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RECEIVED 30 August 2024

ACCEPTED 18 September 2025

PUBLISHED 16 October 2025

CITATION

Mak LM, Ross M-C, Noonan-Birch R,
Singh GG and Cisneros-Montemayor AM
(2025) From ambiguity to action: a framework
for assessing ocean-based projects in
Canada's Blue Economy.
Front. Mar. Sci. 12:1488879.
doi: 10.3389/fmars.2025.1488879

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From ambiguity to action: a framework for assessing ocean-based projects in Canada's Blue Economy

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Canada's Blue Economy could benefit from an operational, equity-first definition that incorporates an environmentally inclusive framework. Current project assessments follow a neoliberal approach which prioritizes economic viability and leaves social equity and ecological concerns as secondary or tertiary. This Policy and Practice Review proposes an approach to Blue Economy activities by introducing the Blue Economy Development Approach (BEDA) - a structured methodology and decision sequence (Equity → Health → Wealth) to guide decisions.

By making consent and equity a gate, pairing Indigenous and local knowledge with scientific indicators for ecosystem health, and verifying benefit-sharing before economic metrics, BEDA offers a clear, workable and inclusive path for Canada. To address the identified gaps, BEDA integrates diverse perspectives and cross-cutting linkages (e.g. the Sustainable Development Goals, SDGs) and functions as a systematic project-evaluation tool for municipal, provincial, and federal governance.

Examples of potential applications show how principles translate to action, ensuring equitable local access to ecosystems; guiding provincial sustainable use of marine resources; and informing a comprehensive national Blue Economy strategy. Taken together, these contributions support Canada's transition toward a sustainable Blue Economy, aligning national strategies with international commitments to equity, sustainability, and resilience.

KEYWORDS

blue economy, indigenous co-governance and FPIC, marine spatial planning (MSP), ocean accounts/natural capital accounting, performance-based assessment, adaptive governance, equity-health-wealth sequencing

1 Introduction

The concept of the Blue Economy has garnered increasing global attention, underscoring the need to balance economic viability, environmental sustainability, and social equity, often referred to as the Triple Bottom Line (TBL). Although various international bodies (e.g. World Bank, High Level Panel for a Sustainable Ocean Economy) offer definitions of the Blue Economy, there is no universally agreed-upon framework (Voyer et al., 2018). This lack of consensus frequently leads to economic growth overshadowing critical social equity and environmental objectives (United Nations, Department of Economic and Social Affairs (DESA), 2021; Österblom et al., 2020; Bennett et al., 2019; Cisneros-Montemayor et al., 2019, 2020, 2021, 2022a, b; Louey, 2022; Crosman et al., 2022).

Canada's pursuit of a Blue Economy strategy, as evidenced in various national policies (e.g. Fisheries and Oceans Canada, 2021, 2022a, 2024a), similarly grapples with definitional ambiguity and inconsistent prioritization. Many high-level documents highlight sustainable use of ocean resources (e.g. World Bank, 2017; HLP, 2023a, b) but do not fully clarify how to integrate social equity (ocean equity) with environmental health (ocean health) and economic viability (ocean wealth). Compounding the challenge is a persistent "business as usual" mindset in ocean industries, which often treats social, environmental, and economic factors in isolation instead of as interlinked priorities. Failing to cohesively address TBL objectives poses significant risks to both human well-being and the marine environment (Bennett et al., 2019).

This paper responds to these gaps by proposing the Blue Economy Development Approach (BEDA), a new framework specifically designed to align with Canada's needs. By sequentially, but equally, prioritizing ocean equity, ocean health, and ocean wealth, BEDA operationalizes core ideas from existing theoretical and policy approaches. Illustrative case scenarios demonstrate how BEDA could be applied, helping stakeholders move from conceptual ambiguity to concrete action. Our objectives are:

1. To review existing models and frameworks for Blue Economy development and identify limitations that perpetuate social inequities and ecological risks.
2. To propose and detail BEDA as a comprehensive project evaluation tool, integrating social, environmental, and economic imperatives through a structured and scalable methodology.
3. To illustrate how BEDA can guide real-world decision-making with two hypothetical scenarios, showcasing its adaptability to diverse Canadian contexts.

By engaging each of these aims, this paper contributes to Canada's evolving discussions on sustainability, addressing calls to strengthen the TBL focus across different ocean sectors, including new key

priority areas highlighted in Canada's Blue Economy Regulatory Roadmap - marine renewable energy and environmental protection, marine spatial planning (MSP), maritime autonomous surface ships (MASS), ocean technology, and sustainable fishing gear and practices (Fisheries and Oceans Canada, 2024a).

As a policy review, this paper translates established tools into an operational, inclusive and environmentally friendly sequence (Equity → Health → Wealth), with clear, non-tradeable gates, sign-offs, and adaptive safeguards. An academically rigorous investigation of different logic models and lenses will need to be done.

2 Conceptual and literature review

2.1 Defining the Blue Economy

Various definitions of the Blue Economy emphasize the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs, while preserving ocean health (World Bank, 2017; HLP, 2023a, b). However, as Voyer et al. (2018) and Silver et al. (2015) observe, there are four major "lenses" through which the Blue Economy is interpreted, which are as follows:

1. Oceans as natural capital – giving primacy to environmental sustainability.
2. Oceans as livelihoods – focusing on social welfare, equity, and poverty reduction.
3. Oceans as good business – prioritizing large-scale economic growth and established industries.
4. Oceans as a driver of innovation – emphasizing emerging technologies, data-driven approaches, and new industries.

The defining attributes of these dominant lenses are summarized in Table 1. Although each lens stresses a particular pillar - environmental, social, or economic, they share important commonalities, such as the use of valuation studies (e.g., quantifying ecosystem services) and reliance on cross-sectoral tools like Marine Spatial Planning (MSP) (Voyer et al., 2018).

However, their differences in objectives, enabling conditions, actors, sectors, and scales shape the global Blue Economy discourse. Aligning these lenses is further complicated by the absence of a unified Blue Economy definition. For instance, one lens might exclude oil and gas, while another would readily include it.

