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Utilizing the SDGs to develop a blue economy capacity framework enabling a shift from an ocean economy to a blue economy in Canada

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Canada has committed to establishing a socially equitable, environmentally
sustainable and economically viable blue economy but has not yet determined
a sustainability standard that industry must meet to be included in this
aspirational blue economy. For the blue economy to be an effective,
sustainable alternative to the regular ocean economy, clear criteria for ocean
business must be established to reduce the risk of blue washing. The UN
Sustainable Development Goals (SDGs) provide an ideal theoretical basis from
which to develop a marine sector standard for blue economy industry. Using a
criteria-based approach, this work selected relevant SDG targets that can guide
Canada's ocean industry in the transition to a blue economy. Through a stepwise
process, the selected targets were further contextualized to the company level
resulting in a blue economy capacity assessment framework (BECF) that offers
four blue economy industry aims and associated enabling mechanisms. The
BECF practically links the theory of the SDGs to a desired outcome, providing a
method for an ocean-based company to assess its contribution to all three
dimensions of Canada's blue economy.

Introduction

To address the challenges facing climate and ocean health while considering the need
for food, energy and trade security, several nations, including Canada, have begun to shift
toward an ocean-based economy that integrates social inclusion and environmental
sustainability by transitioning to a Blue Economy (BE) approach. Canada has adopted

the World Bank Group definition which is "a concept that seeks to promote economic growth, social inclusion and the preservation of livelihoods while at the same time ensuring environmental sustainability of the oceans and coastal areas" (World Bank, 2017). The BE should not be confused with the ocean economy which is "measured in terms of the oceans-based industries' contribution to economic output and employment (OECD, 2019)." Only measuring economic output, the ocean economy is one of the fastest growing and profitable industries (OECD, 2019) puts planetary health at risk.

The ocean is the largest and most critical ecosystem on Earth. Covering over 70% of the planet's surface, and through adaptive systems and feedback loops, the ocean influences, and is influenced by climate. It produces at least 50% of global oxygen supply. Human activity on land, and within the ocean is wreaking havoc on these systems and the ocean's ability to sustain life within it. In addition to a large body of evidence, a systematic literature review by Talukder et al., (2022), investigated the effects of climate change-induced ocean warming, acidification, and deoxygenation on ocean biodiversity and their resulting planetary health impacts. The findings are significant. Without a healthy ocean, life on Earth is in jeopardy as ecosystem services, food and nutrition security, livelihood, pathogenic organisms, biomedical and pharmaceutical, and disaster risks are all affected in the negative (United Nations, 2015; IPCC, 2019; Talukder et al., 2022). The ocean is also potentially the largest provider of food, materials, energy and ecosystem services such as nutrient cycling, carbon sequestration and moderation of extreme events (Ocean & Climate Platform, n.d). It is necessary for a thriving human race. Ocean industries that do not consider the environmental and social impacts of their operations exacerbate the current issue, particularly as "past and current uses of the ocean continue to be unsustainable, with increasing demand contributing to the ocean's decline" (Kraemer, 2017).

Until the idea of the BE was conceived in 2012 (Lesperance, 2016) ocean industries primarily focused on economic gain. Overfishing, the destruction of the seabed via bottom trawling, oil & gas extraction, and pollution from maritime industries have all contributed to an ocean that is failing to thrive (Kraemer, 2017). The consequences are not just impacting ocean health, but also impact social equity, which is why improving it is a goal of sustainable ocean governance (Lubchenco et al., 2020). Research has shown several examples of how inequity is both created and perpetuated. Examples include how the exclusionary tactics have displaced Black and Indigenous peoples so they cannot access the resources in their own coastal homelands, and how scientific principles erase or exploit Indigenous knowledge systems (Crosman et al., 2022). Adopting a BE, as defined by the World Bank, is seen as a path to continued economic prosperity, but with improved governance and strategies that can reduce environmental and social degradation.

Canada has taken a global lead in working with stakeholders to develop a Blue Economy Strategy (BES). The country has committed to developing its blue economy but has not yet published a strategy for its growth. Currently, all ocean industries, regardless of their environmental sustainability or social equity are included (DFO, 2021). To shift toward a BE, it will be important to consider environmental sustainability and social equity alongside economic viability (Cisneros-Montemayor et al., 2021). To do so, these three priorities will need to be reflected within the operations of the maritime industries that operate in Canada's ocean territories. Clear, assessable criteria that can determine which industrial operations and activities could be considered "blue enough" i.e., those that meet sustainability standards of ocean health and social equity, are needed to ensure the BE's necessary sustainability-focus. In addition to preserving ocean health, ocean wealth and social equity, such criteria can also be used 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, 2021).

