INCEPTION REPORT

Project: Mainstreaming Marine and Coastal Natural Capital Assessment and Accounting into Viet Nam's Development Planning for Blue Economic Growth of Key Sectors

Task Name: Developing the Project Inception Report.

04/2026

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
GDP	Gross Domestic Product
GIS	Geographic Information System
NCA	Natural Capital Accounting
OECD	Organization for Economic Co-operation and Development
SEAA	System of Environmental-Economic Accounting
SEEA EA	System of Environmental-Economic Accounting – Ecosystem Accounting
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
WAVES	Wealth Accounting and the Valuation of Ecosystem Services
WB	World Bank

SUMMARY

This inaugural report is developed to support the implementation of the project "Mainstreaming Marine and Coastal Natural Capital Assessment and Accounting into Viet Nam's Development Planning for Blue Economic Growth of Key Sectors". The report focuses on synthesizing foundational information to support the project implementation process, including: reviewing the relevant legal and policy framework; analyzing international experiences on natural capital accounting (NCA); consulting with stakeholders; and proposing an approach to applying NCA suitable to the Vietnamese context.

Over the years, Vietnam has issued many important guidelines, strategies, and policies related to green growth, sustainable development, integrated resource management, and marine environmental protection. However, the full integration of the value of natural capital into the planning, policy-making, and development decision-making systems remains limited. Current assessment tools mainly focus on traditional economic indicators, while the value of natural resources and ecosystem services is not fully reflected in the policy-making and resource allocation processes.

The report also shows that many countries around the world have successfully implemented natural capital accounting (NCA) as a tool to support policy planning and resource management in a sustainable manner. International experience shows that the implementation of NCA requires institutional development, a synchronized data system, appropriate technical capacity, and an effective inter-sectoral coordination mechanism among relevant agencies.

Through consultations with stakeholders, the report identified several key gaps and challenges, including: a lack of integrated and synchronized data; limitations in technical capacity and methodology; and the absence of an effective coordination mechanism among ministries, sectors, and localities during implementation. Based on this, the report proposes adopting an approach based on the System of Ecosystem Economic Accounting (SEEA EA) framework, combined with phased pilot implementation to ensure feasibility and suitability to Vietnam's practical conditions.

The priority sectors identified in the initial phase include fisheries and aquaculture, marine tourism, seaports and maritime transport, coastal construction and infrastructure development, coastal industries, and coastal trade and services, as these sectors are highly dependent on marine resources and ecosystems and play a crucial role in green economic growth. The report also proposes a phased implementation roadmap for the project, starting with perfecting the legal and institutional framework, strengthening data systems and information infrastructure, enhancing technical capacity and human resources, promoting pilot implementation at the local and priority sector levels, refining methodology, conducting pilot implementations, and expanding application, ensuring scalability and integration into future development planning and management systems.

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I. GENERAL INTRODUCTION

The project "Mainstreaming Marine and Coastal Natural Capital Assessment and Accounting into Viet Nam’s Development Planning for Blue Economic Growth of Key Sectors" was developed in the context of Vietnam strongly promoting the transformation of its development model towards green growth, circular economy, low-carbon development, and sustainable development. This is a consistent orientation reflected in many of Vietnam's national strategies, policies, and commitments to ensure harmony between economic development, environmental protection, and sustainable use of natural resources.

Over the years, Vietnam has achieved significant progress in economic growth, international integration, and improving people's living standards. However, rapid industrialization and urbanization, along with increasing resource exploitation, have created immense pressure on the environment and natural ecosystems, particularly in coastal and marine areas. Issues such as biodiversity loss, marine pollution, coastal ecosystem degradation, overexploitation of fisheries resources, coastal erosion, and the impacts of climate change are increasingly affecting the ecosystem's ability to provide services and the livelihoods of local communities.

Vietnam boasts a coastline stretching over 3,260 km, with a vast exclusive economic zone and diverse marine ecosystems. Vietnam's marine and coastal ecosystems include mangrove forests, seagrass beds, coral reefs, lagoons, estuaries, and coastal wetlands. These ecosystems provide numerous vital ecosystem services such as coastal protection, climate regulation, carbon sequestration, biodiversity maintenance, and support for the livelihoods of millions of people.

Vietnam's key economic sectors, such as fisheries, marine tourism, maritime transport, seaports, and renewable energy, all depend directly or indirectly on the quality and resilience of marine and coastal ecosystems. Over the years, the marine economy has become a crucial driver of national economic growth. However, this rapid development has also created increasing pressure on marine resources and the environment.

Overexploitation of fisheries resources, mangrove deforestation, marine pollution, and the impacts of climate change are significantly degrading the quality and function of natural ecosystems. Many coastal areas have experienced erosion, biodiversity loss, and depletion of natural resources. Extreme weather events, sea-level rise, and ocean acidification are also increasing the vulnerability of coastal ecosystems and communities.

Despite their immense role and value, the values of marine and coastal natural capital are currently not fully reflected in economic statistics, development planning, and policy-making processes. Many development decisions are still primarily based on traditional economic indicators without fully considering environmental costs, resource depletion, or the long-term value of ecosystem services. This leads to the risk of overexploitation of natural resources, a decline in ecosystem resilience, and a failure to achieve long-term sustainable development goals.

Vietnam has gradually perfected its national policy, legal, and strategic framework to enhance integrated management, rational exploitation, and sustainable use of marine and coastal resources. The perspective of developing the marine economy in conjunction with the conservation of natural resources and environmental protection has been affirmed in many important documents of the Party and State, reflecting Vietnam's strong commitment to sustainable development and green growth.

Resolution No. 36-NQ/TW of 2018 on the Strategy for Sustainable Development of Vietnam's Marine Economy to 2030, with a vision to 2045, clearly defines the requirement of "sustainable development of the marine economy based on green growth, biodiversity conservation, protection of marine ecosystems, and harmony with nature." The resolution emphasizes the transformation of the development model from purely exploiting marine resources to integrated management and efficient use of marine natural capital, while considering the conservation and restoration of marine ecosystems as a prerequisite for long-term development.

Furthermore, the 2015 Law on Marine and Island Resources and Environment has created an important legal foundation for integrated resource management and

environmental protection in the marine sector, including provisions on basic marine resource surveys, marine spatial planning, exploitation and utilization of marine resources, environmental protection, and integrated coastal zone management. The law also promotes an interdisciplinary approach and strengthens coordination among management agencies in the process of utilizing marine and coastal resources.

The 2020 Environmental Protection Law continues to add many regulations related to nature conservation, ecosystem protection, circular economy, green growth, and climate change adaptation. In particular, the law has gradually promoted the integration of environmental factors and ecosystem values into policy planning and economic development. Along with this, national strategies and programs such as the National Strategy on Green Growth, the National Strategy on Biodiversity, the National Marine Spatial Planning, and commitments to implement the Sustainable Development Goals (SDGs) have created a favorable policy framework for the application of new management tools, including natural capital accounting.

Furthermore, Vietnam is actively participating in and implementing international commitments related to marine conservation, climate change, and sustainable development, including the 1982 United Nations Convention on the Law of the Sea (UNCLOS), the Convention on Biological Diversity (CBD), the Paris Agreement on climate change, and global initiatives on sustainable marine economy. These commitments place increasing demands on improving the quality of marine resource governance, enhancing data systems, and strengthening tools for assessing the value of resources and ecosystem services to support decision-making.

In this context, Natural Capital Accounting (NCA) is increasingly being adopted by many countries and international organizations as an important tool to support the management of natural resources and integrate environmental factors into development decision-making processes. NCA allows for the measurement, quantification, and monitoring of the value of natural resources and ecosystem services in a systematic approach, consistent with national accounts and international standards such as the United Nations System of Environmental Economic Accounting (SEEA). Through this, NCA helps provide a database and scientific evidence to support policy making, marine spatial planning, resource management, public investment, and the evaluation of development effectiveness in a more sustainable direction.

For Vietnam, research and implementation of natural capital accounting (NCA) in coastal and marine areas is of particular importance in the context of the country's efforts to promote the implementation of the Vietnam Marine Economic Sustainable Development Strategy, the Green Growth Strategy, climate change commitments, and the Sustainable Development Goals (SDGs). Integrating NCA into development planning and management not only contributes to improving resource utilization efficiency but also supports strengthening the resilience of coastal ecosystems and communities to the impacts of climate change.

Based on this foundation, this inaugural report is designed to synthesize initial information, data, and context for project implementation; review policies, strategies, and initiatives related to natural capital accounting and marine resource management in Vietnam; and propose approaches, methodologies, and implementation plans for subsequent project phases. The report also serves as initial guidance for coordination among management agencies, research organizations, development partners, and stakeholders in promoting the application of natural capital accounting to the management and planning of green economic development in Vietnam.

1.1. Objectives of the report

This report aims to provide a scientific, legal, and practical basis for developing a natural capital accounting system to support the sustainable management of marine resources in Vietnam. Based on this, the report focuses on the following main objectives:

- Review and analyze Vietnam's current legal framework, policies, and strategies related to natural capital accounting, marine resource management, biodiversity conservation, green growth, and sustainable marine economic development;
- Synthesize, analyze, and evaluate international experiences, models, and practices on natural capital accounting and marine ecosystem accounting, particularly approaches based on the United Nations' SEEA standards and related global initiatives;
- Review studies, programs, projects, and initiatives that have been and are being implemented in Vietnam related to natural resource accounting, marine ecosystem management, and ecosystem service pricing to determine the current status of data, capacity, and readiness.
- Conduct consultations with stakeholders, including government agencies, research organizations, local authorities, development partners, and the private sector, to identify practical needs, institutional gaps, data gaps, technical capacity gaps, and coordination mechanisms in the implementation of marine natural capital accounting;
- Propose appropriate approaches, methodological frameworks, and technical guidelines for implementing a marine natural capital accounting system in Vietnam, based on the national context and international standards;
- Propose a roadmap and implementation plan for subsequent phases, including priority activities, coordination mechanisms, data requirements, capacity building, and resource mobilization to support the development of a natural capital accounting system for the sustainable development of the blue marine economy.

1.2. Implementation Method

This report is based on a comprehensive, interdisciplinary approach and references international standards on natural capital accounting, particularly the United Nations

System of Environmental Economic Accounting (SEEA). The research process combines various methodologies to ensure scientific rigor, practical relevance, and applicability within the context of marine resource management in Vietnam.

The main methods used include:

(i) Review of secondary documents

The research team collected, systematized, and reviewed secondary documents related to natural capital accounting, marine resource management, biodiversity, and sustainable marine economic development. The review process focused on:

- International reports on Natural Capital Accounting (NCA);
- The United Nations' guidance documentation system on SEEA-CF and SEEA-EA;
- Scientific studies and academic papers;
- Technical reports from the World Bank, UNEP, UNDP, OECD, FAO, and other international organizations;
- Programs and projects related to marine ecosystem management, green growth, and ecosystem service pricing in Vietnam and internationally.

The literature review helps identify international approaches, lessons learned, common methodologies, and research gaps related to the accounting of marine natural capital.

(ii) Policy and legal document analysis

The report reviews and analyzes Vietnam's system of policies, strategies, laws, and legal documents related to marine resource and environmental management; biodiversity conservation; marine spatial planning, etc.

The analysis focuses on assessing the current state of the existing policy and legal framework and opportunities for integrating the NCA into Vietnam's planning, statistics, and policy-making systems.

