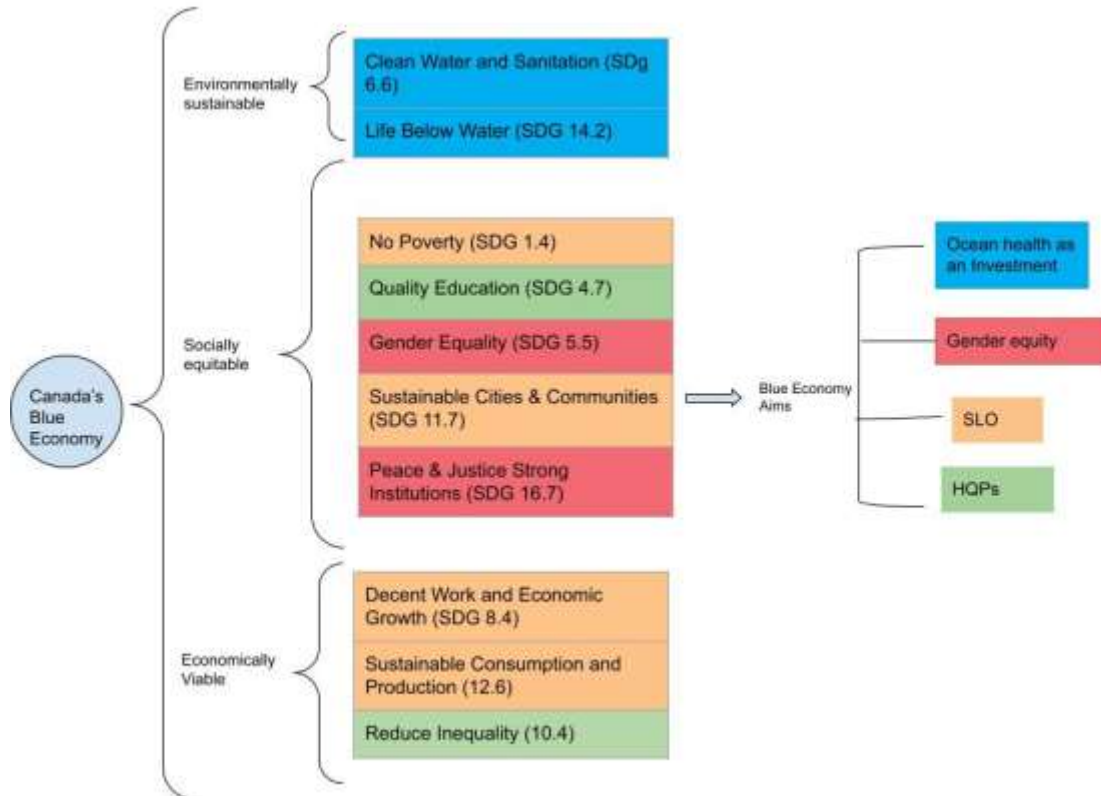
Figure 3. SDG targets relevant to industry in Canada's blue economy organized by the three dimensions of sustainable development and coded by their subsequent Blue Economy Aims

The Aims are: Gender Equity (GE), Social License to Operate (SLO), Ocean Health Investment (OHI) and Highly Qualified Personnel (HQP) training and retention (Fig 3). These synthesized Blue Economy Aims align with the national blue economy aims determined by Niner et al., 2022. These include livelihoods (SLO), capacity and skills (HQP) and environmental protection (OHI). While gender equity is not an identified blue economy aim by Niner et al., 2022, its inclusion is paramount to achieving a socially equitable blue economy (Alexander et al., 2022, Cisneros-Montemayor et al., 2021, Bennett et al., 2018). To operationalize these Aims, enabling mechanisms for each were developed (Tables 2-6). These mechanisms, when actioned by industry operators, also enable either environmental sustainability and or social equity (Table 1). The mechanisms presented in this research are derived from the blue economy aims identified during SDG selection (Fig. 4).

SDGs	Blue Economy Aim	Enabling Mechanisms
First SDG targets that are relevant to Canada's blue economy were determined	Then, the economic benefit to industry operators that comes with achieving SDG targets were identified	Finally, the mechanisms that enable that blue economy aim and therefore the SDG targets were synthesized

Figure 4. The process through which enabling mechanisms were synthesized first through SDG target selection and then blue economy aim identification.

4.2.1 Gender Equity
SDG targets 5.5 and 16.7 (Table 1) enable an economically viable blue economy by addressing gender equity. Pursing Gender equity has an economic incentive because industries that implement gender equity practices often see increased profitability and

productivity (Herring 2009). While these SDG targets expand past gender to address other inequities, they would be outside the scope of this thesis project. To address equity in a meaningful way, structure-agency must be considered i.e., whose equity and fairness is being addressed, when and in what context (Alexander et al., 2022). Considering the structure-agency of other inequities in the blue economy besides gender should be pursued in further research.

Canada has committed to addressing gender equity in the ocean sector through G7 commitments and the UN Decade of Ocean Science (Gov't of Canada 2022). Considering gender equity as an integral part of the blue economy from the beginning is a necessity or we risk magnifying existing inequities (Alexander et al., 2022, Bennett et al., 2021). The Government of Canada (2020) defines gender equity as providing disadvantaged genders extra assistance they need to ensure they have the same opportunities as the dominant gender. This differs from gender equality which does not reconcile the gap between dominant and marginalized genders with extra assistance for the latter. The Government of Canada (2020) recognizes that gender is not binary and that there is a spectrum of gender expression. It is not enough to simply achieve the SDG targets on gender equity, but organizations within the blue economy must strive to re-align their inequitable, systematic characteristics. ᴛable 2 highlights the enabling mechanisms that were adapted from Mangubhai and Lawless (2021). These mechanisms are designed to go beyond simply reaching women and gender non-conforming (GNC) people but aim to benefit and empower them.