Assessing the trade-offs and interdependencies among social, environmental, and economic priorities is complex. The UN Sustainable Development Goals (SDGs), developed to address these complexities, are now widely accepted as a response and offer Goals, Targets and Indicators that are designed to reflect the indivisible socio-ecological relationships inherent in strong sustainability, which links triple bottom line objectives as different but not interchangeable (Purvis et al., 2019; Singh and Devi, 2019; Fallah Shayan et al., 2022). However, in practice, the SDGs 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). To remedy this, it is necessary to adapt the SDGs to a Canadian blue economy context or else there is risk of promoting palliative, short-term sustainability goals that dimmish overtime (Niner et al., 2022). This research does so by creating a criteria-based approach to selecting relevant SDG targets for Canada's blue economy. These targets are then contextualized into Blue Economy Industry Aims with subsequent enabling mechanisms. The resulting framework can be used to assess an ocean business' contribution to a socially equitable, environmentally sustainable, and economically viable blue economy i.e., their blue economy capacity. When contextualizing the SDGs in this way, trade-offs among and between targets become clearer and more relevant at the company level. By establishing a sustainability requirement for industry to be included in the blue economy, and therefore creating a distinction between the blue economy and ocean economy, companies can identify their "blue" shortcomings and assess trade-offs among social, environmental and economic priorities to achieve a greater blue economy capacity.

SDGs

A framework that can assess blue economy capacity is needed to provide clear inclusion criteria for industry; one that can provide guidance to industries that wish to support Canada's transition to a blue economy. While the SDGs lack clarity on the processes and instruments for ensuring a BE (Kraemer, 2017), the authors believe they remain a strategic basis from which to define operational targets and can be used to develop a blue economy capacity

assessment framework (BECF) that can assess a company's ability to address the interconnectivity of social, environmental and economic goals. The SDG framework highlights interconnectivity and potential synergies among these relationships. They also increase the likelihood of success and return on investment for reaching the other goals. This research is predicated on the applicability of the SDGs as a theoretical backdrop from which such a framework can be developed.

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 was to identify and mitigate potential negative impacts of industrial activities on the environment and local communities, with many assessments targeted at exploitative industries such as mining or forestry (Bond and Morrison-Saunders, 2011). In the 1990s, a shift towards a more comprehensive approach began; one that considered the interconnectedness of social, environmental and economic factors (Elkington, 1998; Cashmore, 2004). The result was the development of several frameworks and tools for sustainability assessments, such as the Global Reporting Initiative (GRI).

The development of SDGs in 2015 provided a new framework that industry could adopt by offering a more holistic approach to assess sustainability as well as a consistent and comparable evaluation of sustainability practices across different sectors and regions. The advantage of integrating the SDGs into sustainability frameworks has been recognized in widely used assessments like the GRI which now align their Standards to report on specific SDGs and their targets (GRI Universal Standards, 2021). Adherence to the international sustainability norm that the SDGs offer can lead to enhanced access to finance and global markets and can support collaborative management of shared and connected resources by establishing a common aim (Niner et al., 2022). While the GRIs and similar assessment frameworks offer a set of sustainability reporting standards, using them to assess a company's capacity to contribute to a blue economy is difficult due to the lack of a blue economy standard in Canada. Because of this, companies may struggle to determine which topics are most significant for the transition to a blue economy and which impacts are most critical to report. By utilizing the SDGs, the BECF offers blue economy priorities for Canadian ocean companies. Based on their global acceptance and

their integrated nature, the SDGs provide an excellent basis from which to build a solid BECF and support the necessary enabling conditions for a successful blue economy (social equity, environmental sustainability and economic viability). According to the UN SDG framework, social sustainability involves creating equitable societies where everyone has access to essential services, opportunities, and rights, fostering well-being and dignity for all. Environmental sustainability focuses on protecting and managing natural resources to ensure they are available for future generations, addressing issues like climate change, biodiversity loss, and pollution. Economic sustainability aims for inclusive and resilient economic growth that provides decent work and reduces inequalities, ensuring long-term prosperity without depleting resources or harming the environment. These dimensions interact with each other and are designed to link how improvements in one area can drive progress in others, such as how economic growth can fund social programs and environmental conservation can support livelihoods and health (United Nations, 2015).