(iii) Consult with experts and stakeholders

To ensure the practicality and applicability of the report, the research team consulted with experts and stakeholders through technical meetings, in-depth interviews, and professional exchanges.

The advisory groups include a number of government agencies, research institutes and universities; international organizations and development partners; and experts in environmental economics, biodiversity and GIS.

The consultation process aims to identify policy needs and priorities; assess the current state of data and technical capacity; and identify difficulties, challenges, and the applicability of NCA in Vietnam.

(iv) Data synthesis and analysis

The collected data and information are compiled, compared, analyzed, evaluated, and used to propose approaches and the application of NCA for Vietnam in the future.

II. ACCOUNTING FOR NATURAL CAPITAL

2.1. Definition and Necessity of Natural Capital Accounting (NCA)

The concept of "Natural Capital" marks a profound shift in thinking within economic science. The term was first systematically discussed by pioneering economists such as Ernst Friedrich Schumacher in his landmark book "Small Is Beautiful" (1973), and was subsequently developed extensively by Herman Daly and his colleagues within the framework of Ecological Economics in the 1990s. Natural capital is defined as the stock of all natural assets found in the subsurface, on the surface, and in the atmosphere, including geology, soil, air, water, and all living organisms. From this stock of natural capital, ecological interactions generate a continuous flow of Ecosystem Services. This flow provides humanity with both tangible and intangible values, from raw materials for production to life-sustaining functions that no artificial technology can completely replace.

Natural Capital Accounting (NCA) is the systematic , statistical , and quantitative measurement of natural asset reserves and ecosystem service flows within a defined spatial and temporal scope . The core objective of the NCA is to integrate all environmental and ecological information into the structure of the System of National Accounts (SNA) – the system currently used by all countries to calculate key macroeconomic indicators .

The strategic necessity of implementing NCA stems from the following three fundamental reasons :

Firstly , the NCA helps overcome the systemic limitations of the traditional GDP indicator . GDP is a measure of the scale of market economic activity , but it is an ineffective accounting tool for measuring a nation 's long - term prosperity . GDP recognizes the exploitation and sale of timber as a positive contribution to economic growth , but this balance sheet completely ignores the value of lost forest assets . Even when an environmental disaster occurs , such as an oil spill at sea , the costs of cleaning up the damage and restoring the coastline are included in GDP as an economic activity that increases this indicator . The NCA addresses this paradox by introducing the concept of " Natural Capital Depreciation , " forcing countries to see the true costs behind the glamorous growth figures .

Secondly , the NCA provides a scientific , consistent , and comparable data platform for policymakers . When faced with difficult trade - off decisions – such as choosing

between destroying 1,000 hectares of mangrove forest to build an industrial port complex or preserving it to conserve biodiversity and develop ecotourism – managers often lack quantitative tools .The lack of data on monetary valuation has led to environmental values being consistently overlooked or disregarded in purely financial cost - benefit analysis (CBA) reports for infrastructure projects . The National Council for the Science and Technology of Agriculture (NCA) is translating ecological terminology (such as biomass , vegetation cover , species density) into economic terminology (currency) to place nature on an equal playing field with other economic sectors .

Third , the NCA is key to accessing new international green finance sources . In the context of modern global governance , multilateral financial institutions such as the World Bank (WB) , the International Monetary Fund (IMF) , and the Asian Development Bank (ADB) are applying extremely stringent environmental , social , and governance (ESG) criteria . Countries that demonstrate transparent natural asset governance through a standardized national account system will have a significant advantage in mobilizing concessional loans , issuing green bonds , and attracting large sustainable investment funds from around the world .

2.2. International experience in accounting for natural capital

2.2.1. Australia — National Marine Ecosystem Accounting

Australia has the world's most comprehensive National Marine Account (NCA), built on satellite spatial data and a long-term ecological monitoring network. The Australian Bureau of Statistics (ABS) developed the Integrated National Ecosystem Account (INEA) in 2020, covering the entire 7.7 million km² exclusive economic zone. The most notable achievement is the Great Barrier Reef Account – the first time in the world that a single ecosystem has been fully accounted for according to SEEA-EA standards, with a total value of AUD 56 billion. This data directly drives the Great Barrier Reef Restoration Strategy 2050 with a budget of AUD 3 billion – the clearest evidence of the policy impact of the NCA.

Below is a detailed analysis of Australia's experience in developing and implementing a National Marine Ecosystem Accounting System .

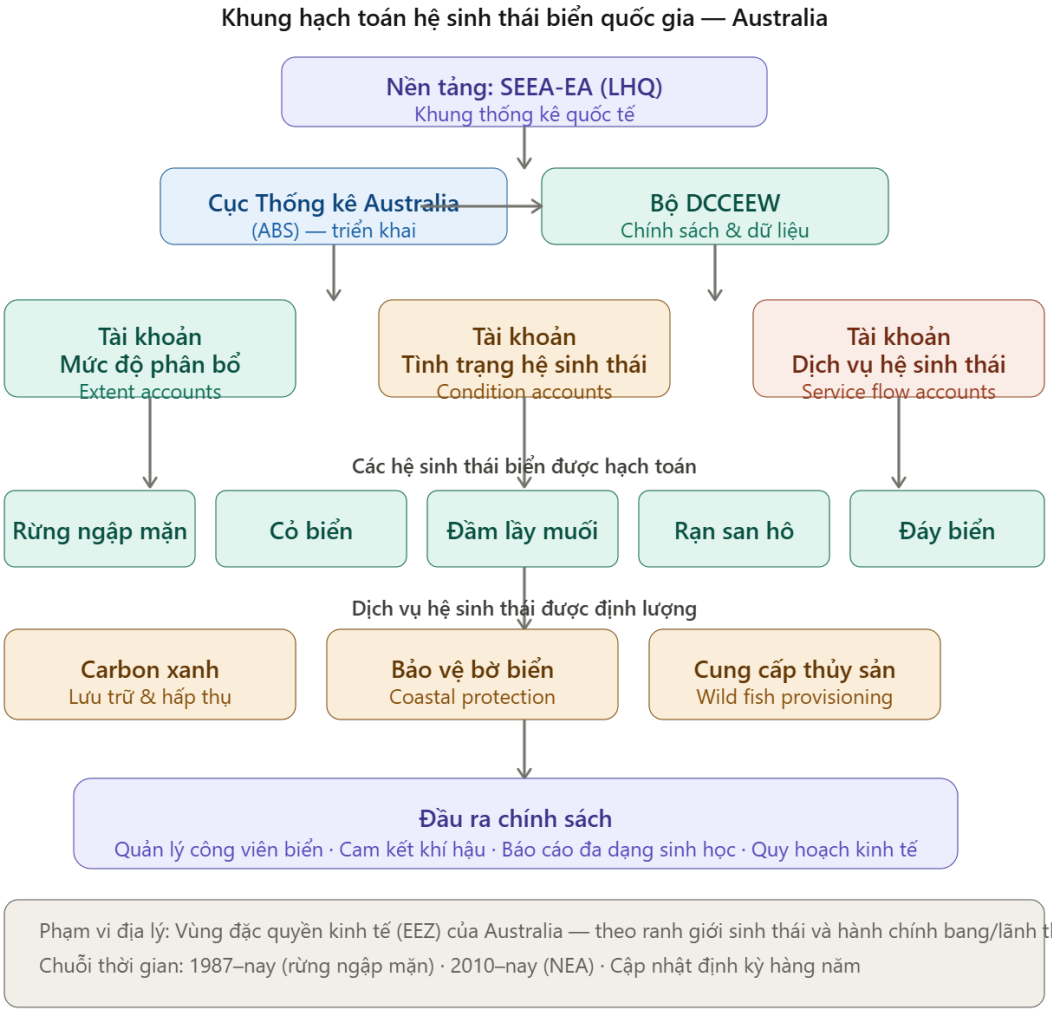

Figure 1: Australia's National Marine Ecosystem Accounts Framework

Context and legal basis

Australia is a global pioneer in marine ecosystem accounting, building a system that meets international standards. The Australian Bureau of Statistics (ABS) and the Department for Climate Change, Energy, Environment and Water (DCCEEW) have collaborated to develop Australia's first National Ocean Account, aiming to support decision-making on the sustainable use and management of carbon-rich ecosystems that underpin marine industries.

Ecosystem accounts adhere to international guidance from the United Nations System of National Environmental-Economic Accounts (SEEA), enabling Australia to report in line with global commitments such as the National Biodiversity Strategy and Action Plan.

Phased development roadmap

Phase 1 — Pilot project at the Great Barrier Reef (2014–2017)

This is a crucial starting point for the entire program. The dual objectives of the experimental accounts for the Great Barrier Reef are: to connect the vast body of scientific work in the region with the environmental and macroeconomic information compiled by the ABS; and to provide feedback to the United Nations on the refinement of the recently published SEEA Experimental Ecosystem Accounting Framework (SEEA-EEA).

This account uses the international SEEA-EEA framework to integrate and monitor changes to complex geophysical data, economic data, and human activities, and defines ecosystem assets as "a spatial area containing a combination of biological, abiotic, and other features that function together as a unified whole."

Phase 2 — National Ocean Account, Phase 1 (August 2022)

First released in August 2022, the National Ocean Account—a collaboration between ABS and DCCEEW—provides information on key green carbon ecosystems including mangrove forests, salt marshes, and seagrass beds. The account describes the area and condition of each ecosystem, as well as the ecosystem services they provide—specifically carbon stocking, carbon sequestration, and coastal protection services.

Phase 3 — Expansion to Salt Swamps and Seagrass (November 2022)

Phase 2 scope adds area accounts for salt marshes and intertidal seagrasses, carbon sequestration and carbon stock accounts for salt marshes, and coastal protection service accounts for salt marshes and mangroves. Kelp seaweed production accounts were surveyed but insufficient data were available to create a reliable national kelp account at the time of release.

Phase 4 — Integrated National Ecosystem Account (2024–2025)

The second report of the National Ecosystem Account includes estimates of the area and condition of Australian ecosystems, along with indicators of selected ecosystem services and their contribution to economic activity and human well-being.

Methodology and technical tools

Spatial data system

Carbon uptake by seagrasses and mangroves was calculated using the Green Carbon Method (Lovelock et al. 2022), based on mangrove and seagrass bed areas . For mangroves, DEA (Digital Earth Australia) data provided information on area and canopy density for the entire Australian coastline from 1987 to 2021.

BlueCAM model

The BlueCAM model uses Australian data to estimate the reductions in carbon and greenhouse gas emissions resulting from the restoration of coastal wetlands through tidal regeneration, in line with IPCC guidance on national greenhouse gas inventories. BlueCAM includes carbon stored in soil and biomass, as well as emissions avoided from alternative land-use forms.

Outstanding quantitative results

As of June 30, 2021, 243 million tonnes of carbon were stored in mangrove ecosystems, with the Northern Territory having the largest carbon storage capacity due to its vast mangrove area and higher carbon density per hectare. For seagrasses, national estimates of carbon absorption ranged from 4.9 to 5.6 Mt CO2e (equivalent to the emissions of 1.6 to 1.9 million cars).

Integration into the National System of Economic Accounts

The unique aspect of the Australian model is its close integration of environmental accounting with the national economic accounts system. Three pillars enabled ABS to launch its experimental ecosystem accounting: sustained experience in accounting within the SEEA Central Framework; a national accounts system encompassing input-output and supply-use tables, along with expertise in leveraging and applying this data to quantify ecosystem services at scale; and international experience gained from collaborations with leading global experts.