Table 2. Mechanisms that enable blue the Blue Economy Aim, Gender Equity, and address the relevant SDG targets identified in Table 1.

Blue Economy Aim	Enabling Mechanisms	SDGs addressed
Gender Equity	**GE.1** Increasing women and GNC people's participation **GE.2** Provide specific benefits to women and GNC people to increase their wellbeing **GE.3** Increase or strengthen the ability of women and GNC people to leadership at all levels of decision making **GE.4** challenge underlying gender norms (visible and invisible), structures and power dynamics that create and reinforce inequalities	5.5: Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in blue economy operations 16.7: Ensure responsive, inclusive, participatory and representative decision-making at all levels

4.2.2 Social License to Operate

SDG targets 1.4, 8.4, 11.7, and 12.6 achieve an economically viable blue economy by increasing the likelihood of achieving social license to operate (SLO). SLO is generally defined as the ongoing acceptance and approval of an operations by those local communities affected by it and those stakeholders who can affect its profitability (Voyer and Leeuwen 2019). Obtaining and maintaining SLO is economically benefical to a company because this social support is needed to ensure ongoing project viability and political and social capital.

SDGs 1.4 and 11.7 are concerned with the access to and the use of geographic areas of the ocean and coast for both consumptive (e.g., fishing, mining, aquaculture) and non-consumptive (e.g. transportation, recreation) activities. This type of multi-dimensional spatial access to the ocean is imperative to the holistic well-being of Canada's coastal and Indigenous communities (Bennet et al., 2018). Blue economy operations are also responsible for their environmental impact on surrounding areas and how this can have socio-economic implications (8.4, 12.6). SLO addresses inequities broadly by ensuring that there is participation in governance and inclusion in decision making and by ensuring

that there is a fair distribution of benefits and minimization of burdens on stakeholders impacted by operations. The goal in achieving SLO is that individuals are ensured a level of empowerment and participation within a given setting. To obtain and maintain social license to operate, blue economy operations must engage with these communities to understand marine and coastal access issues, environmental sustainability concerns, and ongoing challenges and potential solutions.

Table 3. Mechanisms that enable the Blue Economy Aim, Social License to Operate, and address the relevant SDGs identified in Table 1.

Blue Economy Aim	Enabling Mechanisms	SDGs addressed
Social License to Operate (SLO)	**SLO.1** One-way engagement e.g., PR exercises, education programs, information days **SLO.2** Two-way engagement e.g., participatory process/workshops to identify concerns **SLO.3** Mitigation options proposed and enacted	1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance 8.4: Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead 11.7: By 2030, provide universal access to safe, inclusive and accessible, ocean spaces, in particular for women and children, older persons and persons with disabilities 12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle

4.2.3 Ocean Health Investment

Targets 14.2 and 6.6 both focus on ocean health. 6.6 considers the upstream consequences of ocean health by protecting and restoring ecosystems that provide nursery habitats to marine species (wetlands, lakes) and filtering and detoxification services (mountains, forests). 14.2 is concerned directly with the protection and management of marine ecosystems. These two SDG targets work in tandem.

There are industries in the blue economy that rely directly on ocean health to generate ocean wealth through bio assests (e.g., fisheries and marine tourism). Investing in activities that protect and restore ocean assets increases an operation's economic viability (Barbier et al., 2011). Additionally, operations that have abiotic ocean assets (e.g., ocean energy, shipping) also rely on ocean health for economic viability, even if indirectly. This can be seen in the feedback loop between the two blue economy pillars of environmental sustainability and social equity. An operation that has greater environmental sustainability by investing in ocean health improves their likelihood to achieve a social licence to operate. Increased SLO potential can positively impact economic viability, as described above.

Ocean resources that benefit humans are known as ecosystem services (Richter et al., 2021). This research considers both direct use and indirect use values as an ecosystem service. Here, direct use includes both extractive (e.g., fishing) and non-extractive (e.g. tourism/recreation) while indirect use includes bequest, option and existence values that benefit people altruistically as well as culturally and spiritually (The et al., 2021). There is a growing body of literature designed to measure the direct and indirect economic value that ecosystem services provide (Teh et al., 2021). There is a positive correlation between economic growth (GDP) and resilient and healthy ecosystem services; this dependence is predicted to increase (Guo et al., 2010). It is within industry's best interest to understand the breadth and value of ecosystem services they are dependent on to ensure ongoing economic viability. Table 4 lists the enabling mechanisms, which are adapted from Richter et al., 2021 and The International Classification of Ecosystem Services V5. (Haines-Young et al., 2016).

Table 4. Mechanisms that enable the Blue Economy Aim, Ocean Health Investment, and address the relevant SDGs identified in Table 1.