Methodology for developing BECF

To utilize the SDGs in an assessment framework that accounts for trade-offs and interdependencies, a localized approach is required where targets can be applied in a national and industry specific manner (Tremblay et al., 2021; Niner et al., 2022). When applied to a Canadian blue economy context, interactions among and between the SDGs become clearer which allows for companies to have more informed and transparent decision making on necessary trade-offs. Our approach can be seen in Figure 1. The first step in this process was to define criteria for SDG target selection that characterizes the term "relevant" in such a way that it applies to Canada and that industry has the agency or power to influence the target (Figure 2). To apply the SDG targets at the company level for the purpose of the BECF, we theorized how these selected targets would economically incentivize a company to increase their blue economy capacity. This is to address the concern that companies can view sustainability initiatives from a cost-centered rationale which prevents action (Slatter et al., 2022). By assessing the selected targets against the three enabling conditions for a blue economy (Supplementary Table 1), four thematic incentives were revealed and were then classified as Blue
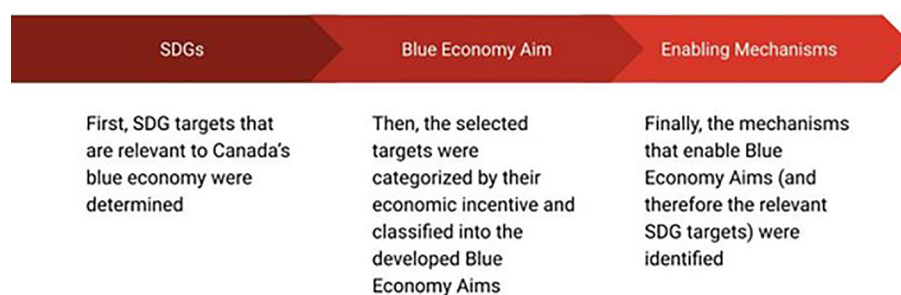

FIGURE 1
The process through which enabling mechanisms were identified first through SDG target selection and then Blue Economy Aim development.
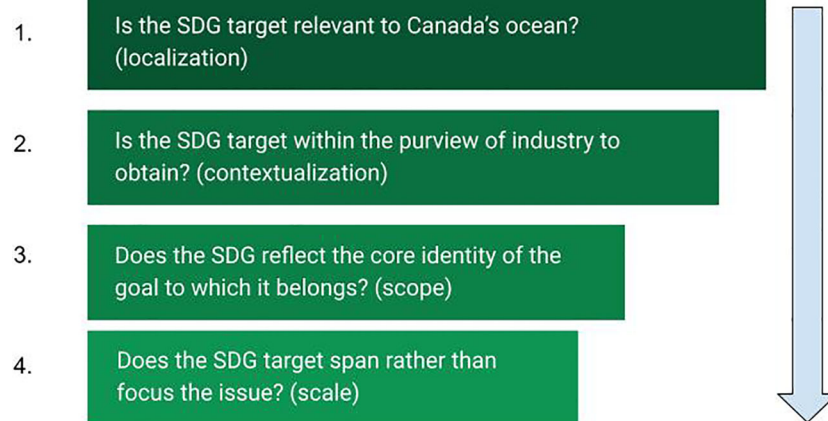
FIGURE 2
Stepwise criteria used to determine which SDG targets are relevant to industry in Canada's blue economy.

Economy Industry Aims (Aims). Actions that a company can take to fulfill these Aims, and therefore the associated SDG target, are defined as enabling mechanisms. Supplementary Table 1 shows how the selected SDG targets fulfill the three enabling conditions (social, environmental and economic) ensuring the resulting BECF does not forego the environment or equitable outcomes for the sake of industrial expansion (Cisneros-Montemayor et al., 2021). Within the Table, the reasons a company would pursue each SDG target, as per the literature, are listed for each of the enabling conditions per target.

Selecting SDG targets

Narrowing down SDG targets for Canada's BE followed the process found in Figure 2. This process was influenced by Lisowski et al. (2020) who used a criteria-based approach to select relevant SDG indicators to assess the European automotive industry. In their methods, the authors qualitatively analyzed the indicators in three steps to determine if the content of the indicators met their criteria. As the authors were only selecting indicators with an environmental impact, that was their first criterion. Next, they assessed whether or not an indicator measured environmental impact that directly led to change in environmental condition. This, they stated, is because the directness of impact is closely linked to causative action and the influence a company is more likely to have on the indicator (Lisowski et al., 2020). The final criterion evaluated if an indicator is influenced by the inputs or outputs of the automobile lifecycle.

In a similar way, this work qualitatively analyzed SDG targets in four steps to assess relevance to Canada's BE (Figure 2). At each stage, the SDG target was evaluated to ascertain whether the targets' content aligns with the categories of "selected" or "not selected" as outlined in Table 1. While Lisowski et al. (2020) determined the influence industry could have on an SDG indicator through directness of impact, this work evaluated the higher-level targets by whether or not they could be meaningfully influenced by industry without the involvement of the public sector. For example, SDG 6.5 was not selected because its

realization would require regulatory changes. In both this work and that of Lisowski et al. (2020), the purpose of using a criteria-based approach for SDG selection is to contextualize the SDGs so that they are relevant to the industry and theoretically attainable by the company they are meant to assess. This ensures that the application of SDG targets for the purpose of the BECF accounts for the interdependencies among the SDGs (Nash et al., 2020; Niner et al., 2022).