Canada has a desire to address ocean equity (Fisheries and Oceans Canada, 2021, 2022a, 2024a, b), which highlights an opportunity to incorporate it more holistically. As a signatory to the the High Level Panel (2023b) and the understanding that "ocean equity, ocean health, and ocean wealth", require each to be pursued in lock-step, Canada can address systemic gaps of limited local participation and inequitable benefit-sharing (Cisneros-Montemayor et al., 2022a) (See Table 2).

TABLE 1 Summary of [Voyer et al. \(2018\)](#) Blue Economy framework.

Lenses	Oceans as natural capital	Oceans as livelihoods	Oceans as good business	Oceans as a driver of innovation
Overarching Goals	Ecosystem health	Equitable benefits	Total production	Total production
Key Objectives	Ecosystem protection/restoration	Poverty reduction, food security	Economic growth, employment	Economic growth, clean technology
General Enabling Conditions	Ecological function, habitats, pollution, water quality, biodiversity	Economic equity, gender equity, corruption control, public health, human rights.	Physical infrastructure, national stability, stable banking systems.	Physical infrastructure, national stability, stable banking systems.
Actors	Environmental NGO	SIDS, SSF, Development agencies	Industries, large economies (EC, OECD, China, India)	Academic institutes, industry, governments
Sectors	Eco-tourism, payment for ecosystem services, blue carbon etc. Likely exclude oil and gas, deep sea mining.	Small-scale fisheries, aquaculture, eco-tourism. Precautionary approach to deep sea mining.	All sectors but focus on high value sectors (shipping, oil and gas, large-scale fisheries, maritime clusters)	All sectors but focus on emerging industries (biotechnology, deep sea mining, marine renewables)
Scale	All scales, ecosystem scale	Small-scale, locally based	Global, regional, national	Sub-national, district level, provincial scale
Tools	MPA, EBM, MSP, valuation of ecosystem services	Community managed fisheries, MPA, MSP, EBM, valuation of ecosystem services	MSP, economic valuation, sector-specific growth strategies, maritime clusters	Research institutes and networks, incubators, innovation challenges, investment, public-private sector partnerships
Commonalities	Valuation studies, Marine spatial planning (MSP), Maritime security			

2.2 Logic models for prioritizing Blue Economy objectives

Whereas there are different lenses from which one can view the Blue Economy, there are also different systematic approaches. [Ota et al. \(2022\)](#) propose five “logic models” to guide the sequencing of social, environmental, and economic objectives:

- Natural capital logic model: Ocean health is prioritized first, followed by ocean wealth, then social equity.
- Environmental worldviews logic model: Focus is primarily on environmental health, but integrates diverse cultural contexts.
- Social well-being logic model: Social equity (community inclusion) comes first, then environmental sustainability, and finally economic viability.

- Neoliberal logic model: Economic growth is the main driver, followed by social and environmental considerations.

Ecomodernist logic model: Emphasizing market-based innovation to achieve environmental gains while pursuing economic growth.

[Ota et al. \(2022\)](#) conclude that the Social Well-being Logic Model is most likely to foster balanced outcomes because it places social equity at the core. This approach mitigates the risk of marginalized voices and ecological concerns being addressed only after economic agendas have set entrenched paths. Prioritizing social equity is in line with both [Bennett et al. \(2019\)](#) and [Crosman et al. \(2022\)](#) who note that failing to address social equity and environmental health from the outset can undermine long-term sustainability and widen social divides. Further, any

TABLE 2 Practices for Blue Economy development as per [Cisneros-Montemayor et al. \(2022a\)](#).

Blue Economy in practice
Equitable benefits.
Need more Local-based planning.
Sustainability and livelihood diversification – artisanal fisheries, habitat protection/restoration.
Public sector in resource management and equitable distribution of benefits. Private sector in innovations.
Intergovernmental and non-governmental organization in supporting implementation.
Natural capital approaches dominate equity focus approaches for World Bank financed blue economy projects.
Blue tax, collective bargaining, board of directors shared by employees, public investment into welfare programs, public-private sector partnership, multilateral cooperation, ocean plan with clear regulations.

robust Blue Economy framework must provide enough flexibility to accommodate local contexts (Cisneros-Montemayor et al., 2022a, b; Noonan-Birch, 2023). Table 2 highlights the actionable ocean equity conditions Cisneros-Montemayor et al. (2022a) argue are still missing from many national strategies.

3 Methods and strategy development

3.1 Rationale for a new framework (BEDA)

The BEDA framework emerges from a comparative analysis of the four Blue Economy lenses identified by Voyer et al. (2018) and the five logic models developed by Ota et al. (2022). Recognizing the persistent overshadowing of social equity, BEDA adopts the Social Well-being Logic Model as its foundation based on Ota et al.'s research. A more thorough evaluation of the logic models and their lenses is outside the scope of this paper. This logic model sequentially prioritizes:

1. Ocean equity: Emphasizing inclusivity, fairness, and meaningful participation by local and Indigenous communities.
2. Ocean health: Safeguarding ecosystem integrity, biodiversity, and climate resilience.
3. Ocean wealth: Pursuing long-term economic viability aligned with the above social and ecological imperatives.

BEDA treats these three pillars as equally important, but acknowledges that, in practice, social equity often has to be addressed first to secure buy-in, mitigate inequities, and prevent potential “backfiring” of later economic or environmental policies (Ota et al., 2022).

3.2 The development process

Figure 1 shows the BEDA development process.

1. Lens review: We first examined commonalities - valuation studies, MSP, maritime security, across competing lenses (or perspectives) (Voyer et al., 2018 and Silver et al., 2015). BEDA uses these commonalities to build consensus across people with different perspectives, while using these common tools to guide decision-making in alignment with TBL objectives.

We strengthen Voyer et al.'s (2018) framework by adding the UN Sustainable Development Goals (SDGs) as an additional commonality, which:

- knit the economic, environmental and social strands of TBL into a single, globally recognised reference point;
- promote cross-sector collaboration;
- provide clear guidance for policy and implementation; and
- ensure Canada's ocean activities remain aligned with its international sustainability commitments.

2. Logic model selection: We surveyed the five models (Ota et al., 2022), concluding that the Social Well-being model best aligned with the goal of embedding equity in planning projects in the Blue Economy.

3. Contextualization for Canada: We integrated the findings of various authors regarding local-based planning, capacity-building, and sector-specific approaches.