Economic Driver	Enabling Mechanisms	SDGs addressed
Ocean health investment	**OHI.1** Identification of ecosystems that provide or support economic gain **OHI.2** Set of indicators to understand an ecosystem's capacity to provide an Ecosystem Service (ES) **OHI.3** Relationships between indicators and final ES (both negative and positive) **OHI.4** Assessment method to measure indicators and their relationship to the ES **OHI.5** Using a standardized reporting system to record impacts **OHI.6** Full economic valuation of ecosystem services	6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes 14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

4.2.4 HQPs Training and Retention

For the blue economy to be economically viable, it must attract and train highly qualified personnel (HQP). Target 4.7 relates to training HQPs while target 10.4 relates to attracting and keeping HQPS through equitable employment policies. In Canada, HQPs are "workers who possess significant education and training, are subject to high performance expectations, and are performing roles that employers often find difficult to fill due to high skill or knowledge requirements" (Mitacs 2020). Skills of HQPs are especially important for the blue economy's innovation agenda.

In a review conducted by Mitacs (2020), it was found that that there is misalignment between the skills that employers say they are looking for and the investment they are willing to put into skill development. Additionally, it is challenging for other stakeholders

(post-secondary institutions and governments) to help prepare HQPs for employment due to employers not fully understanding their skill needs. Target 4.7 and 10.4 cannot be achieved by industry alone; organizations need to share data, best practices, and results with other stakeholders to successfully utilize HQPs in the blue economy. Table 5 lists the enabling mechanisms that industry can action to achieve HQP attraction and retention. Canada has several compulsory fiscal wage and protection policies for private industry to reduce inequalities in employment that address 10.4. However, companies that participate in voluntary reporting of social governance are seen to have a higher retention of HQPs and therefore greater economic viability (Montgomery and Ramus 2011).

Table 5. Mechanisms that enable the blue economy aim, Highly Qualified Personnel training and retention and address the relevant SDGs identified in Table 1.

Economic Driver	Enabling Mechanisms	SDGs addressed
HQP training and retention	**HQP.1** Sharing data, best practices, and results with other stakeholders **HQP.2** Offering work-integrated learning opportunities **HQP.3** Voluntary reporting on social governance through an accredited reporting initiative (e.g., GRI, ESG)	4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development 10.4: Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality

4.3 An important contributor to Canada's GDP (2.4, 7.2, 9.1)

Targets 2.4, 7.1 and 9.1 were identified as being relevant to Canada's blue economy because they represent the sustainable ideal of marine sectors that significantly contribute

to Canada's GDP. These targets relate to the fishing and seafood industry (21.1% of total GDP), oil and gas (20.8%), and transportation (20.8%) respectively. These targets were not used to synthesize enabling mechanisms because their narrow scope would limit this framework's applicability. However, they are a representative of the major industries that will be transitioing into the blue economy. Their succes will impact the success of many younger industries and companies. While these industries have unsustainable operations within them, the space they occupy represents the importance of their services to Canada and therefore the opportunity sustainable operations have within these industries. The blue economy needs these industries to become environmentally sustainable and socially equitable so that the blue economy as a whole can be economically viable. To that end, the framework was ground-truthed by interviewing two companies that operate in two of these sectors.

4.4 Framework Application

The framework was developed by first determining which SDG targets are relevant to Canada's ocean industry. Using the stepwise criteria described in Figure 2 (section 4.1), 13 out of the 169 targets were determined to be relevant. Targets were chosen at an appropriate level of granularity because they give context to the less specific 17 Goals but are not too specific that they become irrelevant to industry like the 247 indicators designed for public sector implementation. Each of the SDG targets chosen can be linked to an economic incentive that benefits the industry operator who aims to achieve them. These incentives are categorized as Blue Economy Aims (Fig. 2). To operationalize these aims, enabling mechanisms for each were developed (Tables 3-6).

The framework is intended to be a tool that can help assess the blue economy capacity of industry operators in Canada. It addresses the need for clear inclusion criteria that can determine which industries and operations are "blue" enough to benefit from being included in the blue economy. As Canada intends to put a significant number of resources into the development of their blue economy, it is important that these resources are being allocated to those that are enabling an environmentally sustainable, socially equitable and economically viable blue economy. If not, blue washing can occur, and the blue economy will not succeed in addressing the problems of the current ocean economy. The framework was developed in response to the critique that the SDGs and broader

sustainable development priorities are disconnected by localizing and contextualizing the SDGs to industry. Industry is just one stakeholder in building the blue economy and the SDGs should be applied in a similar way to other stakeholders such as NGOs and different levels of government. The application of the framework can help identify new incentives and justifications for non-living industries to invest in ocean health by illustrating the connection between ocean health and social license to operate (4.2.3)

The framework is underpinned by a definition of blue economy that is aligned with the national blue economy aims determined by Niner et al., 2022. As such, it can be used by industry operators to assess their own blue economy capacity. It can be used by operators to examine their decisions and assess whether they align with a socially equitable, environmentally sustainable, and economically viable blue economy. Through self-assessment, operators can make decisions on which Blue Economy Aims (Fig. 2, section 4.1) synthesized in this research they need to invest more resources in to increase their blue economy capacity. While self-assessment sustainability tools can be ineffective (Cho et al., 2020), this framework facilitates materiality by contextualizing the SDGs in a way that makes them most impactful to industry and vice versa. This improves the framework's effectiveness as a self-assessment tool.