The criteria for SDG target selection were applied in a manner such that steps 1 and 2 localized, then contextualized, the SDG targets under consideration for Canada's BE. This means that the target must be relevant to Canada's ocean (localization), and that industry must have the agency or power to meaningfully contribute to the target (contextualization). The following steps ensure a reasonable scope and an attainable scale. Table 1 provides definitions of the criteria and selection examples.

Steps 3 and 4 are adapted from Niner et al. (2022) who used a criteria-based approach to select relevant SDGs to assess national BE policies of different countries. In this work, these final two criteria were applied to ensure that the selected targets did not obscure the interconnectedness and interdependencies of the SDGs when taken out of the context of the goal. For example, SDG 8.2 was not selected because when taken out of context, it's focus on technology and innovation could misconstrue the overall purpose of SDG 8. Instead, 8.4 was chosen as a better representation of the goal. It's ability to link to the social equity and environmental sustainability purposes of the other SDGs was also more desirable. All selected SDGs simultaneously address the social, environmental and economic equality conditions as specified in the World Bank BE definition as can be seen in Supplementary Table 1.

This process of elimination reduced the original 169 targets to 10 deemed relevant for industries operating in Canada's BE (Figure 3). There were no targets chosen from SDGs 3, 13, 15 and 17 because they are either not relevant to Canada's ocean and/or not within the purview of industry control. 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 were

TABLE 1 Definitions of the criteria for SDG targets and selection examples.

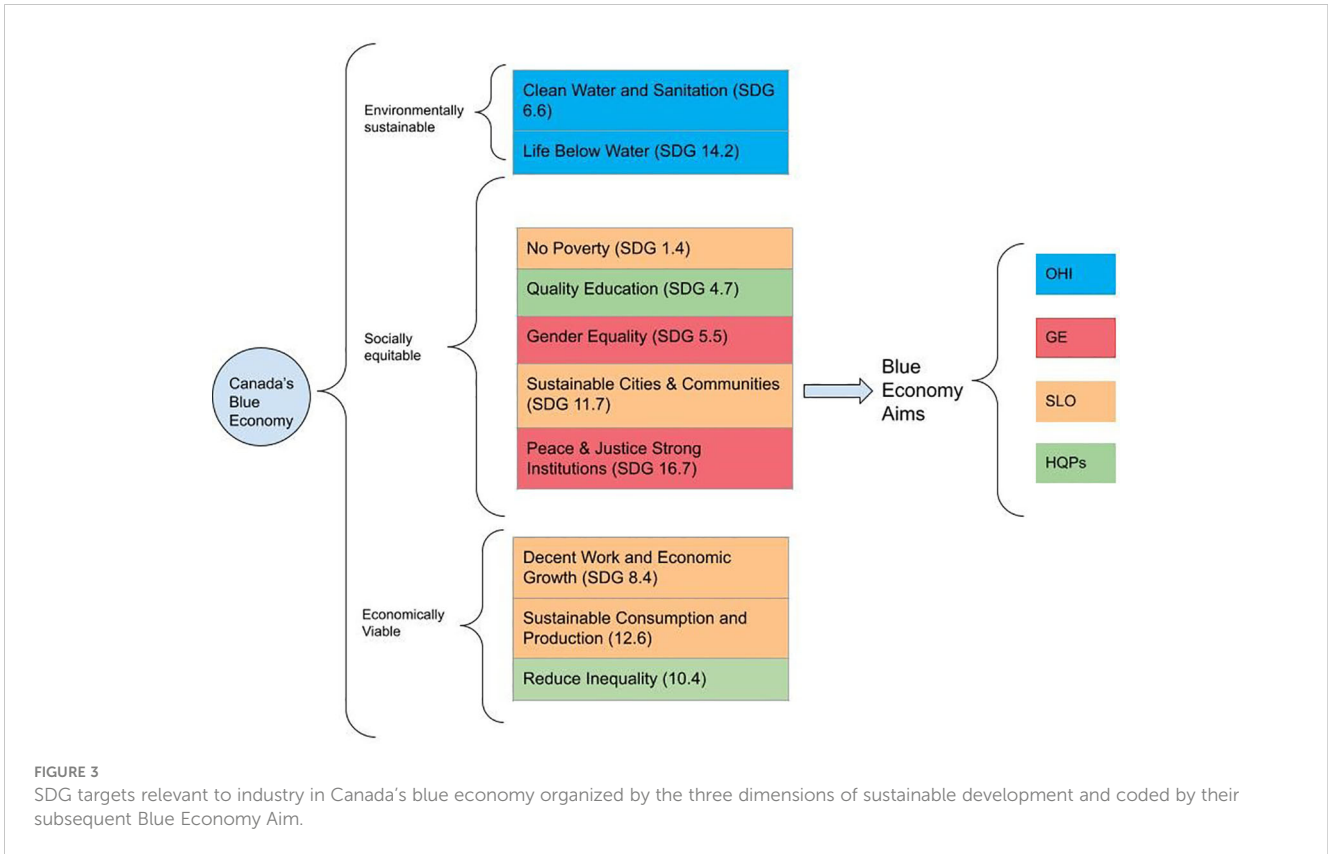| Step	Criterion	Selected When	Not Selected When	Example Targets
1.	Is the SDG target relevant to Canada's ocean?	The SDG or target is focused on the Global North and the target has an influence on ocean health	The SDG or target is focused on the Global South and/or has no influence on ocean health	Selected: 11.7: access to ocean and coastal spaces Not Selected: 11.1: safe and affordable housing 14.7: Increase economic benefit of marine resources for small island developing states
2.	Is the SDG target within the purview of industry to impact?	The target can be reasonably influenced by industry action without the need of public sector	The target requires government influence or mandate to achieve	Selected: 12.6: companies to adopt sustainability information in their reporting cycle Not Selected: 6.5: implement integrated water resource management
3.	Does the SDG target reflect the core identify to which it belongs? (Niner et al., 2022)	The target can be taken out of the context of the Goal and the overall purpose of the goal can still be understood	The target may contradict the overall purpose of the Goal when taken out of context	Selected: 8.4: decouple economic growth from environmental degradation Not Selected: 8.2: achieve greater economic productivity through innovation and technology
4.	Does the SDG target span rather than focus the issue? (Niner et al., 2022)	The target addresses a broad range of interconnected aspects of the SDG and its other targets	The target narrows down too specifically that its relation to the other targets of the SDG can not be understood	Selected: 2.4: ensure sustainable food production systems to increase productivity and production Not Selected: 2.5: maintain the genetic diversity of domesticated animals