4. Framework construction: BEDA structures the evaluation of ocean projects in three steps (Equity → Health → Wealth) while drawing on common tools to keep the approach holistic and flexible.

Figure 2 illustrates the synthesis of interconnections, including commonalities shared across all lenses and key considerations unique to each lens, between the various Blue Economy lenses and the Social Wellbeing model within the BEDA framework. This visualization demonstrates how these elements work together to align TBL objectives with the commonalities, and SDGs, fostering a cohesive and integrated approach to sustainable development.

A key design feature is adaptability. Rather than imposing a rigid system, BEDA encourages local communities to assign specific weightings to each key considerations discussed below, customize

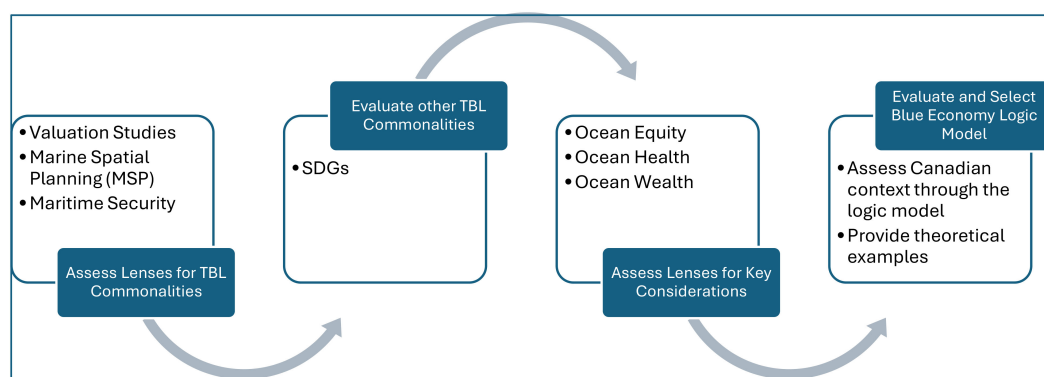


FIGURE 1
Methodology development process to align ocean-based projects with Blue Economy objectives and recommendations.

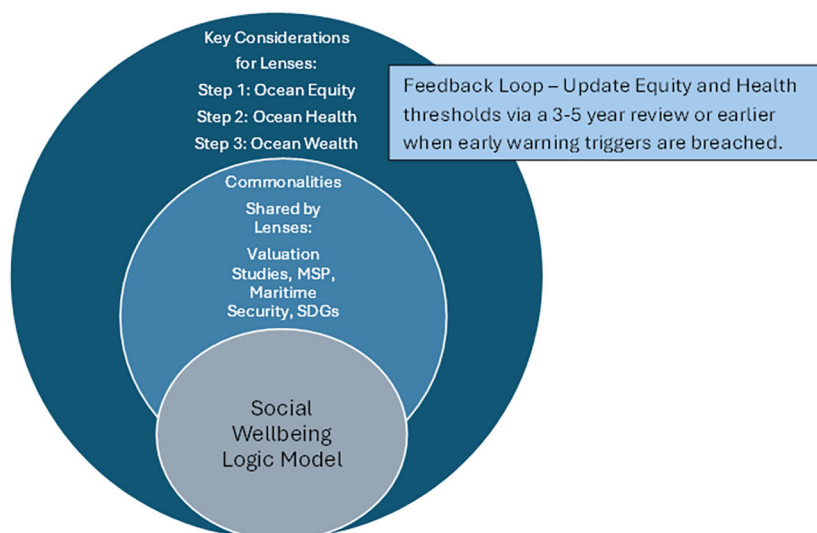


FIGURE 2

Suggested holistic analytical framework for the TBL within the context of Canada's Blue Economy.

evaluation criteria, and apply relevant planning tools according to their contexts.

4 Key TBL considerations for Canada's Blue Economy

Any transition to a Blue Economy from a traditional ocean economy will succeed only if ocean equity, ocean health and ocean wealth are treated as equal and complementary, not interchangeable, pillars. This is consistent with the spirit of the World Bank Independent Evaluation Group's balanced approach that reconciles economic growth/livelihoods with ocean health (World Bank, 2024). Drawing on policy scan of different authors, Table 3 distills the key decision criteria that Canadian proponents, regulators and communities could apply when they evaluate new ocean projects. It lays out how BEDA operationalizes the three TBL pillars by addressing ocean equity, ocean health and ocean wealth in sequence, according to the Social Well-being Logic model.

4.1 Ocean equity

Securing ocean-equity is the indispensable first step. Because social equity is often overlooked in ocean policies (Cisneros-Montemayor et al., 2022a, b, 2021; Österblom et al., 2020; Bennett et al., 2019; Voyer et al., 2018), coastal and Indigenous communities frequently absorb disproportionate social and ecological costs when marine industries expand without their explicit consent (Bennett et al., 2019; von der Porten et al., 2019a, b). Global syntheses reach the same conclusion, warning that “equity-

blind” ocean policies can back-fire even when they are environmentally ambitious (Österblom et al., 2020; Crosman et al., 2022).

As the left-hand column of Table 3 (“Step 1: Ocean Equity”) shows, inclusive governance, equitable ocean access, transparent benefit sharing, recognition of Indigenous knowledge, capacity building, poverty reduction, equity and continuous engagement to build trust are baseline requirements for ocean equity. Specific elements include:

- Inclusive governance, local voice & vision, and full transparency - Ocean projects must be co-designed with Indigenous Nations and coastal communities, honouring the rights and the principle of Free, Prior and Informed Consent (FPIC). Free means no pressure, prior means before decisions are made, and informed means clear information in plain language. Such rights-based, transparent decision-making is the surest path to durable social licence (Fawkes et al., 2021; von der Porten et al., 2019a; Croft et al., 2024).
- Human rights and multi-dimensional equity - Policies should advance economic, gender, group and social equity, recognizing the distinct rights of Indigenous Peoples and other marginalised actors (Fawkes et al., 2021; Bennett et al., 2019; Cisneros-Montemayor et al., 2021).
- Equitable ecosystem & resource access for livelihoods, food security and social-ecological well-being - Safeguard small-scale fisheries, community aquaculture and culturally important harvests to prevent displacement and ocean grabbing (Cisneros-Montemayor et al., 2021; Bennett et al., 2021; The White House, 2023b).