For government, this tool could be incorporated into Canada's blue economy strategy so that their activities align with the Sustainable Development Goals. This framework offers a benchmark or target capacity "score" that operators can strive for (Fig. 5). This benchmark can also be used by government actors and private investors when deciding who to allocate benefits to. Ideally this framework, with further development, would be used to develop Canada's blue economy. In the present, it can be used to assess existing industry operations, but it could also be used in the creation of emerging industries. This framework creates an indivisible link between the three dimensions, and therefore it can be used by either party to discuss and debate trade-offs that come with managing ocean resources. Overall, this framework contextualizes the SDGs so that they can be applied to the development of Canada's blue economy. In time, this framework could support the creation of a benchmark that determines who and how blue economy

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resources are allocated. To further realize the relevance of this framework to Canada's blue economy, two Canadian ocean companies were consulted using ground-truthing methods.

Chapter 5. Framework Ground Truthing

5.1 Methods

The findings of this thesis so far are from literature that describes what an ideal blue economy should look like. As the blue economy is actively developing, it is useful to draw upon the knowledge of those who are experiencing this change on the ground. To that end, two blue economy corporations were interviewed to cross-reference how the recommended mechanisms of this framework relate to current activities corporations use to contribute to an environmentally sustainable, socially equitable and economically viable blue economy. This method of ground-truthing is known as triangulation of sources; the use of multiple sources such as interviews and literature to cross-reference information obtained from each source (Patton, 1999). The two companies chosen were, OpenOcean Robotics and Clearwater. These companies self-identified as being a part of the blue economy and have been generating revenue for at least a year; the second criterion ensures that there are resources being allocated to the mechanism in review and that their answers about the mechanism are backed by action. In each case, the person interviewed was a C-level executive who knew the current sustainability goals of the company and who could speak to future goals.

The two companies were first asked which of the SDGs that are an important contributor to Canada's ocean economy (7.2, 2.4 or 9.1) best represent their operations (Table 6). The mechanisms were then posed as questions e.g., "how does the company conduct one-way engagement with local communities and or stakeholders". This type of peer debriefing provides an additional perspective on what is currently needed in Canada's blue economy and the applicability of this research's framework (Moon et al., 2016). Engaging blue economy corporations in the creation of this framework increases the likelihood that the framework will be a useful tool for corporations (Moon et al., 2016, Yonto and Schuch 2020).

The full list of questions can be found in the Supplementary Information section (Appendix S2). Using a binary scoring system, a mechanism was given a score of 1 when implemented by the company. If a mechanism was not implemented by any of the two

companies interviewed, then it would receive a 0. Mechanisms were considered implemented if the company either had a key performance indicator to measure it and/or if the company had a standardized process for implementing it. The total number of mechanisms across all the blue economy aims is 16. There are 4 in Gender Equity (GE), 3 in achieving and maintaining Social License to Operate (SLO), 6 in Ocean Health Investment (OHI), and 3 in Highly Quality Personnel (HQP) training and retention. The number of mechanisms in each blue economy aim was determined by what was found in the literature and is not indicative of significance or weight. The rational for aims and mechanisms are found in the following individual sections for each aim.

While these industries do not fully represent the extent of the blue economy, they are the industries that will most likely lead the changeover. Ideally, this framework could be used as a blueprint to help synthesize emerging blue economy companies and industries. If a mechanism was not implemented by any of the two companies interviewed, then it would receive a 0.

5.2 Findings

The two companies interviewed were Clearwater and Open Ocean Robotics. Hereby known as CorpA and CorpB respectively. CorpA and CorpB are examples of companies in a living ocean sector and a non-living ocean sector respectively. CorpA addresses SDG 2.4 as a commercial fishing company that contributes to the blue economy by being "stewards of the ocean" and using scientifically informed management. CorpB addresses SDG 7.2 and 9.1 as an ocean technology company and contributes to the blue economy by monitoring the anthropogenic impacts of offshore industries, port infrastructure and vessel traffic and enabling the responsible development of offshore wind. CorpB is an example of an emerging industry in the blue economy while CorpA is within a long-established ocean industry.

Neither company implemented all mechanisms of one blue economy aim (Table 6). Across the two companies, the most mechanisms implemented were in the blue economy aim Gender Equity (Fig 5). CorpA implemented none of the mechanisms in Social License to Operate and CorpB implemented none of the mechanisms in Ocean Health Investment (Fig 4). Across the two companies, only 2 of the same mechanisms were implemented. They are a) increase or strengthen the ability of women and GNC people to