chosen because they address climate action within the context of Canada's blue economy. The SDGs not included 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), who contextualized the SDGs to the municipal level in Quebec, some of the wordings of chosen targets were adapted without changing the original meaning to provide greater contextualization on how the target is relevant to Canada's blue economy as can be seen in target 11.7 where "green spaces" was swapped with "ocean spaces". These changes can be seen in itallicized font. As found in Supplementary Table 1, the selected SDG targets are:

- 1.4: Ensure that all men and women, particularly 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
- 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

- 5.5: Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in *blue economy* operations
- 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
- 8.4: Improve progressively through 2030 global resource efficiency in consumption and production, and endeavor to decouple economic growth from environmental degradation in accordance with the 10-year framework of programs on sustainable consumption and production with developed countries taking the lead
- 10.4: Adopt policies especially fiscal, wage, and social protection policies and progressively achieve greater equality in *Canada's blue economy*
- 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 trans-national companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
- 14.2: By 2020, sustainably manage, and protect marine and coastal ecosystems to avoid significant adverse impacts,

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 Aim.

including by strengthening their resilience and take action for their restoration, to achieve healthy and productive ocean

- 16.7: Ensure responsive, inclusive, participatory and representative decision-making at all levels in *Canada's blue economy*

Targets 2.4 (sustainable food production), 7.1 (access to electricity) and 9.1 (sustainable transport) were identified as being relevant to Canada's blue economy but were not used to develop enabling mechanisms as their narrow scope would limit this framework's applicability. The purpose of the BECF is to provide assessment criteria for companies across all industries of the current ocean economy, and when these targets are contextualized down to the company level they would produce mechanisms that are too industry specific for the framework to have wide applicability. Rather, SDG targets were selected that could be reasonably applied to many different types of marine industries and are representative of the major industries in Canada that will be transitioning to a blue economy [the fishing and seafood industry accounts for 21.1% of total GDP in 2020), oil and gas (20.8%), and transportation (20.8%) (DFO, 2021)]. While these industries have unsustainable operations within them, the space they occupy represents the importance of their services to Canada and therefore an opportunity to have sustainable operations within these industries. Canada relies on these industries for livelihood, making them important within the blue economy, which will require them to become socially equitable and environmentally sustainable as well as economically viable. The BECF can help with the transition by providing an initial assessment

of companies across industries and in future research, be applied more specifically to these sectors.