TABLE 3 BEDA content and process checklist.

Checklist row	Ocean equity (Step 1)	Ocean health (Step 2)	Ocean wealth (Step 3)	Indigenous decision right & sign-off
A. What to assess (key themes by lenses and cross-cutting commonalities)	• Inclusive governance, local voice & vision, transparency. • Human rights, including the rights of Indigenous people. • Equity (all forms – economic, gender, group, social). • Equitable ecosystems and resources access. • Address corruption, tax evasion, environmental crime, ocean grabbing. • Poverty reduction. • Food security, livelihoods, social-ecological well-being. • Social culture and traditional knowledge. • Democratize ocean knowledge. • Social License. • Shared economy, fair distribution of wealth and benefits. • Build local capacity. • Limit growth, degrowth if ecological or social impacts are beyond acceptable thresholds.	• Environmental protection, restoration, risk mitigation and sustainability. • Climate change mitigation, decarbonization and carbon storage. • Diverse, productive and resilient ocean (including biodiversity and habitat). • Human health and well-being (livelihoods, income, community health, food security, water quality, ocean and human health indicators) • Coastal protection and coastal area resilience-based and eco-disaster risk reduction with nature-based solutions and green and blue infrastructures. • Natural products. • Tourism, recreation and fishing. • Sense of place (iconic species, special places)	• Economic growth and development. • Employment generation, high-value jobs. • Valuation, true costs and benefits. • Maritime clusters and sector-specific growth strategy. • Infrastructures. • New sources of growth and development. • Clean technology, R&D, innovation, data sharing. • Innovative financing. • Private sector involvement. • National stability. • Investment risk. • Social license to operate.	Sign-off once key themes are addressed via indicators and thresholds appropriate to each region.
Cross-cutting Commonalities	Valuation studies, Marine spatial planning (MSP), Maritime security, and SDGs (by Voyer et al., 2018) and SDGs by Noonan-Birch (2023))			
B. Governance & consent (gate)	FPIC obtained and documented; roles of Indigenous and municipal/territorial partners defined; Equity weight agreed.	Indicator menu includes TEK-driven priorities identified in scoping.	Benefit-sharing principles outlined; not activated pre-gate.	Indigenous co-chair confirms FPIC & roles; municipal/territorial leader signs local conditions.
C. Indicators & thresholds	Cultural priorities are embedded as indicators with documented weights.	Paired TEK & science indicators with thresholds and early –warning triggers.	Local prosperity metrics defined (jobs, Indigenous procurement %, stewardship fund).	Indigenous approval of indicator set and weights.
D. Monitoring & reporting	Track equity outcomes & access; grievance mechanism in place.	Track sentinel indicators; trigger-based actions defined.	Public reporting of benefits; align with Ocean Accounts where appropriate.	Co-governed monitoring board (Indigenous + regulator + proponent).
E. Local benefits verification	Hiring & procurement plans include Indigenous participation.	Mitigation & offset plans budgeted and scheduled.	Verification step confirms jobs, Indigenous procurement, and stewardship funding before wealth metrics are used.	Indigenous sign-off on verification results.
F. Risk registry & financial assurance	Community-identified risks recorded.	Environmental risks listed with stop rules and recovery targets.	Financial assurances (e.g., bonds) linked to performance.	Indigenous concurrence that risks & assurances are adequate.
G. Adaptive review	Update every 3–5 years; recorded; responsible authorities named.	Trigger conditions listed; corrective actions (tighten/pause) defined.	Review outcomes inform benefit terms; changes disclosed publicly.	Indigenous co-chair and regulator jointly confirm updates.

It would be beneficial for projects to document complementarity gains (how actions in one pillar support the others) and present a brief trade-off analysis (valuation/MSP) when moving from Equity → Health → Wealth.

- Transparent benefit-sharing and anti-corruption - Revenue flows from ocean-based projects must be traceable and fairly allocated, closing avenues for environmental crime, tax evasion, and corruption (Crosman et al., 2022; HLP 2023b; Fawkes et al., 2021).
- Knowledge democracy, social culture & traditional knowledge - Open-data portals, formal Indigenous-knowledge protocols, community-level training and engaging researchers in evidence-based, collaborative planning, help to build local capacity and reduce information asymmetry, ensuring that stewardship responsibilities are widely shared (Voyer et al., 2018; Cisneros-Montemayor et al., 2021; Fawkes et al., 2021; The White House, 2023b).
- Poverty reduction and equity safeguards - Targeted measures should lower coastal poverty rates and correct under-representation of equity-deserving groups in the Blue Economy, contributing to a more shared economy and fair distribution of wealth and benefits (Ocean Allies, 2021; Cisneros-Montemayor et al., 2022a; Noonan-Birch, 2023).
- Continuous social licence & trust-building - Ongoing engagement, inclusive governance and comprehensive legislation underpin long-term legitimacy (Bennett et al., 2019; The White House, 2023b). If monitoring shows that a project is beginning to cause social tensions or ecological harm that the community regards as undesirable, proponents must be willing to slow or even reverse growth to protect both people and ecosystems (Österblom et al., 2020).

Using BEDA to turn equity principles into action (see Table 3), it distills the broad ideas above into four concrete decision rules and checkpoints:

- Equity gate screening - All proposed projects must satisfy the key equity considerations above before environmental or financial analysis proceeds (Ota et al., 2022).
- Conditional incentives - Public funding, licences and tax credits are tied to measurable equity outcomes (e.g. revenue-sharing agreements, gender-balanced hiring plans) (Noonan-Birch, 2023).
- Equity indicators in MSP - Marine Spatial Plans must embed social-equity layers, for example, how many livelihoods depend on each zone and whether it contains culturally important sites, so that zoning choices advance SDG 10 (reducing inequalities) or other equity objectives alongside SDG 14 (Life below water) (United Nations, Department of Economic and Social Affairs (DESA), 2021).
- Equity assessment - projects scoring “high risk” on any equity criterion are revised or rejected, mirroring the precautionary logic in Bennett et al. (2019) and Cisneros-Montemayor et al. (2022b). Importantly, assessing equity throughout the process of any project or policy can reveal key interdependencies among equity dimensions, and

reveal potentials for inequities to be re-entrenched (Singh et al., 2023; Potier et al., 2025).