all levels of decision making within the driver of Gender Equity; and b) offer work-integrated learning opportunities within the blue economy aim for Highly Qualified Personnel (HQP). Out of the 16 mechanisms, there were 4 that were not implemented by either company. They are a) provide specific benefits to women and gender non-conforming people to increase their wellbeing; b) propose and enact mitigation options to address stakeholder concerns; c) establish relationships between indicators and final ES; and d) establish the full economic valuation of ecosystem services.
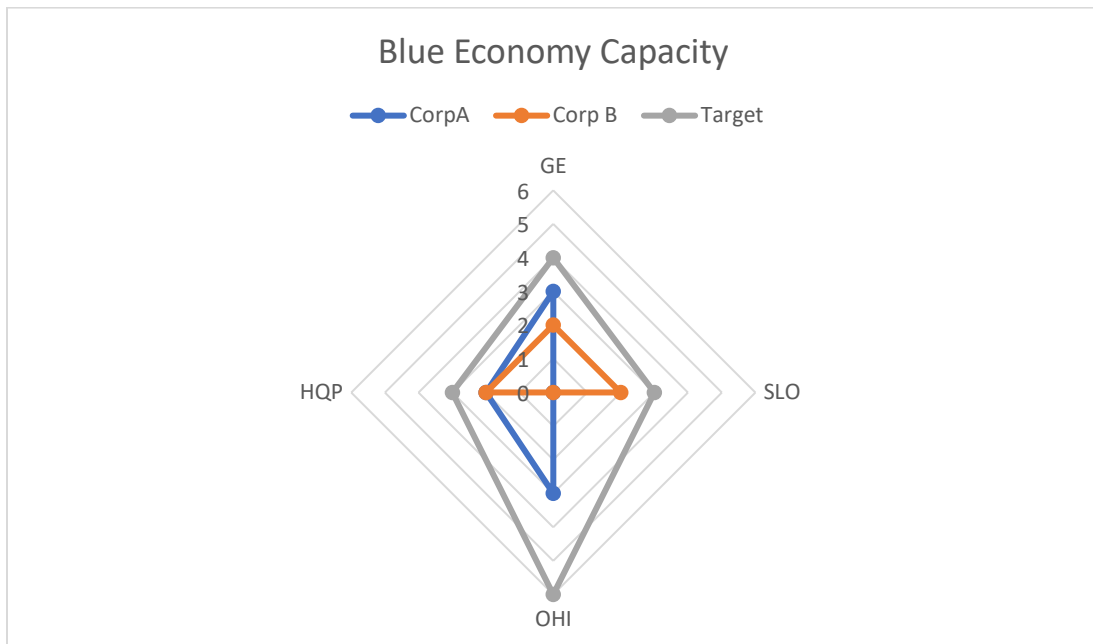

Figure 5. The blue economy capacity of CorpA and CorpB determined by the number of mechanisms implemented in each blue economy aim. A Target example is used for comparison that implements all mechanisms in each of the blue economy aims
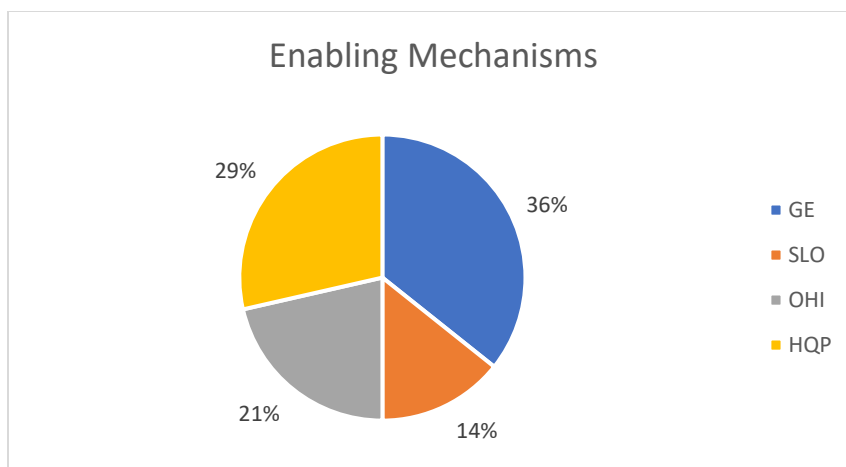
Figure 6. The percentage of enabling mechanisms implemented by both CorpA and CorpB proportional to the total that could be implemented (n=32).

Table 6. Ground-truthing results for the number of mechanisms implemented by each company within the 4 blue economy aims and the SDGs each company chose that best represented their operations. There are 16 mechanisms in total with 4 in GE, 3 in SLO, 6 in OHI and 3 in HQP

	SDG	GE	SLO	OHI	HQP	Total
CorpA	2.4: By 2030, ensure sustainable sea-food production systems and implement resilient maricultural practices in Canada that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, ocean acidification, sea level rise other disasters, and that progressively improve ocean health	3	0	3	2	8
CorpB	7.2: By 2030, increase substantially the share of renewable energy in the Canadian ocean energy mix	2	2	0	2	6
Total		5	2	3	4	

5.3 Discussion

Of the two companies, it was found the CorpA does not implement any of the SLO mechanisms. This was surprising given the fact that fishing and seafood operations are highly vulnerable to social acceptability (Voyer and Leeuwen et al., 2019); as such, one would expect activities that increase the likelihood of SLO would be important to the industry. However, there is a known gap of social factors in fisheries-based management in Canada and operators rely on top-down government legislation to make management decisions (Angel et al., 2019). Even so, CorpA has existed for over 25 years and has a presence in the community that can be seen from their interview responses when they stated, "our employees are advocates to the community". CorpA also expressed that social media makes it difficult to have community dialogue as messages can be "warped" and that there is no process for community engagement because they operate offshore. It is a challenge for non-static ocean industries like fisheries to identify relevant stakeholder groups and the concerns that they might have as there is no obvious community of place that they are impacting (Voyer and Leeuwen et al., 2019).

In contrast, CorpB takes a blanket approach to stakeholder engagement through one-way activities like PR exercises and information presentations to broad audiences. This is an approach to combat a similar problem to CorpA where the nascence of CorpB's sector makes it difficult to narrow in specific stakeholders and their concerns. This proactive approach is common in emerging ocean sectors where operators view SLO as part of the formal, regulatory approval process that's crucial for legitimizing their operations (Voyer and Leeuwen et al., 2019). Difficulty in identifying stakeholders and their concerns is likely the reason neither CorpA nor CorpB implements mechanism SLO.2 (Table 3). Without understanding who an operation impacts, what the extent of the impacts are, and how to address them, it is difficult to assess a company's blue economy capacity.