Blue economy industry aims

With the SDG targets selected for relevancy to Canada's blue economy, we further contextualized them down to the company level by analyzing how these selected targets economically incentivize those adhering to this framework's blue economy capacity assessment. This was done by analyzing the social, environment and economic reasons for a company to pursue each SDG target (see Supplementary Table 1), always keeping in mind the economic drive of industry. This review showed that these reasons were associated with more than one SDG. By coupling the SDGs via reason, four Aims emerged: Gender Equity (GE), Social License to Operate (SLO), Ocean Health Investment (OHI) and Highly Qualified Personnel (HQP). These support the national objectives for Canada's blue economy such as developing capacity and skills, environmental conservation and protecting livelihoods (Niner et al., 2022).

SDG targets 5.5 and 16.7 enable an economically viable blue economy by addressing GE. Pursuing this Aim has an economic incentive because companies that implement gender equity practices often see increased profitability and productivity (Herring, 2009; Gomez and Bernet, 2019). While these SDG targets expand past gender to address inequities faced by other equity deserving groups, to address such 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). The underpinning driver

for such consideration would be outside the purview of a company; they implement rather than develop government directives.

SDG targets 1.4, 8.4, 11.7, and 12.6 achieve an economically viable blue economy by increasing the likelihood of achieving SLO, which is generally defined as the ongoing acceptance and approval of operations by the local communities affected by it and the stakeholders who can affect its profitability (Voyer and van Leeuwen, 2019). Obtaining and maintaining SLO is economically beneficial to a company because this social support is needed to ensure ongoing project viability and political and social capital (Moeremans and Dooms, 2021).

SDG Targets 14.2 and 6.6 both focus on ocean health and how an ocean company can invest in its ocean assets through the protection and restoration of ecosystems critical to ocean health. 6.6 considers the consequences of upstream conditions for ocean health by protecting and restoring ecosystems that provide nursery habitats to marine species (wetlands, lakes) and filtering and detoxification services (mountains, forests). Here, a company may need to consider its supply chain to understand how freshwater or inland ecosystems are being impacted by their operations e.g., through terrestrial aquaculture feed production or fishing net manufacturing both of which have the potential to negatively impact upstream ecosystems.14.2 is concerned directly with the protection and management of marine ecosystems and together these SDGs form the basis for OHI.

For the blue economy to be economically viable, it must attract and train 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.

Enabling mechanisms per aim

The last step in establishing the BECF was to define specific enabling mechanisms that, when implemented by industry, are designed to positively affect social equity, environmental sustainability and economic viability of the BE. In this work,

mechanisms are defined as the actions that a company can take to fulfill the Aims, and therefore the associated SDG target. They practically link the theory of the SDGs to the desired outcome, making it possible for an ocean company in Canada to increase its blue economy capacity.

These enabling mechanisms were developed by adapting relevant literature to a Canadian blue economy context. The literature was found by using each of the Aims as keywords along with "blue economy" and "Canada" when searching literature in Google Scholar. Literature that gave a Canadian perspective was prioritized but examples from other countries were used and adapted to a Canadian context. Additionally, information on how these Aims might present themselves in other industries outside of the ocean sector was included.

Gender equity

Considering gender equity as an integral part of the blue economy from the beginning is a necessity or we risk magnifying existing inequities (Bennett et al., 2021; Alexander et al., 2022). 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 (Bennett et al., 2021; Alexander et al., 2022). Table 2 contains the enabling mechanisms that were adapted from the research of Mangubhai and Lawless (2021) on gender inclusion in small scale fisheries. These mechanisms are designed to go beyond simply reaching women and gender non- conforming (GNC) people in the blue economy but also to benefit and empower them.

Social license to operate

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

TABLE 2   Mechanisms adapted from Mangubhia and Lawless (2021) that enable the Blue Economy Aim, Gender Equity, and address the relevant SDG targets.

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

extractive (e.g., fishing, mining, aquaculture) and non-extractive (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 (Bennett et al., 2018). Blue economy operations are also responsible for their environmental impact on surrounding areas and how this can have socio-economic implications (SDG targets 8.4, 12.6). SLO broadly addresses inequities by ensuring there is participation in governance, inclusion in decision making as well as ensuring there is a fair distribution of benefits and minimization of impacts by operations on stakeholders and rightsholders (Voyer and van Leeuwen, 2019). 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 (Bennett et al., 2018). There are a variety of degrees of engagement discussed in the literature and the enabling mechanisms in Table 3 are derived from multiple studies that discuss the differing degrees (Reed et al., 2018; Voyer and van Leeuwen, 2019; Moeremans and Dooms, 2021).

Ocean health as an investment

There are industries in Canada's blue economy that rely directly on ocean health to generate ocean wealth through bio assets (e.g., fisheries and marine tourism) and those that must avoid doing harm to ocean health to ensure social capital (e.g., ocean energy and shipping) (Moeremans and Dooms, 2021). In both cases, investing in activities that protect and restore ocean assets increases an operation's economic viability (Barbier et al., 2011; Mehvar et al., 2018).