Practical application of policies

The Australian government has committed $10.8 million to improve ocean and marine park management, and over $500 million to support ocean adaptation and recovery; it also prioritizes the implementation of an internationally recognized ocean accounting framework, the development of ocean ecosystem accounts, and the monitoring of national performance based on these accounts.

Australia currently holds approximately 12% of the world's green carbon ecosystems, accounting for 5–11% of global green carbon reserves. Seagrass beds in the Great Barrier Reef contain about 11% of the world's seagrass green carbon.

6. Lessons Learned and Challenges

Experience in ecosystem accounting at the Great Barrier Reef and surrounding forest areas has demonstrated that structuring information in the form of accounts reveals interactions between human activities and ecosystems, and shows the impact on the level of ecosystem service utilization as well as the area and condition of ecosystem assets.

The three key lessons from academic research are: (1) practical issues of data availability and quality; (2) the need to account for both ecosystem services and assets for sustainability assessment; and (3) how ecosystem accounting supports sustainable development through specific policies and management.

As a series of experimental estimates, the methods, data sources, and scope of accounts are continuously being refined, and users are advised not to compare estimates between different releases while development continues.

The Australian model stands out in three respects: (1) institutional linkage between the statistical agency (ABS) and the environmental management agency (DCCEEW); (2) a phased approach —starting with a coral reef pilot and gradually expanding to other ecosystems; and (3) genuine economic-environmental integration , where marine accounts are directly linked to the national GDP system of accounts, enabling quantitative evidence-based policy decision-making.

2.2.2. Seychelles — The Green Maritime Economy and Innovative Financing Mechanisms

Seychelles is a small developed island nation (SIDS) located in the western Indian Ocean. Despite having a land area of only about 455 square kilometers, the island nation manages a vast Exclusive Economic Zone (EEZ) of 1.37 million square kilometers (3,000 times its land area). Economically, Seychelles is entirely dependent on its marine natural resources through two key sectors: high-end tourism and fisheries (especially tuna fishing).

Seychelles offers invaluable lessons on how to integrate the National Coastal Authority (NCA) with innovative financial mechanisms to protect marine ecosystems. The island nation developed Africa's first Marine Space Plan (2020), with the NCA as the foundation for allocating marine space. Notably, Seychelles pioneered debt-for-nature swaps: $21.6 million of national debt was restructured into conservation commitments—conditional on protecting 30% of its territorial waters. The NCA provided quantitative economic evidence that the value of the marine ecosystem ($12 billion) far exceeded the swapped debt, providing a basis for negotiations with international creditors. This is an innovative financial model with significant scalability potential.

In the late 2000s, Seychelles fell into a severe public debt crisis when its total foreign debt exceeded 150% of its GDP, leading to default in 2008. Against this backdrop of dwindling financial resources, Seychelles' natural marine assets faced serious degradation risks due to climate change (causing coral bleaching), illegal, unreported, and unregulated (IUU) fishing, and environmental pollution.

To save itself, the Seychelles government made a historic shift: Instead of viewing the vast ocean as a management burden, Seychelles positioned the ocean as a **core driver of growth** and issued *the Seychelles Green Economy Strategic Framework and Roadmap to 2030.* The core objective of this strategy is to optimize the

economic benefits from the ocean while ensuring the conservation and rigorous accounting of the sustainability of coastal ecosystems, transitioning from a model of destructive exploitation to one of investment in nature restoration.

Debt-for-nature swap program

To address two objectives simultaneously: reducing public debt pressure and mobilizing investment capital for marine conservation, Seychelles collaborated with The Nature Conservancy (TNC) to establish the world's first impact investing mechanism based on a market-based **debt-for-nature exchange in 2015.**

- **Financial structure:** TNC established an independent trust fund called *the Seychelles Biodiversity Restoration and Conservation Trust (SeyCCAT)* . TNC provided SeyCCAT with a concessional loan of US$20.2 million, combined with US$1.4 million in funding from international charities. SeyCCAT used this money to acquire US$21.6 million of the Seychelles government's foreign debt from Paris Club creditors (primarily France, the UK, Italy, and Belgium) at a significantly negotiated discount.
- **Cash flow mechanism:** After the debt is acquired, the debt structure is completely transformed:
    1. The Seychelles government no longer has to repay its debts in hard currencies (USD or EUR) abroad, but instead repays them in its domestic currency (Seychelles Rupee) to the SeyCCAT fund.
    2. Interest rates on new loans have been lowered to preferential rates, and the repayment period has been extended to up to 20 years.
    3. Instead of disappearing from the economy, the government's annual debt service revenue is now directly allocated by SeyCCAT to domestic environmental activities: **70%** is used to finance marine conservation projects, coral reef and seagrass restoration by local fishing communities and scientists; **30%** is accumulated into a long-term asset fund to ensure sustainable financing for marine protected areas after the debt is repaid.

Issuing ocean green bonds

Following the success of its debt swap mechanism, in 2018 Seychelles continued to make global financial history by successfully issuing its first Sovereign Blue Bond , raising $15 million from international private investors (such as Calvert Impact Capital, Nuveen, and Prudential).

For a country with a low credit rating like Seychelles to be able to issue bonds on the international market at an attractive interest rate (only 6.5%), its financial structure has adopted a multi-tiered risk mitigation mechanism:

- Credit guarantee: The World Bank provides a guarantee covering part of the payment risk worth US$5 million.

- Interest rate subsidy: The Global Environment Fund (GEF) provided a $5 million concessional, interest-free loan to offset and reduce the effective interest rate paid by the Seychelles Government to 2.8% .

The entire $15 million raised from the Blue Bond program was disbursed as concessional loans through the Seychelles Development Bank (DBS) and grants through SeyCCAT to support the domestic fisheries sector in transitioning to sustainable fishing technologies, investing in high-tech seafood processing value chains, minimizing post-harvest losses, and establishing a vessel tracking system to combat IUU (Illegal, Unreported, and Unregulated) fishing.

Marine spatial planning (MSP) is based on ecological science accounting.

A prerequisite and mandatory condition that international creditors and investors require Seychelles to fulfill in order to activate these financial instruments is the implementation of the Seychelles Marine Spatial Plan (SMSP) based on transparent natural capital accounting data.

Seychelles has digitized and built GIS maps for its entire 1.37 million square kilometers of marine space, specifically quantifying the area and green carbon reserves of seagrass beds (*Thalassodendron ciliatum*) and mangrove forests. Based on this scientific data, the island nation has made a legal commitment to place 30% of its EEZ (approximately 410,000 square kilometers – larger than the entire area of Germany) within environmental protection zones, completing the global 30x30 goal ahead of schedule. The marine space is divided into three strictly managed zones:

- **Zone 1 (High Protection Zone - 15%):** All oil and gas exploration and commercial fishing activities are completely prohibited in ecologically sensitive areas (such as the Aldabra coral reef) to preserve natural "original resources".
- **Zone 2 (Medium-protected and regulated zone - 15%):** Allows non-residential ecotourism activities and small-scale artisanal fishing with quota controls.
- **Zone 3 (Sustainable Economic Development Zone - 70%):** Dedicated to maritime activities, large-scale tuna fishing, and marine renewable energy.

Lessons learned for Vietnam

The Seychelles model offers three strategic lessons for Vietnam in its maritime economic governance roadmap:

1. Shifting the mindset about assets **:** Oceanic natural resources (such as seagrass beds and mangrove forests) are not entities that need passive protection through bailout budgets, but rather quantifiable financial assets . Internationally standardized Natural Capital Accounts (NCA) data is the core legal and technical basis for building trust in global capital markets.

2. Innovating financial instruments **:** Vietnam could fully adopt a debt-for-nature swap model or issue Blue Bonds at the local level (piloted in provinces with unique marine spaces such as Khanh Hoa, Kien Giang, or Quang Ninh) to attract international investment capital and reduce pressure on the state budget in fulfilling its Net-Zero 2050 commitments.
3. Institutionalizing multi-stakeholder governance **:** The success of SeyCCAT demonstrates the crucial role of an independent, transparent financial mechanism with co-management involving government agencies, scientists, non-governmental organizations, and representatives of fishing communities on the ground, ensuring that funding is allocated appropriately and delivers tangible ecological benefits.

2.2.3. Costa Rica — Linking the NCA with the Ecosystem Services Payment Mechanism

Costa Rica was the first country to successfully institutionalize the Payment for Ecosystem Services (PES) mechanism in 1997, with the National Council for Ecosystem Services (NCA) as the pricing foundation. The PES system pays farmers and coastal communities to maintain the ecosystem, with payments determined based on the estimated value of the services provided. The results after 25 years include: forest cover increased from 21% (1987) to 54% (2020); ecotourism reached US$4 billion per year; and most notably, Costa Rica's green GDP—after adjusting for the added value of the ecosystem—is 8–12% higher than conventional GDP. This is one of the very few empirical examples showing that investment in conservation based on NCA yields a positive net economic benefit.

The context of forest degradation and the turning point of the 1996 Forestry Law.

During the 1970s and 1980s, Costa Rica was one of the countries with the highest rates of deforestation in the world due to policies encouraging the expansion of pastures for cattle grazing and agriculture. The forest cover of this Central American nation plummeted dramatically from over 75% in the 1940s to a mere 21% in 1987, plunging the country to the brink of biodiversity loss, soil erosion, and water depletion.

Recognizing that the ecological crisis would cripple the long-term economic foundation, the Costa Rican government undertook a landmark institutional reform by enacting **Forestry Law 7575** in 1996. This law established two core legal frameworks that fundamentally changed the landscape:

1. The conversion of land use in areas that already have natural forests is strictly prohibited.
2. Officially recognizing and institutionalizing the concept **of Payment for Environmental Services (PES)** transforms forests from a passive object requiring protection into a "service provider" with economic value for society.

Operating the PES Mechanism through the National Forestry Finance Fund (FONAFIFO)

To implement the 1996 Forestry Law in practice, Costa Rica established **the National Forestry Finance Fund (FONAFIFO)** – a semi-autonomous agency under the Ministry of Environment and Energy (MINAE) that acts as an "environmental services exchange".

Costa Rica's PES mechanism focuses on paying landowners based on four core forest ecosystem services recognized by law:

- Absorbing and storing carbon helps reduce greenhouse gas emissions.
- Protecting water resources for domestic use, agriculture, and hydropower.
- Preserving biodiversity is essential for the development of science and ecotourism.
- Protecting the beauty of natural landscapes for recreational and tourism purposes.

Sustainable financing mechanisms generate revenue for FONAFIFO: Not dependent on fluctuating international funding, Costa Rica has become self-sufficient in funding for PES by implementing **Water & Fuel Taxes** . Specifically, 3.5% of revenue from national hydrocarbon consumption taxes is directly allocated to FONAFIFO's fund. In addition, the government imposes a water tariff on large hydropower companies, breweries, bottled water plants, and large farms. These entities pay directly for the river basin protection services provided by the upstream forests owned by local people.