CorpB implemented none of the OHI mechanisms while CorpA applied all but OHI.2, OHI.3 and OHI.6 (Table 4). When asked about ecosystem service indicator establishment (OHI.2), the CorpA respondent stated that it is a "loaded question" because the science is constantly developing for better management. Because CorpA does not have true KPIs to monitor this, they are unable understand their impact on ecosystem services (OHI.3). CorpA also mentioned that while there are catch and landing surveys, which are the main

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method for monitoring a fisheries impact ecosystem service in Canada, CorpA described these surveys are "spotty" and "cost-prohibitive". The lack of a standardized process for the above means that they as an operator, are unable to establish the full economic valuation of the ecosystem service, fish stocks (OHI.6). The Canadian government does take assessments of national fishery stocks, but this process is highly bureaucratic and difficult to adapt at the individual operator level. Moreover, there seems to be a lack of incentive for individual fishing operators to assess ecosystem services because this is seen as the responsibility of government (Angel et al., 2019)

While CorpB does not implement any of the OHI mechanisms, the respondent did state that they rely on ocean health being a priority for the blue economy because it is closely tied to the direction of the company and the services they offer. CorpB's primary offering is monitoring ecosystem services so that offshore energy, shipping, and ports may develop sustainably. This includes monitoring the patterns and health marine mammals and Marine Protected Area (MPA) indicators. It is difficult for non-living ocean industries to identify the ecosystem services that are relevant to their operations as their primary function does not rely on a healthy ocean. However, CorpB's services would not be needed if ocean health wasn't a priority of the blue economy. CorpB's respondent stated that they have a "vested interest in seeing more parts of the ocean protected because this requires more monitoring." Extractive, non-living industries like CorpB operates within, have the most pressure to consider ocean health from stakeholders to obtain and maintain social license to operate (Vollero et al., 2016). If a company is seen to be negatively impacting ocean health, this directly impacts its SLO and therefore its economic viability. In this point of view, ecosystem services used as the indicator for OHI may not be what provides ocean assests but what ocean assets are being impacted by a company's operations (e.g., shipping traffic on marine mammals). These services have an indirect bequest value, that is an existence value which is known to a company's stakeholders and by investing in their health, operators can increase their likelihood of obtaining and maintaining SLO. This connection can provide an economic incentive for non-living ocean industries to invest in ocean health and create a perspective shift from the ocean simply being a medium for operations to an asset worth investing in (Fig 6).

The need for SLO, which greatly determines economic viability in extractive, non-living industries, can be achieved by investing in ocean health. By doing so, operators increase their social acceptability and therefore their economic viability. As they obtain and maintain SLO, there will be continued pressure from stakeholders to keep up with that standard, promoting more investment into ocean health (Fig 6).
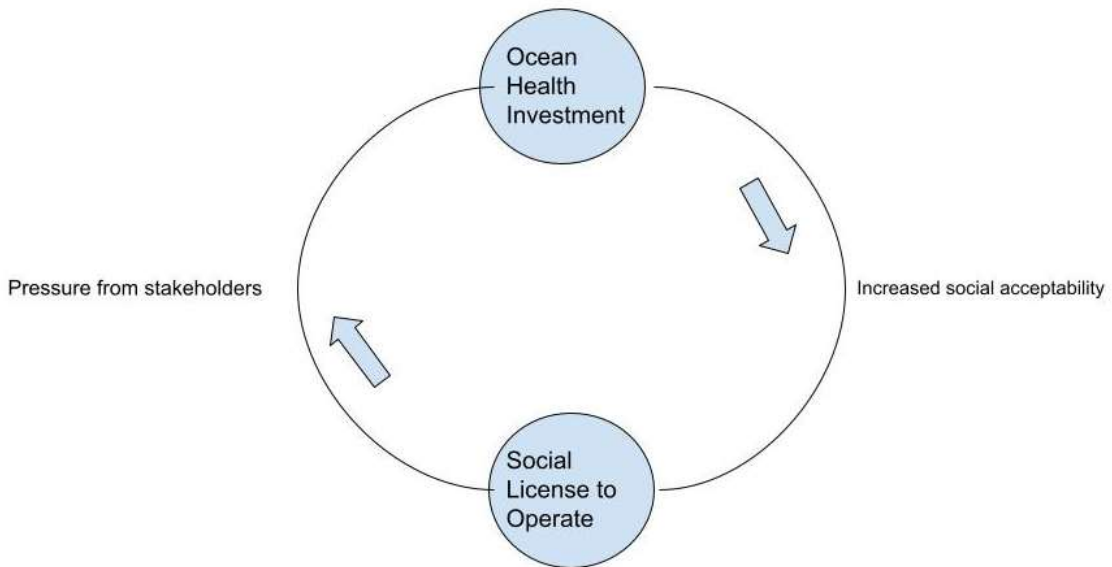

Figure 7. The feedback loop between the two blue economy aims of SLO and OHI.

Companies like CorpB assist other non-living ocean operations in making an investment into ocean health by offering monitoring services to understand their impacts on ecosystem services. To accurately assess the blue economy capacity of a non-living ocean operation, further research is needed to determine the economic valuation of indirect ecosystem services. As well, other mechanisms besides ecosystem services will be needed to assess emerging industries that contribute to ocean health in other, potentially indirect ways.