Ocean resources that benefit humans are known as ecosystem services (Richter et al., 2021). This service can be direct through extractive or non-extractive. There are also lesser understood indirect services which include bequest, option and existence values that benefit people altruistically as well as culturally and spiritually (Teh et al., 2022). There is a growing body of literature designed to measure the direct and indirect economic value that marine ecosystem services provide (Teh et al., 2022), however there are no standardized methods to doing so. There is a positive correlation between economic growth (GDP) and resilient and healthy ecosystem services; this dependence has been 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

TABLE 3 Mechanisms adapted from literature that enable the Blue Economy Aim, Social License to Operate, and address the relevant SDGs.

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

TABLE 4 Mechanisms adapted from Richter et al. (2021) and Haines-Young et al. (2016) that enable the Blue Economy Aim, Ocean Health Investment, and address the relevant SDGs.

Blue Economy Aim	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

TABLE 5 Mechanisms adapted from Mitacs (2020) that enable the blue economy aim, Highly Qualified Personnel training and retention and address the relevant SDGs.

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

enabling mechanisms as adapted from Richter et al. (2021) and The International Classification of Ecosystem Services V5 (Haines-Young et al., 2016).

HQPs training and retention

In a review conducted by Mitacs (2020), it was found that that there is misalignment in Canada 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 post-secondary institutions and governments to help prepare HQPs for employment as employers do not fully understand 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 as suggested by the Mitacs (2020) review. 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).

Discussion

The economic opportunities for ocean industries are apparent by the growth of Canada's ocean economy which is shaped by three ocean territories: the North Pacific, North Atlantic and Arctic. All three contribute to the nation's $31.7 billion ocean economy (1.6% of total gross domestic product). Six major sectors are responsible and together create close to 300,000 jobs. Seafood is responsible for 30% of ocean-based employment, followed by transportation (22%), the public sector (18%) and tourism and recreation (18%), manufacturing and construction (7%), followed by offshore oil and gas (5%) (DFO, 2021). Canada is looking to grow its ocean economy by $220 billion by 2030. It is doing so by investing heavily in innovation to support marine energy, seafood, ocean technology, marine transportation, tourism and recreation, as well as the public sector (Ocean Supercluster, 2022).

However, due to the need to protect the ocean for global and human health as well as the need to increase social equity, there is a clear need to re-evaluate business development through a BE lens. As such, inclusion criteria to determine which industries and operations are "blue" enough to benefit from being included in the blue economy are needed. Since Canada intends to put a significant number of resources into the development of its ocean economy, it is important to determine a measure for how industry benefits the ocean environment and addresses social inequality while creating profits if the country is to transition to a blue economy (DFO, 2021). Without a proper framework, blue washing can occur, and the outcomes of Canada's Blue Economy Strategy (BES) will likely not succeed in addressing the problems of the current ocean economy. The BECF provides such a framework by utilizing the SDGs and can be used by Canada's ocean industry to assess the social equity, environmental sustainability, and economic viability of their operations.

While this framework was developed to be implemented by industry, the rationale of both the development of the framework and what it intends to assess can be utilized by regulators to better understand what policy levers could be brought to bear to support a more wholesale transition within the ocean economy and ensure that Canada's BES aligns with the SDGs. Canada's Oceans Act, passed in 1996, provides the legal basis for ocean management. Other legislation, such as the Fisheries Act, the Canada Shipping Act, and the Canadian Environmental Assessment Act, also plays a role in regulating specific ocean-related industry activities. Even though Canada is a signatory country to the UN SDGs, regulatory systems do not effectively integrate the SDGs into management strategies or tools (Lemieux et al., 2019; Ray et al., 2021). These policies have been further criticized for the lack of consideration of the interdependencies among social, environmental, and economic priorities for Canada's ocean economy (Bennett et al., 2021; Cisneros-Montemayor et al., 2021). By creating policy that nudges industry toward the integration of the SDGs into their performance metrics, as well as ensuring its inclusion within the BES, Canada's international commitments to the Convention of Biological Diversity (CBD), the High-Level Panel for a Sustainable

Ocean Economy and the UN Decade of Ocean Science for Sustainable Development can be supported.