Table 1: Revenue structure and financial allocation mechanism of the FONAFIFO Fund

*(Insert at the end of section **5.3.2** to clarify Costa Rica's self-sufficient economic model)*

Category	**Capital generation mechanism / Payment allocation**	**Proportion / Average payout**
Sources of Fund revenue	• National fossil fuel consumption tax. • Water service fees collected from hydropower and agriculture. • Voluntary Environmental Services Certificate (CSA). • Preferential loans/International grants (WB, GEF).	• Approximately 3.5% of total fuel tax revenue. • Approximately 25% of revenue comes from water fees. • Conversion based on commitments made by domestic businesses. • Act as seed capital or provide technical

		support.
Payment mechanism (for citizens)	• **Protect natural forests:** Preserve the forest's original state. • **New forest planting:** Establishing production/protection forests. • **Agroforestry system:** Intercropping with forestry trees. • **Natural forest regeneration:** Allowing forests to regenerate naturally on barren land.	• $60 - $80 USD / hectare / year. • $600 - $800 USD / hectare (disbursed over 5 years). • Approximately $1.3 - $2.0 USD per tree (disbursed over 3 years). • $40 - $50 USD / hectare / year.

The core role of Natural Capital Accounting (NCA) in PES optimization.

Although the PES mechanism proved highly effective, in the initial stages, the allocation of funds faced significant challenges due to the flat rate payment mechanism – meaning every hectare of forest received the same amount regardless of quality and ecological location. To improve the efficiency of capital flow, Costa Rica pioneered the integration of the **Natural Capital Accounting (NCA) system** based on the United Nations' System of Environmental Economic Accounting (SEEA) standards.

NCA has completely changed the way PES is managed and allocated through specialized accounts:

- **Land and Forest Accounts:** These help to accurately quantify the area, biomass, and rate of change of each forest type (primary forest, secondary forest, mangrove forest). From this, FONAFIFO can identify forest areas at highest risk of degradation or those with the best carbon sequestration capacity to prioritize PES contracts.
- **Water Accounts:** Measures the flow rate, water quality, and contribution of forest ecosystems to groundwater resources. This data allows for higher payments for forest environmental services in key river basins (which supply water to hydroelectric dams or large cities) compared to other regions, ensuring fairness and economic efficiency.

Thanks to its transparent NCA data system, Costa Rica has successfully transitioned from a "flat rate" PES model to **a performance-based and target-driven PES model** , optimizing every dollar of public finance investment in the most vulnerable natural capital areas.

Table 2: Matrix linking Costa Rica's Natural Capital Accounts (NCAs) and Payment Schemes (PES).

*(Insert at the end of section **5.3.3** to specify how accounting data is applied to financial management)*

Natural Capital Account (NCA) Type	**Core quantitative indicators**	**Direct application to the PES mechanism**
Land & Forest Account *(Land & Forest Accounts)*	- The area varies from year to year. - Canopy thickness, biomass. - Ratio of primary to secondary forest.	- Identify coordinates and delineate critical forest areas at high risk of deforestation to prioritize the signing of PES contracts. - Assess the level of ecological recovery after payment is made.
Water Account *(Water Accounts)*	- Flow rate. - Groundwater reserves. - The ability of vegetation to filter and retain sediment.	- This serves as the basis for calculating the Water Tariff for hydropower plants and downstream businesses. - Adjusting upwards the PES payment value in key river basins.
Carbon Account *(Carbon Accounts)*	- Above-ground and below-ground biomass. - CO_2 absorption capacity by forest type (ha/year).	- Providing foundational data for issuing internationally standardized forest carbon credits. - Allocate revenue from fossil fuel taxes to forest owners with high absorption efficiency.
Ecosystem & Biodiversity Account	- Map showing the distribution of endemic species. - Species diversity index (H').	- Identify "biological corridors" connecting national parks to increase PES bonus payments, encouraging people not to fragment forest land.

Real-world results: From deforestation to the "Green Miracle"

The perfect combination of sustainable PES mechanisms and the scientific NCA quantitative tool has helped Costa Rica create an unprecedented "green miracle":

- **Restoring forest cover:** Costa Rica is the first tropical country in the world to successfully reverse deforestation. The country's forest cover has increased dramatically from a low of 21% (in 1987) to **nearly 60% of its land area** today.
- **Economic development based on conservation:** The restoration of natural capital has created a solid foundation for the remarkable development of ecotourism, contributing more than 8% to the national GDP and becoming the country's largest source of foreign exchange.
- **Net-Zero Emissions:** Data from the Forest Carbon Absorption Account (NCA) has given Costa Rica the confidence to implement its National

Decarbonization Plan, proactively and sustainably moving towards a net-zero emissions economy.

Lessons learned for Vietnam

Vietnam is one of the pioneering countries in Southeast Asia to apply the Payment for Forest Environmental Services (PFES) policy under Decree 99/2010/ND-CP and later the 2017 Forestry Law. However, Costa Rica's model offers valuable lessons for Vietnam to upgrade its current system:

1. **Shifting from "counting area" to "quantifying quality" with NCA:** Currently, payments for PFES in Vietnam are primarily based on forest area (ha) rather than deeply accounting for forest quality or the actual economic value of the services that the ecosystem provides (such as accurate carbon stocks, water retention capacity of each watershed). Applying NCA will help Vietnam build transparent forest natural capital accounts, thereby personalizing and optimizing payments to people who protect forests.
2. **Diversifying and automating fund revenue sources:** Vietnam needs to expand the scope of ecosystem service payments to include carbon-intensive industries and tourism-related landscape services (as is currently being piloted for forest environmental service payments to industrial production facilities and ecotourism businesses), reducing dependence on hydropower and water supply companies.
3. **Improving the independent financial institution:** The FONAFIFO fund model, operating as a professional financial institution, minimizing administrative procedures and applying remote sensing monitoring technology, is a crucial experience for the Vietnam Forest Protection and Development Fund (VNFF) to enhance transparency, reduce intermediary management costs, and deliver funds to people protecting forests quickly and effectively.

2.2.4. Netherlands — Delta Ecosystem Account and Integrated Planning

Context and motivations for model development

The Netherlands has a unique historical relationship with water — more than 26% of its territory lies below sea level, and nearly 60% of its population lives in flood-prone areas. This very pressure for survival has forced the Netherlands to become a pioneer in quantifying the economic value of natural ecosystems — not for environmental ideals, but purely for financial calculations: without well-functioning delta ecosystems, the cost of protecting the country would be unaffordable for any government.

Since the early 2000s, the Netherlands has been developing its own Natural Accounts (NCA) framework for the Rhine-Maas-Scheldt delta system—one of the world's most complex and tightly managed deltas. A key feature of the Dutch model is the direct integration of NCA data with policy decision-making processes—going

beyond academic reporting and becoming a real tool for planning and budget allocation.

Delta Ecosystem Account Structure

The delta Rhine-Maas-Scheldt ecosystem account is organized into four main service groups, each measured by both physical and monetary value:

a) Flood control services

This is the most valuable and also the most thoroughly measured group of services. Wetlands, riparian buffer zones, and natural mangrove forests provide water storage and regulation capabilities, reducing flood peaks. The valuation method uses an avoided damage model *:* if these ecosystems disappear and are replaced by hard infrastructure, the annual cost of flood damage would increase by an estimated **€15 billion per year** — including property damage, economic disruption, medical costs, and resettlement.

Importantly, the €15 billion figure is not a rough estimate but is constructed from detailed hydrological models incorporating flood risk maps, real estate data, and economic infrastructure data across geographical grids. This approach allows policymakers to make a direct comparison: investing €1 in wetland conservation vs. investing €1 in concrete dikes — which provides greater protection?

b) Drinking water supply service

Groundwater aquifers and natural filtration systems through sand and peat ensure a supply of clean water for large cities. The value is quantified at **€2 billion per year** , based on the cost of alternative water treatment if these natural filtration services were absent. Notably, the Netherlands tracks trends over time: as wetland quality deteriorates due to agricultural pollution or urbanization, water treatment costs increase accordingly—a causal link demonstrated by continuous data.

c) Entertainment and tourism services

The delta ecosystem—including wetlands, riverine green corridors, and natural coastlines—generates an estimated **€1 billion in direct recreational value annually** . The measurement methodology combines travel cost *methods , willingness-to-pay* surveys , and local economic data from ecotourism destinations. This service sector, while smaller in absolute value, is politically significant as it generates broad support from both the local community and the tourism industry.

d) Maintaining groundwater quality

This is the most difficult service to quantify but has the greatest long-term importance. Peat and wetland ecosystems act as biological filters, retaining nitrates, phosphates, and agricultural pollutants before they seep into groundwater. The

Netherlands uses a combination of hydrogeological modeling and long-term monitoring data to estimate the cost of replacement treatment if the natural filtering function is lost — particularly important in the context of climate change increasing salinity intrusion events.

Nhóm dịch vụ	Phương pháp định giá	Giá trị (EUR/năm)	Tỷ trọng
Kiểm soát lũ lụt Giảm đỉnh lũ, tích trữ nước	Thiệt hại tránh được (avoided damage)	15 tỷ EUR	80%
Cấp nước uống Lọc tự nhiên qua đất và than bùn	Chi phí xử lý thay thế	2 tỷ EUR	11%
Giải trí & du lịch Đất ngập nước, bờ sông tự nhiên	Chi phí du lịch + sẵn lòng chi trả (WTP)	1 tỷ EUR	5%
Chất lượng nước ngầm Lọc sinh học, giữ nitrat, phosphate	Mô hình thủy địa chất + quan trắc dài hạn	~0.7 tỷ EUR	4%
Tổng cộng	—	≈ 18.7 tỷ EUR	100%

Bảng 1. Tài khoản dịch vụ hệ sinh thái delta Rhine-Maas-Scheldt (ước tính tổng hợp, giá 2015)

Figure 2: Delta Rhine-Maas-Scheldt Ecosystem Service Account

Key finding: The rate of return on natural investment

Synthesizing data from numerous coastal wetland restoration projects between 1995 and 2015, the Dutch study yielded a finding with significant policy implications: every €1 invested in coastal wetland restoration generates €5–€8 in cumulative ecosystem service value —a superior social return *on investment* compared to most hard infrastructure projects.

This figure is calculated using the net present value method *over* a 30–50 year lifespan, including initial investment costs, maintenance costs, and the total accumulated ecosystem service value over time. The key point is that natural ecosystems, unlike hard infrastructure, typically *upgrade themselves* over time—a restored wetland will have better service capacity in year 20 than in year 5, while a concrete dike will not.

Hạng mục đầu tư	Chi phí (30 năm)	Lợi ích / 1 EUR đầu tư
Phục hồi đất ngập nước ven biển Hà Lan, giai đoạn 1995–2015 (tổng hợp 40+ dự án)	1 EUR	5 – 8 EUR SROI cao nhất trong nhóm
Nâng cấp đê điều bê tông Hạ tầng cứng truyền thống, khấu hao 30–50 năm	1 EUR	1.5 – 2 Không tự nâng cấp theo thời gian
"Room for the River" (phương án B đã chọn) 2,3 tỷ EUR tổng đầu tư, hoàn thành 2015	2.3 tỷ EUR	Tiết kiệm 3 tỷ So với phương án đê điều

Bảng 2. Tỷ suất hoàn vốn xã hội (SROI) — Hạ tầng xanh vs Hạ tầng xám, Hà Lan
Nguồn: PBL Netherlands Environmental Assessment Agency; Deltares (2016)

Figure 3: Social Return Rate – Green Infrastructure vs. Gray Infrastructure in the Netherlands

Source: PBL Netherlands Environmental Assessment Agency; Deltares (2016)

From account to action: The "Room for the River" program

Evidence from the NCA directly shaped one of the Netherlands' boldest policy decisions: the "Room for the River" (***Ruimte voor de Rivier*** **) program** , launched in 2006 with a budget of €2.3 billion.