It is unsurprising that the two mechanisms that were implemented by both companies were in blue economy aims Gender Equity and Highly Qualified Personnel attraction and retention. Outside of the blue economy, these aims are well understood to be important to the success of companies (Montgomery and Ramus 2011, Herring 2009). It should be

noted that the responses from both companies for GE.3, "how does your company increase or strengthen the ability of women and GNC people to leadership at all levels of decision making", included processes that reached everyone and were not specific to women or GNC people. This included outreach outside of the company and mentorship within it. Both CorpA and CorpB expressed that women and GNC people are a minority in their industries of fishing and ocean tech respectfully. CorpA has a standardized process for challenging these underlying gender norms (GE.4) through awareness training that is operationally led. CorpA stated that this approach "meets people where they are at" in an effort to break through generational believes and practices. Gender equity is especially important in the fishing industry as it is historically male dominated in Canada and there is existing literature that correlates greater gender equity with fishery success (Harper et al., 2013, Harper et al., 2017, Harper et al., 2018).

The Blue Economy Aims SLO and OHI had the least number of mechanisms implemented across both examples (Fig 5). The results of this ground-truthing shows the contrasts when applying this framework to two operators in different industries. One in an established, living industry (CorpA) and the other in an emerging, non-living industry (CorpB). The OHI mechanisms were not as applicable to the non-living example and SLO mechanisms were not as applicable to the already established industry example. The SDGs are designed to encourage activities that avoid harm to the environment more so than activities that promote doing good (Lisowski et al., 2019). This reflects the origins of sustainable development and many of today's management strategies, especially in the ocean. This reality also influenced the mechanisms synthesized for Ocean Health Investment as they are focused on avoiding harm to an operation's ocean asset. But emerging industries and operators, like CorpB, that do not rely on ocean assests but the monitoring of them, are an example of how there are other ways to invest into ocean health, even if indirectly.

SLO had already been achieved and continues to be easily maintained by CorpA because of the corporations long standing community history. However, if Canada wants to achieve a socially equitable blue economy, legislation on resource management will have

to adapt so that organizations will be legally bound to putting ocean health first. Non placed based operations, like fishing require a thorough supply chain analysis to understand who they are impacting. This undertaking will span across corporations and fisheries which will require government support.

The findings from this peer debriefing show that the actions which have been recommended by this research for a successful blue economy are currently not being taken to the fullest by the two companies interviewed (Fig 4). Efforts to address the Blue Economy Aims seem to be ad hoc and are not comparable across the two examples. They are also not rooted in a national or international sustainability standard, such as the SDGs. Ideally, blue economy capacity should be comparable across industries, regions, and time periods.

5.4 Application Constraints

The ground truthing methods used were not meant to validate this framework but to gain insight from blue economy operators if these proposed mechanisms were already something that they implement and/or the difficulties that may come with implementation. Essentially, this process was intended gain an understanding how embedded were the strategies and processes that aligned company operations with expectations of those operating in the blue economy. To further understand how this framework relates to current efforts by blue economy companies, operators across many different ocean industries, both emerging and established, living and non-living would need to be consulted. For full application, a participatory process that includes industry and government stakeholders would be needed. Furthermore, this ground-truthing process was not meant to give an overall score for the assessed companies but to analyze which Aims resources were allocated to. Subjectivity could be a challenge when deciding if a company does implement a mechanism as the responses were up to interpretation if the company had a key performance indicator to measure the mechanism and/or if the company had a standardized process for implementing it. This was not self-evaluation because the results were interpreted by the researcher. Future research should test the tool both as a self-evaluation and as third-party assessment.

Chapter 6. Conclusion

This research used the SDGs as a theoretical backdrop, from which a framework was generated to assess an industry operation's blue economy capacity. It was first necessary to understand the history and progress of sustainable development and the SDGs to understand what foundation this framework was built on and what gaps needed to be addressed (Chapter 2 and 3). It was found that because of sustainable development's roots in economic solutions above social and environmental ones, the SDGs are often criticized for their inability to accurately represent the interconnected nature between these three dimensions. The literature on incorporating the SDGs in sustainability assessments at the industry level was limited and there were no sources that did so for the blue economy. From what was available, it was found that the SDGs need to be contextualized and localized to better acknowledge the interdependencies among goals and for effective implementation for assessing sustainability or in this instance, blue economy capacity of industry operators.

Following that knowledge, the next objective of this thesis was to identify which of the 169 targets of the 17 goals were relevant to Canada's blue economy (Chapter 4). Stepwise criteria were created to narrow down the targets to those that were most applicable to assessing the blue economy capacity of industry in Canada. As this framework is meant to measure blue economy capacity in industry, it was necessary that each of the SDG targets chosen could be linked to an economic incentive that benefits the industry operator who works to achieve them. These incentives were then categorized into four Blue Economy Aims, Gender Equity, obtaining and maintaining Social License to Operate, Ocean Health Investment, and attracting and training Highly Qualified Personnel. In this process of SDG selection, three targets were identified as being relevant to Canada's blue economy because they represent the ideals of marine sectors that significantly contribute to Canada's GDP. However they were not used to synthesize enabling mechanisms because their narrow scope would limit this framework's applicability. Instead, they were used to identify current blue economy companies that were interviewed to ground-truth this framework.