Elements used within the BEDA depend on local and regional realities. Not all may apply. However, by front loading the ocean equity safeguards, BEDA ensures that subsequent objectives (healthy ecosystems and prosperous industries) are built on foundations regarded as legitimate and fair by the communities most affected.

4.1.1 Operationalizing indigenous and municipal co-governance in Canada

In BEDA, a project only moves forward when those directly affected have provided free, prior and informed consent (FPIC) (UN General Assembly, 2007; Government of Canada, 2021; OHCHR, 2013). Roles are straightforward. During planning, local communities, Indigenous and municipal governments help set what matters, where, and why. When deciding how to measure success, they help select indicators and the weights assigned to each, especially for Equity and Health (IAAC, 2022). Before moving on to Ocean Health and Ocean Wealth assessments, an Indigenous co-chair confirms that FPIC and other Equity requirements are met, and municipal leaders provide regulatory sign-off that local governance conditions are satisfied.

4.1.2 Integrating indigenous and traditional knowledge

BEDA places Indigenous knowledge and science side by side (“Two-Eyed Seeing”). Observations such as seasonal timing of species, habitat use, or culturally important places are written down in ways that can be monitored and are used together with scientific measures such as biodiversity scores or water-quality targets. These paired measures feed into the Health assessment and are treated with equal weight in decisions (Bartlett et al., 2012; Wright et al., 2019; IAAC, 2022).

4.1.3 Regional tailoring

Canada’s three ocean regions, Pacific, Arctic, and Atlantic, differ in culture and ecology. BEDA therefore uses regional menus of indicators developed with local, Indigenous, provincial, and territorial leadership and aligned with Canada’s marine spatial planning work (DFO, 2024c). Proponents and regulators choose from these menus with local partners and record the reasons for their selections and the Equity weights they agree to use. Where policies are still developing, BEDA lists items for future policy work, rather than replacing cultural or ecological values with monetary valuation.

4.2 Ocean health

Ocean Health is the second step in BEDA. In line with the High Level Panel for a Sustainable Ocean Economy (2023b), it means maintaining biodiversity, safeguarding critical habitats, sustaining water quality, and building climate resilience. Health thresholds

draw on co-defined Indigenous knowledge and science (IAAC, 2022; Wright et al., 2019), and an Indigenous sign-off confirms they are met and documented before projects proceed. The second column of Table 3 summarizes the key considerations or safeguards required to keep marine ecosystems resilient while Canada expands Blue Economy sectors. These are tied to monitoring with trigger-based adjustments. Environmental sustainability is central to the Blue Economy approach.

These representative key considerations for ocean health were drawn from Voyer's analysis of the lenses, specifically the "Ocean as Natural Capital" and "Oceans as Livelihoods" lenses, along with a review of the Ocean Health Index (OHI) and proposed enhancements by Franke et al. (2020), an examination of the links between ocean health and human health, the U.S. Ocean Climate Action Plan, and relevant Canadian literature.

- Environmental protection, restoration, risk-mitigation & sustainability - For long term viability, each ocean venture would ideally leave ecosystems at least as healthy as they were found. Restoring habitat, preventing pollution, and applying the precautionary principle can be achieved with ecosystem-based risk assessments (Halpern et al., 2012; Franke et al., 2020). In Canada, progress can be tracked through Canada's Ocean Accounts, while the Sustainable Fisheries Framework and robust MSP embed the precautionary approach in regulation. Together, these tools keep new activities aligned with SDG 14 targets for biodiversity and habitat (DFO, 2009, 2022b; Franke et al., 2020; GOAP, 2022).
- Human health & well-being links - Clean water, toxin-free seafood, coastal disaster risk reduction, and accessible coastal spaces directly influence livelihoods, community health and food security. Monitoring programs should track ocean-human health indicators alongside biophysical metrics (Franke et al., 2020).
- Climate-change mitigation, decarbonization & carbon storage - Projects should cut direct emissions, scaling up marine renewables, restoring kelp, seagrass and salt-marsh habitats, and support safe subsea carbon-storage pilots, aligning with the High Level Panel's "Ocean as a Solution" roadmap (HLP 2023b and c; Konar et al., 2020).
- Diverse, productive & resilient oceans (biodiversity & habitat) - Maintaining species richness and intact habitats underpins fisheries, coastal protection and climate regulation. Marine Spatial Planning must embed biodiversity targets and "no net loss" rules (Halpern et al., 2012; Franke et al., 2020; Voyer et al., 2018).
- Coastal protection, resilience-based & eco-disaster-risk reduction with nature-based solutions and green & blue infrastructures - Salt-marsh, seagrass and shell-reef restoration, plus hybrid dykes-and-dunes, reduce storm damage and support carbon sequestration (Birtill et al., 2022; Konar et al., 2020; Perricone et al., 2023; The White House, 2023a).
- Natural products - Harvesting algae, bio-prospecting microbes or cultivating marine botanicals must follow ecosystem-based quotas and benefit-sharing rules to avoid over-extraction (Ameen et al., 2021).
- Tourism, recreation & fishing — Eco-tourism, recreational boating and sustainable fisheries generate jobs but depend on healthy seascapes; carrying-capacity limits and certification schemes prevent degradation (Voyer et al., 2018; Halpern et al., 2012).
- Sense of place (iconic species, lasting special places) - Conserving emblematic wildlife and culturally important seascapes strengthens stewardship ethics and reinforces local identity (Bennett et al., 2015).

To operationalize ocean health priorities above (see Table 3), BEDA converts them into four project-level checks:

- Ecosystem baselines & thresholds - Each project must define clear pre-development ecological baselines and "red-line" thresholds. If monitoring shows a threshold has been crossed, the proponent must either adapt operations immediately or suspend the project if the impact is severe or irreversible.
- Life-cycle & cumulative-effects analysis - Environmental reviews cover the full supply chain and cumulative regional impacts, not just site-level footprints.
- Integration with MSP - Ocean zoning maps set aside sensitive habitats, marine protected areas, climate safe areas, and busy industrial zones, and make sure the activities allowed in each area can coexist without conflict.
- Nature-positive performance metrics - Funding and permits hinge on demonstrable improvements in biodiversity, decarbonization, carbon storage and coastal-risk reduction.