Background: Following the near-severe floods of 1993 and 1995, the Dutch government faced a choice between two options — (A) raising and reinforcing the entire dike system at an estimated cost of €5.3 billion, or (B) "returning space to the river" by relocating some residential areas away from the floodplain, expanding floodplains, digging additional channels, and restoring wetlands — at a cost of €2.3 billion. NCA analysis showed that option B was not only €3 billion cheaper but also generated an additional €1.2 billion in new ecosystem services (recreation, water purification, biodiversity), while reducing the risk of further flooding in the long term due to greater adaptability to climate change.

The program, completed in 2015, was implemented at 30 sites along the Rhine, Maas, and Waal rivers. Post-audit assessments confirmed: significantly increased flood protection, increased riverside property values, and markedly restored biodiversity indicators—comprehensive results that could not have been achieved with investment in hard infrastructure alone.

Success factors and institutional lessons

The Dutch model's success is due not only to the technical quality of the NCA, but also to several key institutional factors:

Institutional integration: The Netherlands Environmental Assessment Agency (PBL) plays a formal role in the budget approval process — all public investment projects over €100 million related to water management must include a quantitative ecosystem impact assessment . The NCA is not an optional advisory report but a mandatory document in the assessment dossier.

Long-term monitoring data: The Netherlands maintains a continuous hydrological and ecological monitoring network for decades, providing reliable *baseline data* for all NCA calculations. Without high-quality historical data, estimates of ecosystem service values would be questionable and difficult to incorporate into policy decisions.

Multidisciplinary technical capabilities: The NCA development teams include ecoeconomists, hydraulic engineers, ecologists, and GIS specialists—reflecting the view that NCA is a product of multiple disciplines and cannot be effective based on a single specialization.

Effective policy communication: The Dutch government invested in presenting NCA results in language that policymakers and the public could understand — not dense academic reports, but infographics.

2.2.5 . Norway — Sustainable Fish Resource Accounting

Norway has implemented fish resource accounting since 1985 — the world's longest-running continuous fisheries NCA program — providing a 40-year historical data series. This system is directly integrated into the annual fishing quota decision-making process: the catch threshold is determined by maintaining a non-negative net fish asset value according to SEEA-CF. The result: Norway maintains a fish export industry worth over $12 billion per year while much of the global marine fish population is declining. The North Atlantic herring population — once nearly extinct in the 1960s — has fully recovered thanks to NCA-based management.

1. Global pioneering position

Norway was one of the first countries in the world to establish natural resource accounts linked to a national economic planning system. Norway's first natural resource accounts were established for energy, minerals, forests, fish, and land use in the early 1980s. The aim was to provide a better long-term planning foundation for resource use, through new and improved data, coordinated efforts, and the integration of resource planning with traditional economic planning.

Norway has a long history of developing management tools for sustainable development — from the early development of natural resource accounts in the 1980s, through discussions about the usefulness of indicators such as "green GDP", to efforts to develop sustainable development indicators.

2. History of fisheries statistics — a solid data foundation

Fishery statistics were first presented in a separate publication in 1868. The Fisheries Service took over the preparation of this publication in 1900. Since 1977, this has been the responsibility of Statistics Norway (SSB) in collaboration with the Fisheries Service.

The purpose of collecting data on fishing yields is to gather the necessary information to ensure the viable management of marine resources—through resource control and quotas, and high-quality fisheries statistics. The data forms the basis for research in management, strategic analysis, fleet structure analysis, and the consequences of administrative actions on the industrial economy. Fisheries statistics are part of the national accounts.

3. Financial accounting framework — calculation of resource land rent

The most fundamental and unique aspect of the Norwegian model is the integration of fish resource values into the System of National Accounts (SNA), particularly through the concept of **resource** *rent* .

Statistics Norway has calculated the value of Norway's natural resources over many years based on data from the System of National Accounts (SNA). Resources included in the Norwegian SNA encompass renewable resources—agriculture, forestry, aquaculture, fisheries, and hydropower—and non-renewable resources—oil, gas, and minerals. The SSB has periodically calculated resource rent time series for all Norwegian natural resource sectors for use as indicators of sustainable development.

This calculation yields an important—and controversial—financial rent: realized resource rent is negative for all years except 2010–2011 and 2015–2016. The reason for the negative rent is primarily the high labor compensation relative to the gross product. Regardless of this, resource rent has increased over time due to industry consolidation.

Using numerical optimization models, the counterfactual value of resource land rent if the 2011 quota were exploited efficiently is estimated at approximately 9.3 billion NOK — 7 billion NOK more than the observed actual value, meaning that the Norwegian fishing industry contributed four times more to national assets than the official SNA figures suggest.

4. Quota System — Account-Based Management Tool

Total Allowable Quota (TAC)

The establishment of TACs based on prudent management strategies and harvest control rules since the beginning of this century has contributed to the recovery of depleted stocks and laid the foundation for improved profitability in fisheries.

Individual Ship Quotas (IVQ/ITQ) are transferable.

Harvest control rules based on reference points proposed by ICES were developed for all major commercial fish stocks in the Norwegian fisheries in the early 2000s. For Barents Sea species such as capelin, Arctic Northeast cod, and haddock, species-specific harvest control rules were developed and agreed upon by the Norwegian-Russian Joint Fisheries Commission.

Ecosystem approach

ICES adopted an ecosystem approach strategy in 2002, and this ecosystem approach is now a central principle for Norwegian fisheries management. Since 2004, there has been a shift from separate fishery and oceanographic surveys to comprehensive ecosystem surveys.

6. Legal basis — Law on Marine Resources 2008

The Marine Resources Act of June 6, 2008, stipulates that "marine wildlife resources belong to the whole of Norwegian society," setting out the goals and requirements for Norwegian fisheries policy and providing the legal basis for calculating and redistributing resource rent.

7. Contributing to international standards

In many ways, Norway has pioneered the use of cost-effective management measures, including the early implementation of CO2 taxes and individual quotas in fisheries. The focus on conserving natural capital and the principle of prudence is evident in Norway's policy objectives on climate change and fisheries.

Norway is one of the countries that has published an ecosystem account under the SEEA-EA framework, along with Australia, Canada, Costa Rica, Colombia, Indonesia, Italy, Mexico, the Netherlands, the Philippines, Rwanda, Spain, and Uganda.

8. Lessons learned and limitations

Outstanding achievements

Deep integration of SNA–fisheries: Norway is one of the rare countries that has regularly included the value of fish resources in its National Accounts since the 1980s — setting a precedent for the global SEEA-CF in 2012.

The policy feedback loop works well: Data from the SSB → IMR stock assessment → ICES recommendations → Norwegian-Russian Commission establishes TAC → Fisheries Department allocates quotas – this cycle is strictly enforced annually.

Successful stock recovery: Arctic Northeast cod are now at historically high biomass levels after a period of severe decline — thanks to data-driven accounting management.

Limitations still exist.

The national asset index only includes inputs used to produce net national income under the SNA — resource rent calculations based on official statistics may underestimate the role of natural resources. Limited available data prevents the construction of comprehensive marine ecosystem accounts.

To compare the systems of lessons learned from the five countries above and determine the priority levels for experience transfer, Table 1 below summarizes the dimensions most relevant to the context and priorities of developing countries with long coastlines, especially Vietnam.

Table 3: Summary of international experience and lessons learned for developing countries

Nation	Outstanding model	The measured results	Priority lesson
Australia	National Ecosystem Accounting (INEA)	56 billion AUD worth of coral reefs; 3 billion AUD invested in restoration.	Develop a GIS-satellite platform; prioritize accounting for coral reefs and mangrove forests.
Seychelles	Debt-for-nature swap; MSP based on NCA	30% of the sea is protected; $21.6 million in debt restructuring.	Developing innovative financing mechanisms: green bonds, debt-to-nature swaps.
Costa Rica	25-year sustainable PES; Blue GDP	Green GDP is 8–12% higher than conventional GDP; forests are doubling.	Linking NCA with PES for coastal fishing and salt-producing communities.
Netherlands	NCA delta; Room for the River; BCR 5–8x	Savings of €3 billion; conservation return rate of 5–8 times.	Integrating NCA into coastal plain planning and sea dike systems.
Norway	40-year accounting system; quota management based on NCA.	Seafood exports reach $12 billion per year; fish populations are recovering.	Methods for accounting for fish stocks; integration into fisheries management.

Source: *Compiled from ABS (2022); Government of Seychelles (2020); SINAC-Costa Rica (2021); PBL Netherlands (2023); Statistics Norway (2023).*

3. Selecting priority sectors/fields

3.1. Marine economic sectors

3.1.1 . Marine tourism and services

According to statistics from the Vietnam National Administration of Tourism, during the period 2010-2019 (before the Covid-19 pandemic), the number of tourists visiting coastal localities consistently increased faster than the national average growth rate, reaching 13.6% per year for international tourists and 12.3% per year for domestic tourists. In 2019, international tourists to coastal provinces accounted for 71.9% of the total international tourists to Vietnam; domestic tourists to coastal provinces accounted for 59% of the total domestic tourists; and total tourism revenue from the 28 coastal provinces and cities accounted for 67% of the total tourism revenue nationwide. The number of hotel rooms in coastal provinces also accounted for two-thirds of the total number of hotel rooms nationwide; most 4-5 star hotels are also concentrated in coastal provinces and cities. Many coastal resorts have won prestigious awards from reputable international tourism organizations...

3.1.2. Maritime Economy

Maritime transport: Regarding shipping routes, 25 international shipping routes have been established. In addition to intra-Asia routes, the northern region has developed two routes to North America, while the southern region has established 16 long-haul routes to North America and Europe, surpassing other Southeast Asian countries (only behind Malaysia and Singapore).

Vietnam's port system currently comprises 286 berths, distributed across 6 port groups, with a total wharf length of over 96 km. The infrastructure is capable of handling over 692 million tons of cargo in 2020. Gateway ports combining international transshipment have been established in the North and South; successfully receiving container ships up to 132,000 DWT at the Lach Huyen port area (Hai Phong) and up to 214,000 DWT at the Cai Mep port area (Ba Ria-Vung Tau). Most ports are connected to major economic centers and regions nationwide, forming large seaports that serve as hubs for import and export of goods and create momentum for regional development, such as: Quang Ninh and Hai Phong (connected to the Northern key economic region), Nghi Son (Ha Tinh), Thua Thien-Hue, Da Nang, Quang Ngai, and Quy Nhon (connected to the Central key economic region), Khanh Hoa, Ba Ria-Vung Tau, and Ho Chi Minh City. Ho Chi Minh City and Dong Nai are associated with the Southeast economic growth region, while Can Tho, Long An, and An Giang are associated with the key economic region of the Mekong Delta.

In terms of scale and quality: In recent times, Vietnam's seaport system has received significant investment, with its current scale and technology reaching

international standards, especially the container port system (Vietnam's two major seaports, Hai Phong and Ho Chi Minh City, are both among the top 50 largest container ports in the world) [44].

3.1.3. Exploitation of oil, gas, and other marine mineral resources

Domestic oil and gas exploration

Domestic oil and gas exploration and production began in 1986 with the Bach Ho field, gradually developing and expanding with the subsequent addition of several large-reserve fields such as Dai Hung, Rang Dong, Ruby, Su Tu Den, Rong, Te Giac Trang, Thien Ung, Ca Tam (for oil), Lan Tay, Lan Do, Rong Doi, Hai Thach Moc Tinh… and more recently Phong Lan Dai (for gas). Oil production peaked in 2004, mainly due to the largest fields such as Bach Ho, Su Tu Den, Hai Su Trang, and Hai Su Den being in their peak production phase.