Framework applicability

Canada's ocean sectors can be meaningful contributors to the BE. By using the SDGs via the suggested enabling mechanisms, standardized industry participation can become the norm and a solid understanding of potential areas of improvement can be determined. It should be noted that there will be marked differences between how living vs non-living industries measure their blue economy capacity. Living sectors, such as fishing and tourism, require a healthy ocean to continue being economically viable. Non-living ocean sectors, such as transportation and mineral extraction, do not rely on ocean health; the ocean is just a medium for their operations (Teh et al., 2022). It could be difficult for non-living industries to implement OHI mechanisms as their operations do not deal directly with ecosystem services. This is corroborated in the graduate research completed by Noonan-Birch (2023) where the framework's applicability was tested through interviews with two "self-identified" blue economy companies in Canada. Reasoning for classifying themselves as such included that they are ocean-based companies, and they consider themselves to integrate sustainable practices. Additionally, these companies had been generating revenue for at least a year at the time of interviewing; this ensured that there were resources being allocated to the mechanism in review and that their answers about the mechanism were backed by action. The purpose of the interviews was to explore how the framework's enabling mechanisms compare to the sustainability initiatives ocean companies are currently implementing. For example, the non-living company interviewed was not able to identify the ecosystem services relevant to their operation. However, there is still an economic incentive for non-living companies to pursue investment into ocean health; 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, measuring relevant ecosystem services may not be a matter of what ecosystems are important, but rather what ocean assets are being impacted by a company's operations (e.g., shipping traffic on marine mammals). These services may hold tangential value for a portion of a company's stakeholders (i.e., it appeals to their personal or cultural values as individuals, not only their economic interests); by investing in the health of these services, 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.

Noonan-Birch's interview with self-identified BE companies also found that neither company implemented two-way participatory engagement as recommended by enabling mechanism SLO.2 (Noonan-Birch, 2023). The reason being that it could be difficult for geographical diffuse ocean industries such as fisheries, to identify relevant stakeholder groups, much less their concerns since there is no obvious impacted community (Voyer and

van Leeuwen, 2019). It would be difficult for this framework to fully assess a company's blue economy capacity without understanding who and how their operations impact stakeholder groups as these are a key element in ensuring social equity (Noonan-Birch, 2023). When considering framework applicability, the mechanisms for GE and HQP could be redundant to the strategies a company might already implement as it is well understood that these Aims are important for economic success outside of a blue economy context (Herring, 2009; Montgomery and Ramus, 2011; Noonan-Birch, 2023). Despite such challenges, there are opportunities to link these types of strategies to the SDGs as it provides greater interoperability and a standardized measurement of success.

The research first reduced the 169 SDG targets to 10 determined relevant to Canada's blue economy. Selected SDG targets were then described by the economic incentive they can offer companies. These economic incentives were categorized into four Blue Economy Industry Aims. The process of identifying Aims to represent and contextualize relevant SDG targets made it possible to extrapolate the enabling mechanisms from the literature. Without the intermediary step of the Aims, it would be difficult to identify mechanisms that businesses can implement to meaningfully contribute to the SDGs and assess their blue economy capacity.

Aside from the challenges mentioned above, there are other practical difficulties in applying this framework to assess the blue economy capacity of ocean companies. How to determine if a company is fulfilling the enabling mechanisms, or not, will require a checklist of metrics that account for the specificities of each industry. Existing reporting metrics could be leveraged, like the GRI, however, metrics will most likely require industry consultation to create. As mentioned, the differences in how industry interacts with the ocean (e.g. living vs non-living) may make it difficult to realize the BECF as a comparable and interoperable assessment tool. Furthermore, getting this standard accepted by industry in a meaningful way is a nebulous process. Since the BECF is designed for industry application and is oriented toward economic incentive, its assessment may overlook nuances of environmental sustainability and social equity within a given situation. For example, the enabling mechanisms for OHI only account for two types of ecosystem services, cultural and provisional, but are not able to consider the more indirect benefits of supporting and regulation services given that it is difficult to associate these with an economic incentive for companies. As it stands, the BECF provides a novel way to link the theory of the SDGs to desired outcomes for Canada's blue economy.

Future research

With further research, this framework could support the creation of a marine sector standard that determines who and how blue economy resources are allocated in Canada.

Engagement with Canadian ocean companies is needed to gain insight on how relevant the synthesized enabling mechanisms are to industry operators; it will be necessary to engage with a large sample size of Canadian companies across many different ocean industries in both emerging and established, living and non-living sectors. Future research can quantitatively determine how aligned current operations are with this framework's idealized blue economy

standard by assigning weighted values to the enabling mechanisms and the creation of industry specific metrics. To fully realize this framework's application as a policy tool to regulate Canada's blue economy, a participatory process that includes industry and government stakeholders is necessary.

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RN-B: Writing – original draft, Writing – review & editing. MA: Conceptualization, Supervision, Writing – review & editing. M-CR: Conceptualization, Funding acquisition, Writing – review & editing.

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Conflict of interest

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmars.2024.1400043/full#supplementary-material

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