Enabling mechanisms are the steps that blue economy industry operators can take to achieve the Blue Economy Aims and therefore the SDGs they relate to. Mechanisms were synthesized from literature on each Blue Economy Aim that used methods to measure their success (Section 4.2). The process of identifying Aims that represent SDG targets allowed for more options in the literature. Where there were gaps in literature that used the SDGs in assessment frameworks, there were more sources that could be used to synthetize mechanisms for the identified Blue Economy Aims. In this way, contextualizing and localizing the SDGs into Blue Economy Aims allowed for better extrapolation of enabling mechanisms and methods that can be used to assess an industry's blue economy capacity. It was challenging to find mechanisms in the literature that could assess a company's Ocean Health Investment as this is a new area of research. Using ecosystem services as the basis for assessment (Section 4.2.3) may not be as applicable to non-living ocean industries that do not rely on a healthy ocean as an asset.

The final objective of this thesis was to understand if the mechanisms developed by this thesis to assess a company's blue economy capacity are being implemented in current operations. Two blue economy corporations were interviewed to cross-reference how the recommended mechanisms of this framework relate to current activities corporations use to contribute to an environmentally sustainable, socially equitable and economically viable blue economy (Chapter 5). Undergoing this peer-debriefing showed that the actions which have been recommended by this research for a successful blue economy are currently not being taken to the fullest by the two companies interviewed. Blue Economy Aims OHI and SLO were they least implemented by the two companies. The literature suggests that these Aims are less understood in how they economically benefit a company.

Without a sustainability standard for the blue economy in Canada, it will be difficult to track progress towards the SDGs and Canada risks promoting short term gains at the expense of long-term sustainability. At the present state, this thesis offers the first research that contextualizes the SDGs into an assessment framework to measure blue

economy capacity in industry. This thesis offers a framework that can facilitate benchmarking and performance comparison, allowing companies to identify areas where they can improve their sustainability performance and set targets for improvement. It also can enable stakeholders and regulators to compare the blue economy capacity of different companies and make more informed decisions on Canada's Blue Economy Strategy. Furthermore, it can help ensure that sustainability reporting for blue economy companies is consistent and transparent, reducing the risk of bluewashing or misrepresentation of sustainability performance.

Appendix A Supplementary Tables

Table S1. The four Blue Economy Aims, their enabling mechanisms and the corresponding relevant SDGs

Blue Economy Aim	Enabling Mechanisms	Relevant SDG targets
Gender equity	- Reach: defined as those that explicitly focus on women's participation in activities or trainings (e.g., attendance at meetings, workshops or trainings) - Benefit: provide specific benefits to women to increase their wellbeing e.g., access to resources and mentorship - Empower: aim to increase or strengthen the ability of women and GNC people to leadership at all levels of decision making - Transform: aim to challenge underlying gender norms (visible and invisible), structures and power dynamics that create and reinforce inequalities	5.5., 16.7
Ocean Health Investment	- Identification of ecosystems that provide or support economic gain - Set of indicators to understand an ecosystem's capacity to provide an ES - Relationships between indicators and final ES (both negative and positive) - Assessment method to measure indicators and their relationship to the ES - Using a standardized reporting system to record impacts - Full economic valuation of ecosystem services	6.6, 14.2
Social license to operate	- One-way engagement e.g., PR exercises, education programs, information days - Two-way engagement e.g., participatory process/workshops to identify concerns - Mitigation options proposed and enacted	1.4, 8.4, 11.7, 12.6
Attracting and Retaining HQPs	- Sharing data, best practices, and results with other stakeholders - Offering work-integrated learning opportunities - Voluntary reporting on social governance through an accredited reporting initiative (e.g., GRI, ESG)	4.7, 10.4

Table S2. Enabling mechanisms for each blue economy aim posed as questions and the scores each mechanism received if they were implemented and given a score of 1 or not and given a score of 0 by the two interviewed companies.

Gender Equity	Clearwater (CorpA)	OpenOcean Robotics (CorpB)
How does/does your company increase women and GNC people's participation in your operations?	1	1
How does/does your company provide specific benefits to women and GNC people to increase their wellbeing?	0	0
How does your company increase or strengthen the ability of women and GNC people to leadership at all levels of decision making?	1	1
How does/does your company challenge underlying gender norms, structures and power dynamics that create and reinforce inequalities?	1	0
Social License to Operate		
How does/does your company establish one-way stakeholder engagement e.g. PR exercises, education programs, information days?	0	1
How does/does your company establish two-way engagement e.g., participatory process/workshops to identify concerns?	0	1

Ocean Health Investment	Clearwater (Corp A)	Open Ocean Robotics (Corp B)
How does/does your company identify ecosystems that provide or support economic gain?	1	0
How does your company establish a set of indicators to understand an ecosystem's capacity to provide an ES?	0	0
How does your company establish relationships between indicators and final ES (both negative and positive)?	0	0
How does/does your company establish an assessment method to measure indicators and their relationship to the ES?	1	0
How does your company use a standardized reporting system to record impacts?	1	0
How does your company establish the full economic valuation of ecosystem services?	0	0
HQP		
How does/does your company share data, best practices, and results with other stakeholders?	0	1
How does/does your company offer work-integrated learning opportunities?	1	1
How does/does your company engage with voluntary reporting on social governance through accredited reporting	1	0

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