During the period 2006-2015, the entire oil and gas industry contributed an average of 20-25% of total state budget revenue and 18-25% of the country's GDP. Since 2015, the oil and gas industry has continuously faced a series of challenges and difficulties due to economic instability, pressure from sharply falling oil prices, the COVID-19 pandemic, geopolitical conflicts, and disruptions in global supply chains. Petrovietnam still contributes an average of 10-13% of the country's GDP; accounts for 9-11% of total state budget revenue and 16-17% of total central government budget revenue.

It is evident that the oil and gas industry has become a special economic sector, an important tool for macroeconomic regulation by the Government, and a sector making significant contributions to solving the country's socio-economic problems. Many projects and industrial plants of the oil and gas industry, such as the Dung Quat Refinery, the Ca Mau Gas-Electricity-Fertilizer Complex, the Vung Ang 1 Thermal Power Plant, the Thai Binh 2 Thermal Power Plant, etc., have yielded positive socio-economic development results wherever they are implemented. In 2023, the contribution to the state budget in the first six months reached VND 78.3 trillion (July 30, 2023); the total revenue of the Vietnam Oil and Gas Group, according to plan, reached VND 677.7 trillion (October 10, 2023).

Oil and gas exploration overseas

Oil production abroad began contributing to the national oil market in 2006 with the PM-304 project. To date, five projects have been put into production, including PM-304, SK-305 (Malaysia), Peru 67 (Peru), Nhenhetsky (Russia), and Bir Seba (Algeria). However, the majority of overseas production comes from the Nhenhetsky field, accounting for approximately 70% of total output.

To date, overseas projects have extracted 13.6 million tons of oil. In 2020, overseas oil production reached 1.82 million tons.

Alongside domestic investment and development, PVN has actively sought and expanded investment to countries in Asia, Europe, Africa, and the Americas. From 1999 to the present, PVN has implemented 32 oil and gas projects and contracts abroad, of which projects constructed through direct negotiations with host countries and partners account for the majority (75%), while projects constructed through competitive bidding account for a low percentage (25%).

3.1.4 . Aquaculture and seafood harvesting

To date, approximately 40 different types of fishing methods have been cataloged in Vietnam, categorized into 9 main groups. Of these, gillnet fishing accounts for the largest proportion, at about 33.2%; trawling still holds a significant share, at about 18.6%; longline fishing accounts for about 16.8%; other methods account for about 14.1%; purse seine fishing accounts for about 6.5%; and other fishing methods such as seine nets, gillnets, and fixed nets account for an insignificant proportion of the overall fishing structure.

Specifically for the tuna fishing industry, according to statistics from a project supported by WCPFC, the total number of fishing vessels engaged in tuna fishing in 2019 was over 7,688, including 3,248 vessels engaged in longline fishing (including both longline and handline tuna fishing), 2,156 gillnet vessels, and 2,284 purse seine vessels for tuna fishing.

During the period 2010-2020, the total output of fisheries production increased continuously year by year, from 2.414 million tons in 2010 to 3.861 million tons in 2020, with an average growth rate of 4.8% per year.

The output of marine fisheries in the period 2010-2020 increased quite rapidly, reaching approximately 5.1% per year. Specifically, the output in 2010 was 2.22 million tons, which increased to 3.66 million tons in 2020. In the structure of the catch, marine fish production consistently accounted for a large proportion, reaching nearly 82% of the total catch in 2020.

Regarding the catch of ocean tuna, according to statistics from a project supported by WCPFC, the total catch of ocean tuna in Vietnam's exclusive economic zone in 2019 was approximately 109,314 tons, a decrease of 9.3% compared to 2018. Of this, skipjack tuna accounted for about 87,357 tons (80%), yellowfin tuna 19,499 tons (18%), and bigeye tuna about 2,458 tons (2%).

Along with the increase in total fishing output, offshore fishing output is also rapidly increasing and accounts for a large proportion of the total output.

In 2020, the total catch in the coastal area was approximately 0.317 million tons, accounting for 8.6%; in the offshore area approximately 0.490 million tons, accounting for 13.4%; and in the deep-sea area approximately 2.859 million tons, accounting for 78% of the total catch in the sea area.

During the period 2010-2020, along with the development of the fishing fleet and the increase in seafood production, the value of seafood production also tended to increase continuously year by year. The value of seafood production at constant 2010 prices increased from VND 58.8 trillion (2010) to VND 108 trillion (2020). The average growth rate of seafood production value during the 2010-2020 period reached 6.3% per year; however, the proportion of seafood value in the fisheries sector tended to decrease from 37.9% in 2010 to 36.1% in 2020.

Vietnam's exports of harvested seafood in 2020 reached US$3.2 billion, a 1.2% increase compared to the same period in 2019. The total area for aquaculture in 2023 reached 9.5 million m^3 of sea cages. Of this, marine aquaculture increased by 5.5%, including: 4.3 million m^3 of sea fish cages; 5.2 million m^3 of lobster cages; and 57,000 hectares of mollusk farming. Total marine aquaculture production reached 789,800 tons, a 10.1% increase compared to 2022, including: 46,000 tons of sea fish; 3,800 tons of lobster; 440,000 tons of mollusks; and 300,000 tons of other species. Brackish water aquaculture reached a total area of approximately 920,000 hectares, with a production of 1.496 million tons, including 274,000 tons of tiger shrimp and 845,000 tons of whiteleg shrimp. High-value export products include marine fish, shrimp, squid, octopus, and crabs. Exports have reached 115 markets worldwide, with the US, Japan, China, South Korea, the EU, and ASEAN being the largest export markets in terms of value.

3.1.5. Coastal industries

Coastal industries can be understood as industries located in coastal provinces. Accordingly, coastal industries are currently concentrated mainly in coastal economic zones. There are currently 18 coastal economic zones developed nationwide. Many economic zones, such as the Nghi Son Economic Zone, the Chu Lai Open Economic Zone, and the Dinh Vu-Cat Hai Economic Zone, have developed strongly, becoming growth engines not only for their localities but also for the entire region.

To date, 28 coastal localities have established 18 coastal economic zones, with only one remaining to be established: the Ninh Co Economic Zone (Nam Dinh province) with a planned area of 13,950 hectares. The 18 established coastal economic zones have a total area of 857.6 thousand hectares (including sea surface area). Of this, the land area is approximately 568.4 thousand hectares

(accounting for 1.68% of the total area), including about 99.2 thousand hectares planned for the development of functional zones (free trade zone: approximately 8.6 thousand hectares; industrial zone within the economic zone: approximately 39.8 thousand hectares; functional zone for production, trade, tourism, and services: approximately 53.8 thousand hectares).

These economic zones have attracted 254 foreign investment projects with a total registered capital of US$42 billion and 1,079 domestic investment projects with a total investment capital of approximately VND 805.2 trillion. In total, about 60,400 hectares of land have been developed by investors for infrastructure and production facilities, and are now operational. The total area of land leased for production investment projects in coastal economic zones reached approximately 44,100 hectares, accounting for about 45% of the total land area allocated for industrial production, tourism, and services in coastal economic zones. Notably, many investment projects in coastal economic zones are in important, large-scale industrial sectors such as petrochemicals, integrated iron and steel production, heavy machinery manufacturing, automotive engine production, and power generation.

Coastal economic zones have initially played a significant role, contributing to the socio-economic development of coastal localities and economic regions, creating hundreds of thousands of direct and indirect jobs, primarily for the workforce in coastal areas, training high-quality human resources, and helping to improve the income and living standards of local people.

The economic structure of many coastal provinces and cities has shifted significantly from agriculture and small-scale industries to services (with a focus on tourism and resort services); at the same time, important industrial centers of the country have been formed, such as the Nghi Son Refinery and Petrochemical Complex, the Vinh Tan Thermal Power Center, and the Ca Mau Gas-Electricity-Fertilizer Complex, etc. The labor structure of coastal provinces and cities has also shifted from agriculture and fisheries to services and industry. Vocational training and career guidance have developed strongly in some localities such as Quang Ninh, Thanh Hoa, Nghe An, and Ha Tinh…

On the other hand, investment in the development of coastal economic zone infrastructure, including foreign investment, has contributed to modernizing the infrastructure system for coastal localities and economic zones, creating transportation and infrastructure connections nationwide, bringing positive effects to the development of the region. The combination of developing coastal economic zones and industrial parks with the construction of economic-defense zones in coastal and island areas has also been emphasized, contributing positively to strengthening national defense and security, and

firmly protecting the sovereignty, unity, and territorial integrity of the Fatherland.

Furthermore, the location of coastal economic zones plays a crucial role in forming economic centers for coastal regions and localities, closely linked to seaports and airports, creating favorable conditions for economic exchange, trade, services, and human resource development. The formation of coastal economic zones has contributed to promoting urbanization in coastal areas and has initially formed a "Coastal Urban Chain" with nearly 600 cities, accounting for approximately 8% of the total number of cities nationwide with a population of about 19 million people, most clearly evident in the central and southern coastal regions. Several modern resorts, entertainment areas, and accommodation facilities have been built around coastal economic zones, contributing to the promotion of tourism activities and providing permanent housing for experts and business managers from around the world who come to live and work long-term in these economic zones. In the long term, these areas will become urban centers with highly qualified residents working within the economic zones.

The "port-city-sea" model has been successfully implemented and is moving in the right direction in many localities. The face of many provinces and cities has fundamentally changed, such as Quang Ninh, Hai Phong, Da Nang, Quang Nam, Binh Dinh, Phu Yen, Khanh Hoa, and Ba Ria-Vung Tau… and has become a locality with urban centers attracting many people from all over the country to work and live, instead of the previous trend of concentrating in two major cities like Hanoi and Ho Chi Minh City.

3.1.6. Renewable energy and new marine economic sectors.

Renewable energy sources in Vietnam's seas are diverse (radiative, wind, wave, tidal, thermal, and bioenergy). Over the years, research has been invested in onshore and offshore wind and solar energy sources. Many research projects on integrated power plants combining solar and wind power have been studied and implemented (such as at Bach Long Vi, Con Co, and Cu Lao Cham...).

The provinces of Binh Dinh, Ninh Thuan, and Binh Thuan have been pioneers in implementing several wind power projects. The wind power industry only began to flourish in Vietnam in 2019, although not as spectacularly as solar energy. However, with investment and research efforts, along with leveraging these potential renewable energy sources, Vietnam hopes to develop a sustainable and environmentally friendly energy source in the future.

Offshore wind power development offers several significant advantages. Offshore areas typically have stronger and more stable winds compared to

inland and coastal areas, enabling greater and more consistent electricity production. The vast open space at sea allows for the construction of a large number of wind turbines. In contrast, coastal and nearshore areas have more limited space, occupying significant land previously used for aquaculture and facing numerous legal, environmental, and social constraints. Offshore wind turbines are positioned further offshore, minimizing noise and visibility disruption to coastal communities and landscapes. Their placement also avoids interference with other maritime activities such as shipping, fishing, and tourism, ensuring safety and reducing conflicts between different industries. However, offshore wind power development also presents several challenges, including high initial investment costs, difficulties in transportation and installation, and requirements for managing the marine environment and ecological resources. Thorough assessment and sustainable management are necessary to ensure that the benefits of offshore wind power are maximized and negative impacts are minimized. To meet the demand for renewable energy development and reduce dependence on fossil fuels, the Government is considering the possibility of developing offshore wind power projects. On average, each 1 MW of wind power will occupy approximately 18.6 hectares of sea.27 Based on planning scenarios, the potential use of sea space for offshore wind power development in Vietnam is calculated. (i) High scenario for operation: By 2030, approximately 6,000 MW of offshore wind power will be operational, occupying approximately 130,200 hectares of sea. During the period 2031-2050, capacity will increase by approximately 80,000 MW, equivalent to utilizing an additional 1,488,000 hectares of sea. (ii) High scenario: By 2030, approximately 4,000 MW of offshore wind power will be operational, occupying approximately 74,400 hectares of sea by 2030. During the period 2031-2050, capacity will increase by approximately 79,500 MW, equivalent to utilizing an additional 1,478,700 hectares of sea.