BEDA ensures that economic activities occur within ecological limits, securing long-term benefits for both marine ecosystems and Canadian society.

4.3 Ocean wealth

Ocean Wealth is the third, and final, step in BEDA as economic viability remains a core policy driver. It verifies local benefit-sharing including jobs, Indigenous procurement, and stewardship funding. Where appropriate, transparent public reporting can align with recognized nature- and ocean-disclosure frameworks (e.g. Ocean Accounts) (GOAP, 2021; Loureiro et al., 2023).

Key considerations include:

- Economic growth and development - Blue-economy policies should expand GDP and diversify provincial revenue while respecting the equity and health considerations noted above (Voyer et al., 2018; OECD, 2024a).

- Employment generation & high-value jobs - Priority goes to initiatives that create long-term, skilled employment for coastal and Indigenous communities, not just short-term work (Cisneros-Montemayor et al., 2021).
- Valuation, true costs and benefits - All project proposals must produce full life-cycle and natural capital accounts, so externalities are priced in and subsidies are transparent (Halpern et al., 2012; Claes et al., 2022).
- Maritime clusters & sector-specific growth strategy - Bringing businesses, research labs, and ports together in one “blue hub” helps to turn ideas and investment to innovation faster. Canada’s main example is the Ocean Supercluster (Canada’s Ocean Supercluster, 2025), a national network with partner companies and universities right across the country that co-funds new technologies in areas like smart shipping, marine sensors, and renewable ocean energy.
- Infrastructure - Modern ports, digital connectivity and renewable-powered grids are foundational, and public-private partnerships can fill capital gaps while meeting climate targets (NRCan, 2020; Konar et al., 2020).
- New sources of growth and development - Emerging sectors, such as marine biotechnology, blue carbon, and producing green hydrogen, can open fresh income streams and cushion Canada’s economy when traditional commodities rise and fall (Kildow, 2021; HLP 2023b and c).
- Clean technology, R&D, innovation & data sharing - Initiatives such as government R&D credits, open-data mandates that transparently and publicly disclose project data and technology-transfer programs help to accelerate the roll out of low-impact ocean technologies (Voyer et al., 2018).
- Innovative financing & private-sector involvement - Tools such as green bonds, blended-finance funds, and pay-for-results contracts attract private money while linking investor returns to clear environmental targets (OECD, 2024b; Konar et al., 2020).
- National stability, investment risk & enabling policy - Clear, stable regulations and predictable permitting timelines lower investment risks and attract direct investment (Cisneros-Montemayor et al., 2022a).
- Social licence to operate - Even economically robust ventures must retain community trust through revenue-sharing, local procurement and transparent impact reporting (Bennett et al., 2019; Noonan-Birch, 2023).

BEDA puts the wealth pillar into practice (see Table 3) by applying four project-level checks:

- Economic–ecological-social scoring balance - A proposal advances only if its ocean equity and ocean health scores meet acceptable threshold. Growth metrics cannot override red-flagged social or ecological risks.
- True-cost reporting - Proponents publish annual dashboards showing natural-capital depletion, carbon

intensity and local wage distribution alongside financial KPIs.

- Cluster fast-track permits - Projects set inside an approved ocean-industry cluster (for example, a hydrogen/ammonia production-CO₂ storage-shipping hub described in one of our hypothetical examples in the next section) can move through the approval process more quickly, if they agree to share data and collaborate to use shared infrastructure, services, and systems (e.g. docks; pipelines; environmental monitoring; emergency response; etc.) with their cluster partners.
- Financing screens - Public guarantees, tax credits or bond issuances are conditional on meeting the innovative-financing and clean-technology criteria.

These requirements ensure that Canada’s pursuit of ocean wealth delivers durable prosperity that is ecologically viable and socially just.

4.4 Complementarity among the three pillars

Although different “lenses” can portray equity, health, and wealth as competing priorities, in practice the three pillars reinforce one another. Centering ocean equity tends to improve fairness, reduces conflict and delay, and strengthens overall project performance. Strong ocean health underpins long-term productivity and risk reduction for coastal communities and industry. Gains in ocean wealth can provide financing for equity measures, restoration and stewardship. Our Equity → Health → Wealth sequence assumes these complementarity effects by treating the pillars as equal and non-interchangeable. This sequencing mirrors the SDG architecture, supported by SDG 17 (Partnerships), where

1. Equity first (People): SDGs 1 (No Poverty), 5 (Gender Equality), 10 (Reduced Inequalities), 16 (Peace, Justice & Strong Institutions).
2. Safeguard Health (Planet): SDGs 13 (Climate Action) and 14 (Life Below Water).
3. Enable Wealth (Prosperity): SDGs 8 (Decent Work & Economic Growth), 9 (Industry, Innovation & Infrastructure), 12 (Responsible Consumption & Production), and 14.7 (Increase Economic Benefits from sustainable ocean use).

Cross-linking commonalities: Actions in one pillar often advance goals in the others. For example, equitable co-governance (Equity) improves compliance and ecosystem outcomes (Health), while healthy ecosystems lower risk and support decent work in blue sectors (Wealth). We therefore use the SDGs as cross-cutting connectors across pillars and note co-benefits wherever possible (UNGA, 2015; Voyer et al., 2018).

The extent of these positive feedback is an implementation hypothesis. We expect complementarity when the BEDA sequence is followed, but validation using Canadian case studies will be needed to confirm the magnitude and conditions under which these effects occur.

4.5 Trade-offs and using BEDA tools to address them

Decisions inevitably involve trade-offs. BEDA explicitly manages these by (i) using valuation studies to compare options on a common basis, (ii) applying Marine Spatial Planning (MSP) to reduce use conflicts and visualize cumulative effects, and (iii) linking approvals to adaptive safeguards with clear thresholds, trigger-based tightening or pauses, and minimum floors for Equity and Health in composite scoring. Together, these steps make trade-offs transparent and keep projects within social and ecological limits, including staying within the ocean's regenerative capacity (Dasgupta, 2021; GOAP, 2021; DFO 2024c).