(iii) Baseline load scenario: During the period 2021-2030, no offshore wind power projects will participate in the power system. During the period 2031-2050, development will reach a total capacity of 46,000 MW, equivalent to a sea surface area requirement of approximately 855,600 hectares. Based on the above scenarios, by 2030, the estimated sea surface area required for offshore wind power development is approximately 334,800 hectares. From 2031 to 2050, this area is expected to increase from 1,302,000 hectares to 1,701,900 hectares. Thus, the development of offshore wind power will create significant pressure on the use of marine space. At the same time, it also opens up opportunities for Vietnam to utilize renewable energy sources, reduce dependence on fossil fuels, and promote sustainable development.

3.2. Identifying priority sectors/fields

In the context of promoting sustainable marine economic development and fulfilling commitments on green growth, climate change adaptation, and biodiversity conservation, identifying priority marine economic sectors in Natural Capital Accounting (NCA) is crucial for Vietnam. Priority sectors include fisheries and aquaculture, marine tourism, seaports and maritime transport, coastal construction and infrastructure, coastal industries, and coastal commercial services. These sectors are closely linked to important marine and coastal ecosystems such as mangrove forests, seagrass beds, and coral reefs, and play a significant role in the national marine economic structure.

Aquaculture and fisheries are sectors most directly dependent on marine ecosystem services. Mangrove forests, seagrass beds, and coral reefs serve as habitats, breeding grounds, nurseries, and food sources for many economically valuable aquatic species. Simultaneously, these ecosystems contribute to maintaining water quality, stabilizing the ecological environment, and protecting aquaculture areas from waves, wind, and erosion. However, overfishing, the use of destructive fishing gear, the conversion of mangrove forests to aquaculture, or the discharge of wastewater from concentrated aquaculture areas also create significant pressure on marine ecosystems. This sector clearly demonstrates the two-way relationship between dependence on natural capital and the impact on its depletion, making it particularly suitable for a natural capital accounting approach.

Marine tourism and ecotourism are also priority sectors due to their heavy reliance on environmental quality and natural landscapes. Marine ecosystems offer numerous cultural and recreational services such as island and coastal scenery, beaches, scuba diving, coral viewing, and biodiversity experiences. In many coastal localities of Vietnam, marine tourism is becoming an important driver of economic growth. However, the rapid development of tourism also brings with it many pressures such as increased waste, wastewater, boat mooring, coastal infrastructure development, and direct impacts on coral reefs or tidal flats. Integrating the tourism industry into natural capital accounting helps quantify the economic value of ecosystem services and assess the trade-offs between tourism development and marine resource conservation.

Seaports and maritime transport play a strategic role in the development of the national marine economy, especially in the context of Vietnam promoting maritime logistics and international economic integration. However, dredging activities, anchorage, ship discharge, cargo transportation, and port expansion can cause turbidity, sedimentation, pollution, and disruption of seabed habitats, thereby affecting seagrass beds, coral reefs, and coastal ecosystems. This sector has a large spatial impact and often creates long-term cumulative impacts on ecosystems; therefore, it needs to be prioritized in the assessment of marine natural capital and marine spatial planning.

Coastal infrastructure development is also one of the priority sectors to analyze in natural capital accounting. Coastal urbanization, industrial park and tourism

development, dikes, land reclamation, and land encroachment are significantly altering the structure and function of coastal ecosystems in Vietnam. Many mangrove forests, tidal flats, or coastal habitats have shrunk or fragmented due to land-use changes. These impacts are often long-lasting and difficult to reverse, directly affecting the ability to protect the coastline, absorb carbon, regulate hydrology, and maintain biodiversity. Including coastal construction and infrastructure in the analysis will help to better assess the environmental costs and natural capital losses caused by coastal spatial development activities.

Coastal industries are another important sector to consider in natural capital accounting due to the risk of large-scale pollution and degradation of the marine environment. Industries such as thermal power, processing, mining, chemicals, or heavy industries often generate wastewater, solid waste, thermal pollution, or heavy metal contamination, which can directly or indirectly impact marine and coastal ecosystems. In many coastal areas of Vietnam, industrial clusters and ports are developing rapidly, creating significant pressure on water quality and coastal sediments. Quantifying environmental externalities and ecosystem service losses from industrial activities is a crucial aspect of natural capital accounting.

In addition to the sectors mentioned above, commercial and coastal services also need to be considered to fully reflect the economic dependence on marine natural capital. Activities such as coastal restaurants, commercial services, fisheries logistics, or tourism services depend significantly on the environmental quality and operations of other marine economic sectors. Although the direct impact of this group of sectors may be lower, the cumulative impact from population growth, waste, and coastal space use can still put significant pressure on the ecosystem if not properly managed.

The prioritization of the aforementioned sectors in marine natural capital accounting stems from four main reasons. Firstly, these sectors are highly dependent on marine and coastal ecosystem services. Secondly, they also exert significant pressure on natural capital through habitat change, pollution, overexploitation, or changes in coastal spatial structure. Thirdly, these sectors make a significant contribution to marine economic growth, creating jobs and livelihoods for coastal communities. Fourthly, these sectors clearly demonstrate the trade-off between economic development and ecosystem conservation, making them particularly suitable for applying a natural capital accounting approach to support marine spatial planning, policy formulation, and sustainable marine economic development management in Vietnam.

Table 4. Analysis of the dependence and impact of marine economic sectors on marine and coastal ecosystems.

Industry/ Field	**Level of dependence on the ecosystem**	**Key dependent ecosystem services**	**Level of impact on the ecosyste**	**Key pressures/impacts**	**The ecosyste m is greatly**

			m		**impacted.**
Fisheries	Very high	Fishery resources; breeding and nursery grounds; natural food chains; ecological regulation.	High	Overfishing; destructive fishing gear; seabed disturbance; biodiversity loss.	Coral reefs; seagrass beds; mangrove forests
Aquaculture	Very high	Water quality; shoreline protection; environmental regulation; habitat for aquatic organisms.	Very high	Mangrove forest conversion; organic pollution; eutrophication; sedimentation; wastewater discharge	Mangrove forests; seagrass beds
Beach tourism and ecotourism	High	Landscape; biodiversity; snorkeling/diving; recreation services	Medium - High	Anchoring ships; trampling on coral reefs; litter; wastewater; tourism infrastructure development.	Coral reefs; tidal flats; coastal areas
Seaports and maritime transport	Medium	Natural conditions of the coastal waters; stable waterways.	High	Dredging; turbulence; oil and grease; ballast water; sediment disturbance; anchoring	Seagrass beds; coral reefs
Coastal construction and infrastructure	Low - Medium	Natural shoreline protection services; shoreline stabilization.	Very high	Land reclamation; leveling; habitat destruction; hydrological changes; ecosystem fragmentation.	Mangrove forests; tidal flats; seagrass beds
Coastal industries	Short	Coastal water resources and spaces	Very high	Water pollution; industrial waste; thermal pollution; heavy metals; sedimentation	The entire coastal ecosystem
Coastal trade and services	Medium	Environmental quality; landscape;	Low - Medium	Waste; wastewater; coastal space	Coastal areas; tidal flats

		tourism and fisheries activities		pressure	
Offshore renewable energy (offshore wind power)	Medium	Oceanographic conditions; seabed stability; marine space	Medium	Disturbance of the seabed; underwater noise; changes in local habitats.	Seagrass beds; benthic habitat
Coastal mining and material extraction	Short	Coastal geological space and resources	High	Dredging; sedimentation; turbidity; destruction of the seabed.	Seagrass beds; coral reefs
Fisheries logistics services and fishing ports	Medium	Fishery resources; water quality	Medium	Wastewater; solid waste; oil and grease; coastal air pressure	Estuary area; coastal area

4. Proposed methods for applying Natural Capital Accounting (NCA) to Vietnam

4.1. Approaches to applying NCA to Vietnam

In the context of Vietnam promoting green economy, circular economy, sustainable marine economy, and fulfilling its commitment to net-zero emissions by 2050, the application of Natural Capital Accounting (NCA) is considered a crucial tool for integrating the value of natural capital into the policy-making and development decision-making system. Unlike traditional approaches that focus solely on economic growth, NCA allows for the quantification of the relationship between ecosystems and the economy, including the ecosystem's contribution to economic sectors as well as the impacts of development activities on natural capital.

For Vietnam, the application of NCA needs to be built on a foundation that combines international frameworks such as SEEA EA (System of Environmental-Economic Accounting – Ecosystem Accounting), Natural Capital Protocol, and Ocean Accounting Framework with the country's data conditions, statistical systems, and resource management context. This approach allows Vietnam to ensure international compatibility while also being able to apply it flexibly given its developing data capacity and institutional framework.

One of the key principles of the NCA is the approach of prioritizing ecosystems and economic sectors. In the context of Vietnam, priority ecosystems include mangrove forests, seagrass beds, coral reefs, wetlands, and natural forests, as these ecosystems provide many important ecosystem services but are under significant degradation pressure. At the same time, economic sectors with a high degree of dependence on or impact on natural capital, such as fisheries and aquaculture, marine tourism,

seaports, coastal industries, coastal infrastructure development, and offshore renewable energy, should be prioritized for analysis.

Table 5. Priority ecosystems and economic sectors for NCA application in Vietnam

Group	Priority group	Reason for priority
Ecosystem	Mangrove forests	Coastal protection, carbon sequestration, aquatic habitat
	Coral reef	Supporting fisheries resources, tourism, and biodiversity.
	Seagrass carpet	Seedling beds, seabed stabilization, green carbon
	Wetlands	Water regulation, water filtration, disaster mitigation.
	Natural forest	Climate regulation, erosion control, biodiversity
economic sector	Fisheries and aquaculture	Directly dependent on ecosystem services.
	Beach tourism	Depending on the landscape and environmental quality
	Seaports and maritime transport	Major impact on coastal ecosystems.
	Coastal construction and infrastructure	Habitat conversion and land reclamation
	Coastal industries	Pollution risks and environmental periphery
	Offshore renewable energy	The need for future expansion of maritime space.

4.2. Proposed NCA implementation process

The process of applying NCA to Vietnam can be implemented in six main steps, including: (i) identifying the scope and priority targets; (ii) developing ecosystem asset accounts; (iii) assessing ecosystem services; (iv) assessing the dependencies and impacts of economic sectors; (v) integrating with national economic accounts; and (vi) applying to planning and policy formulation.

In the initial phase, it is necessary to establish accounts of the extent and condition of ecosystems. This is a fundamental step in determining the area, distribution, quality, and trends of ecosystem change. GIS, remote sensing, Sentinel/Landsat satellite imagery, field surveys, and environmental monitoring data should be integrated to build a spatial database of natural capital.

After determining the current state of the ecosystem, the next step is to assess ecosystem services. This assessment should incorporate both physical and economic values. Priority services should include provision services (fisheries, water), regulatory services (coastal protection, carbon sequestration, water filtration),

cultural services (tourism, landscape), and support services (maintaining biodiversity, breeding habitats).

Table 6. Priority ecosystem service groups in the NCA

Ecosystem Services Group	**Example of a service**	**Socio-economic significance**
Services provided	Fishery resources, water, biological materials	Livelihood and production support
Air conditioning service	Coastal protection, carbon sequestration, water purification.	Reducing risks from natural disasters and climate change.
Cultural services	Tourism, entertainment, scenery	Generating revenue and social value
Support services	Food cycle, habitat of organisms	Maintaining ecosystem function

A key component of the NCA is assessing the dependence and impact of economic sectors on the ecosystem. This assessment helps identify sectors that are both heavily dependent on ecosystem services and exert significant pressure on natural capital. For Vietnam, the impact-dependence matrix approach, combined with expert scoring, GIS analysis, and stakeholder consultation, is most suitable given the current data.

Sectors such as fisheries, aquaculture, and marine tourism often have a very high degree of dependence on marine ecosystems, while coastal infrastructure development, coastal industries, and port construction often create significant pressures such as land reclamation, pollution, sedimentation, and habitat change. Quantifying both dependence and impact simultaneously will help identify trade-offs between economic development and the conservation of natural capital.

Table 7. Illustration of the dependency-impact analysis of marine economic sectors.

Industry/Field	**Level of dependence**	**Level of impact**	**The main pressure on the ecosystem**
Fisheries	Very high	High	Over-exploitation, bottom disturbance
Aquaculture	Very high	Very high	Mangrove forest conversion, pollution
Beach tourism	High	Medium - High	Ship mooring, waste disposal, infrastructure
Seaports and maritime transport	Medium	High	Dredging, muddying, oil and grease
Coastal infrastructure development	Medium	Very high	Land reclamation, leveling, and habitat fragmentation.
Coastal industries	Short	Very high	Water and sediment pollution

After completing the ecosystem services and impact-dependence assessment, the results need to be integrated with economic data such as GDP/GRDP, output value,

employment, industry contribution, and public investment. This integration helps to form indicators such as ecosystem contribution to GDP, ecosystem degradation costs, or natural capital depletion to more fully reflect the environmental costs of economic development.

4.3. Proposed roadmap for NCA implementation in Vietnam

In the short term, Vietnam should focus on developing a national methodology framework and implementing pilot programs in several coastal localities with important ecosystems. Simultaneously, it is necessary to build a GIS database and a system for monitoring ecosystem changes.

In the medium term, it is necessary to gradually integrate the NCA into the national statistical system, marine spatial planning, green growth strategy, and strategic environmental assessment. In the long term, Vietnam can build a national natural capital accounts system as part of an expanded national accounts system, thereby supporting the transition to a development model based on the maintenance and recovery of natural capital.

The application of NCA not only helps quantify the contribution of ecosystems to the economy but also supports the assessment of trade-offs between development and conservation, thereby improving the quality of decision-making and moving towards long-term sustainable development.

Phase 1: Refine the methodology and prepare the data.

The first phase of the project focuses on building the technical and data foundation for NCA deployment. This phase is crucial to the quality and feasibility of the entire project.

The main activities during this phase include:

- Review and standardize existing data sources;
- Develop a spatial database of marine and coastal ecosystems;
- Refine the set of indicators and evaluation methods;
- Develop technical procedures for ecosystem accounting;
- Establish a mechanism for coordination and data sharing among relevant agencies.

Phase 2: Pilot Implementation

After finalizing the methodology and baseline data, the project will be piloted in several priority areas to verify the suitability and applicability of the proposed approach. The pilot locations are expected to be selected based on the following criteria:

- It has important marine and coastal ecosystems;
- There is significant pressure to develop the economy;

- There is a high demand for resource management and planning;
- There is a willingness to participate from local authorities.

During the pilot phase, the project will:

- Create ecosystem accounts for priority ecosystems;
- Evaluating and pricing ecosystem services;
- Analyze development scenarios;
- Experimenting with integrating NCA results into planning and management.

The pilot results will be used to evaluate the feasibility, effectiveness, and scalability of the deployment model.

Phase 3: Integration into planning and policy

Following the pilot phase, the project will focus on integrating NCA findings into the process of developing and adjusting sectoral and local development plans. The integration will include:

- Marine spatial planning;
- Planning for the development of the marine economy;
- Biodiversity conservation planning;
- Coastal land use planning;
- Local-level green growth plan.

The project will develop technical guidelines and policy recommendations to support regulatory agencies in using NCA results for decision-making.

Phase 4: Completing the institutionalization and scaling-up mechanisms

In the final phase, the project will focus on building institutional mechanisms to ensure the sustainability and long-term viability of the NCA system.

The main activities include:

- Proposals to improve the legal framework related to NCA;
- Establish a mechanism for inter-agency coordination;
- Propose a mechanism for updating and managing data;
- Develop a roadmap for expanding the NCA nationwide.

In addition, the project will promote the sharing of lessons learned and the replication of the model to other fields and localities.

4.4. Challenges in Implementing NCA

Despite having a mature methodological framework and rich international experience, the implementation of the NCA still faces two main sets of challenges.

Technical challenge team

- Lack of long-term baseline physical data: especially time series long enough to distinguish long-term trends from short-term natural fluctuations in marine ecosystems.
- Complexity in monetary valuation: non-market services such as climate regulation, marine cultural heritage, and the survival value of biodiversity — CVM methods often have high uncertainty.
- Interdisciplinary workforce shortage: combining ecology, environmental economics, and spatial statistics — this is a rare group of experts in most developing countries.

Institutional challengers

- Lack of inter-sectoral coordination mechanism: The National Committee for Agriculture and Forestry (NCA) involves many ministries and agencies, but there is no clear coordinating body between the statistics agency, the Ministry of Natural Resources and Environment, the Ministry of Finance, and the Ministry of Agriculture, Forestry and Fisheries.
- Lack of a mandatory legal framework to integrate NCA into the national budget planning and allocation process is a crucial factor in preventing NCA from remaining in the pilot phase.
- Political pressure: from affected economic sectors when environmental costs are fully accounted for and reflected in prices and policies.

Data challenges

One of the biggest challenges to implementing NCA in Vietnam today is the limited availability of data. Data on marine and coastal ecosystems is currently scattered among various agencies, lacking methodological consistency and not regularly updated. Many important data types, such as the status of coral reefs, marine environmental quality, and ecosystem services, are still missing or incomplete. Furthermore, economic and environmental data are not yet effectively integrated.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

Natural capital accounting is increasingly seen as an important tool to support the transition to a green and sustainable development model. For Vietnam, the implementation of NCA is particularly important in the context of natural resources and marine ecosystems facing significant pressure from economic development and climate change.

This inaugural report synthesizes initial information and analysis for project implementation, including a review of the current legal and policy framework, an analysis of international experience, a review of relevant studies, consultations with stakeholders, and proposals for an approach and methodology for NCA implementation.

The review results show that Vietnam has many important policies and guidelines related to green growth, resource management, and environmental protection. However, the integration of the value of natural capital into policy-making and development planning processes still faces many limitations.

International experience shows that successful NCA implementation requires a combination of a suitable institutional framework, a comprehensive data system, technical capacity, and effective coordination mechanisms among stakeholders. Based on this, the report proposes several key recommendations as follows:

5.2. Recommendations

Improving the legal and institutional framework

To effectively implement Natural Capital Accounting (NCA) in Vietnam, priority should be given to completing the relevant legal framework and institutional mechanisms to create a foundation for integrating the value of natural resources and ecosystem services into policy planning and development management. Currently, although many national strategies and policies have addressed sustainable resource management, green growth, and biodiversity conservation, Vietnam still lacks a specific legal framework for NCA as well as official technical guidelines on the application of SEEA-CF and SEEA-EA. In the future, it is necessary to research and develop regulations and technical guidelines on marine ecosystem accounting, data standards, and ecosystem service valuation; and to clearly define the roles and responsibilities of relevant agencies such as statistical agencies, environmental resource management agencies, planning agencies, finance agencies, and coastal localities. Establishing an inter-sectoral coordination mechanism will help overcome data fragmentation and enhance the integration of the NCA into the national statistical and planning system.

Strengthening data systems and information infrastructure.

Data is the core foundation for the implementation of natural capital accounting, especially for marine resources and ecosystems, which are highly spatial and volatile. However, currently, data on biodiversity, marine resources, environmental quality, and the marine economy in Vietnam are inconsistent, scattered across many agencies, and not standardized according to SEEA requirements. Therefore, investment is needed to build an integrated database on marine resources and ecosystems on digital platforms, GIS, and remote sensing to support real-time monitoring of ecosystem changes. Simultaneously, it is necessary to promote data sharing mechanisms among ministries, localities, research institutes, and monitoring programs to form an interdisciplinary data system serving marine spatial planning, resource assessment, and the development of marine ecosystem accounts. The application of digital technology, satellite data, and open data platforms will also contribute to improving the quality of resource monitoring and supporting evidence-based marine governance.

Enhancing technical capabilities and human resources.

Implementing NCA requires a team of experts with interdisciplinary knowledge in environmental economics, ecology, statistics, GIS, remote sensing, and ecosystem service valuation. However, the human resources with in-depth expertise in SEEA and ecosystem accounting in Vietnam are currently limited, especially at the local level. Therefore, it is necessary to strengthen training and development of human resources to support NCA implementation through intensive training programs, technical training, and collaborative research with international organizations and domestic training institutions. Besides training technical staff at central ministries and agencies , special attention should be paid to enhancing the capacity of coastal localities – where pilot activities on marine ecosystem accounting are directly implemented and results are applied to resource management. Building a national network of NCA experts will also contribute to strengthening experience sharing and technical support in the long term.

Promote pilot implementation at the local and priority sector levels.

Since natural capital accounting is a relatively new field in Vietnam, pilot implementation in a few priority localities and sectors is necessary to verify the methodology, refine the technical process, and build a practical model before scaling up nationwide. In the initial phase, it is necessary to select coastal localities with highly representative ecosystems and development pressures, such as the Mekong Delta, the central coastal region, or marine protected areas, to pilot the marine ecosystem account. Priority areas could include mangrove forest management, coral reefs, seagrass beds, fisheries, marine ecotourism, and green carbon. The pilot process should focus on developing extent and condition accounts, valuing ecosystem services, and integrating spatial data to support marine spatial planning and coastal zone management. The results and lessons learned from the pilot phase will be crucial for refining the methodology and developing a roadmap for future scaling up.

Strengthening international cooperation and mobilizing resources.

Implementing the National Climate Change Adaptation (NCA) requires significant financial, technological, and expertise resources; therefore, Vietnam needs to continue strengthening international cooperation to secure technical and financial support from international organizations such as the United Nations, the World Bank, UNEP, UNDP, FAO, and development partners. International cooperation could focus on developing methodologies, transferring GIS and remote sensing technologies, training experts, supporting pilot implementations, and developing marine ecosystem databases. Simultaneously, Vietnam needs to proactively participate in global networks and initiatives on SEEA, the Blue Economy, TNFD, and green finance to access new resources related to green carbon, conservation investment, and climate finance. Strengthening international cooperation will not only contribute to enhancing domestic capacity but also support Vietnam's gradual

integration with global standards for resource governance and sustainable development.

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