These are our design expectations, not yet verified outcomes. We therefore propose empirical evaluation in Canadian pilots, to test whether BEDA (i) reduces conflict, (ii) makes trade-offs explicit and improves decisions, (iii) strengthens equity and health outcomes, and (iv) enhances overall project performance.

5 International context and comparable case studies

Before turning to Canada's pilot applications, it is useful to see how countries with similar coastlines and resource profiles are putting "equity-first, nature-positive" Blue Economy ideas into

practice. Table 4 summarises three well-documented cases and lines them up against the BEDA framework.

The comparison shows that Norway, The Netherlands, and Portugal follow the same sequence BEDA recommends - equity first (revenue sharing, job transition, local councils), ecological limits next, then scale up investment. Each country ties profit to public benefits: Norway directs part of the carbon capture and storage (CCS) licence fees to municipal revenue; the Netherlands requires a reef-habitat module under every new wind turbine or pipeline; and Portugal earmarks 10% of its Blue Fund for grants to coastal small-businesses. By doing so, economic results are significant. All three projects are already generating jobs, export sales or new grant funding, and none of them moved forward until the social-equity and ecosystem rules were secured.

6 Two illustrative applications

To highlight how BEDA's sequential approach (Equity → Health → Wealth) can shape decision-making within a Canadian context, we present two hypothetical scenarios:

6.1 Seaweed aquaculture

The first hypothetical scenario envisions a traditional marine sector expanding into innovative applications using a living laboratory off the coast of British Columbia to focus on the full value chain. New techniques to support large-scale seaweed aquaculture are tested. The farm can be used for carbon sequestration, while the harvest can provide the source material for animal feed, fertilizers, food production, pharmaceuticals, and textiles. It is a partnership among an industry leader, Indigenous

TABLE 4 International context and comparable case studies.

Country/region	Anchor policy or program sources	Key social equity feature	Key ocean health safeguard	Key ocean wealth outcome to date
Norway — Longship/Northern Lights (CCS)	Meld. St. 33 (2019–2020) Longship—Carbon Capture and Storage (Government of Norway, 2020; Northern Lights 2021, 2023a, b)	Host–community engagement at Øygarden; local value creation via jobs and supply–chain participation in the benefit realization plan.	Storage permit obligations for continuous monitoring and corrective measures; action if plume behaviour deviates or leakage is detected.	Approx. €2.5 b public–private investment; up to ~4,000 construction jobs and ~170 permanent jobs projected.
Netherlands — North Sea Energy Hub (wind-to–hydrogen integration)	Overlegorgaan Fysieke Leefomgeving (2020); Government of The Netherlands (2022); Netherlands Enterprise Agency (RVO), (2023)	Transition Fund supports nature, monitoring, enforcement and restructuring/job–transition for the cutter fleet; coastal–community grants.	"Nature–inclusive design" embedded in permit/tender criteria (e.g., habitat–enhancing measures in turbine and corridor design).	Build–out advancing (e.g., 4 GW awarded at IJmuiden Ver, 2024) toward ~21 GW offshore–wind target (~2032); national electrolysis target 3–4 GW by 2030 (mix of onshore/offshore integration).
Portugal — National Ocean Strategy (NOS) 2021–2030	Government of Portugal – DGPM (2021); Government of Portugal - DGPM (2016)	Public participation through coastal–community councils; Blue Fund support for SMEs and local projects.	Acceleration toward 30% MPA coverage; Azores MPA network expansion; ecosystem–service valuation and marine ecosystem accounts under EU rules.	Blue economy ~3.7% of GVA (2022); Blue Fund mobilizing new investment (e.g., €50 m calls).

and coastal communities, universities, and federal and provincial government departments.

In line with ocean equity, partnerships with Indigenous and coastal communities ensure local governance roles, job creation, equitable access to resources, and profit-sharing. Next, ocean health metrics involve monitoring carbon sequestration potential, biodiversity and water quality. Finally, ocean wealth emerges through scalable production, exports, and new markets for seaweed-based products. By starting with equity, potential conflicts (e.g. sea-use competition) are resolved before heavy capital is committed. Appendix A provides a sample TBL assessment.

6.2 Ammonia production, carbon storage and shipping industry cluster

Our second hypothetical scenario involves a consortium developing a “green ammonia” hub using renewable energy for electrolysis on Canada’s East Coast. Specialized ships transport ammonia abroad, then return with carbon dioxide for subsea storage in offshore geological formations.

The BEDA approach first addresses ocean equity by involving local fishers, communities and Indigenous groups to co-design the plan and grant free, prior and informed consent before any capital investment or construction begin. It then safeguards ocean health through independent reviews that set strict limits on emissions, shipping safety and seabed CO₂ storage regulations. The comprehensive safety system shares monitoring sensors, maritime autonomous surface ships, autonomous underwater vehicles and satellite data to track compliance in real time. Only after the social licence and ecological safeguards are in place does the hub scale up,

creating skilled jobs, port activity and export revenue while delivering clean hydrogen and fully aligned with the High-Level Panel’s call for ocean-based carbon solutions (HLP 2023c). Appendix B provides a sample TBL assessment.

Table 5 gives a quick snapshot of how BEDA scores a subset of hub activities, marking benefits with “+” and risks with “-”. Full qualitative assessments for both the seaweed-aquaculture example (Appendix A) and this ammonia-CO₂-shipping cluster (Appendix B) show how the same BEDA checklist can guide any new ocean venture, from a single start-up to an integrated industry cluster.

7 Adaptive governance and risk safeguards

As a performance-based approach rather than a prescriptive measurement tool, BEDA is designed to learn and adapt. Indicators and thresholds form a living registry that is reviewed every 3–5 years or sooner when agreed warning signs (triggers) occur (e.g. a threshold breach, a sustained negative trend, or a missed mitigation milestone) (Folke et al., 2005; Walters, 1986; IAIA, 2024). By tracking key performance indicators, decisions and commensurate actions can be taken when a key measure worsens. For example, permit conditions could be tightened or temporarily suspended until recovery targets are met. To prevent short-term trade-offs, Equity and Health can have minimum floors in the composite score (not below ~33.3% each) and activities can be limited to be within the ocean’s regenerative capacity (Dasgupta, 2021). Achieving each TBL objectives will require appropriate metrics. Defining or developing such metrics is outside the scope of this policy review, but is an important part of ensuring equity, health and wealth are trending in the positive direction.

TABLE 5 Evaluation of a subset of considerations for Blue Economy growth in a new ammonia to carbon industry.

	Local (Municipal)	Regional (Province)	National (Canada)
Ocean Equity	+ Provide training, skill upgrading, job creation and incent economic activities associated with the new industries to reduce poverty.	+ Collaborate with the Federal government to democratize ocean knowledge, fostering education and awareness of new industry benefits and challenges.	+ Enact inclusive measures, including gender policies, expanded GBA+ initiatives, and intergenerational sustainability practices, for a fair and inclusive environment.
	- Risk of excluding local communities and Indigenous people from governance and decision-making processes.	- Risk to livelihoods through potential compromise of social-ecological well-being from accidents and spills.	- Possibility of contributing to ocean grabbing and exploitation of marine resources (e.g., prioritizing carbon storage over fisheries).
Ocean Health	+ Health of local ocean territory is preserved with the use of near zero-impact shipping and sustainable ammonia production.	+ Align provincial and federal blue economy plans for sustainable development, fostering a unified and environmentally responsible economic landscape.	+ Encourage ocean stewardship at the national level by promoting responsible ocean use and protecting marine environments.
	- Increase maritime activity poses risks of heightened air and water pollution, along with an increase in noise levels.	- Spills and leaks can harm local habitats, impacting biodiversity and ecosystem health	- The long-term effects of subsea carbon dioxide storage and alternative fuels like ammonia are uncertain.
Ocean Wealth	+ Secure agreements, contracts, and government approvals to attract business investment.	+ Job creation and increased economic output from new sector.	+ Hire experts for valuation and techno-economic studies to boost economic activity and enhance technical expertise.
	- Possible interruptions to local businesses, including competition for investment, land, and labor.	- Government incentives and subsidies funded through deficit spending may contribute to a rise in provincial debt.	- Acquisition of social license to operate by companies and government approval becomes essential.

For new or fast-changing industries, proponents can maintain a risk list, set pre-agreed stop rules (shut-off or pause criteria) in advance, and post financial assurances (e.g. performance-linked bonds) tied to outcomes (Rio Declaration, 1992; CER, 2024, 2025; OECD, 2023). Each year, results can be reported publicly, including indicator trends, triggers breached (if any), actions taken, and timelines, consistent with good practice in follow-up and monitoring (Noble, 2020; IAIA, 2024). A co-governed monitoring board (Indigenous representatives, the regulator, and the proponent) could oversee this cycle and approves updates. These steps would keep BEDA flexible while protecting Equity and Health as conditions change. Further analysis on best practices would require more thorough evaluation.

8 Discussion

8.1 Integrating social well-being and policy implementation

The two scenarios illustrate how prioritizing social equity can avert pitfalls often encountered when economic or environmental goals dominate prematurely (Ota et al., 2022). By adopting a bottom-up approach, BEDA can foster trust, reduce project delays arising from social conflict, and ensure that local knowledge and cultural values guide technological and policy choices. Canada's Blue Economy investments might, for example, benefit from weaving BEDA's emphasis on co-management and transparency into MSP, especially as it pursues large-scale expansions in renewable energy, marine autonomous surface ships, ocean technology and resource extraction (DFO, 2024a).

8.2 Governance tools and adaptability

Robust governance is critical. Tools such as MSP, valuation studies, and targeted regulatory frameworks (e.g. the Sustainable Fisheries Framework) become more effective when guided by explicit social and environmental benchmarks (Cisneros-Montemayor et al., 2021). BEDA's flexibility allows each community or region to adapt weighting and evaluation methods, thereby reflecting local priorities while still upholding national commitments to sustainability and equity (United Nations, Department of Economic and Social Affairs (DESA), 2021).

8.3 Addressing "business as usual" concerns

While transitioning from "business as usual" (BAU) requires new forms of multi-level cooperation, certain BAU elements, such as well-established fisheries management tools or environmental monitoring programs, can serve as useful starting points. BEDA does not dismiss all prior practices but encourages their integration

into a more holistic framework where social and ecological criteria are front-loaded (Bennett et al., 2015; Österblom et al., 2020).

9 Conclusion

A cohesive Blue Economy will require an abandoning of siloed approaches in favor of frameworks that equally emphasize social equity, environmental health, and economic viability. This paper introduced the Blue Economy Development Approach (BEDA), merging theoretical insights (the Social Well-being model) with practical tools (MSP, valuation studies, and SDGs). By placing equity at the forefront, followed by ecosystem health and, ultimately, economic viability, BEDA proposes a flexible methodology to help stakeholders avoid common pitfalls in ocean development while fostering broad-based, long-lasting benefits. Benefits from this approach would support:

- The adoption of a unified framework: Canada could converge on a consistent definition of its Blue Economy, referencing that of the World Bank while specifying how TBL objectives are operationalized.
- Strengthening MSP and valuation efforts: Expanded ecosystem valuation and application of MSP systematically could balance diverse uses, informed by robust local and Indigenous engagement.
- Enhancing marine security and governance: Promoting interdepartmental policies that simultaneously protect maritime domains and support economic innovation aligned with SDGs would create more efficient and effective holistic solutions.
- Prioritization of equity in sector-specific strategies: Whether advancing aquaculture, renewable energy, or innovative carbon storage, such an approach would ensure local communities receive direct benefits and maintain decision-making powers.

BEDA may support Canada in a move beyond conceptual ambiguity toward tangible, equitable, and sustainable ocean activities. Future research would be necessary to validate the claims made in this review, refine localized evaluation schemes, explore further case studies, and investigate how BEDA can accommodate evolving ocean-based technologies and governance imperatives in the decades to come.

Author contributions

LM: Writing – original draft, Writing – review & editing. M-CR: Writing – original draft, Writing – review & editing. RN-B: Writing – original draft, Writing – review & editing. GS: Writing – review & editing. AC-M: Writing – review & editing.

Funding

The author(s) declare financial support was received for the research and/or publication of this article. The National Research Council Ocean Program paid for the publication costs.

Conflict of interest

Author RN-B was employed by the company Pisces Research Project Management Inc.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential 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.2025.1488879/full#supplementary-material>

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