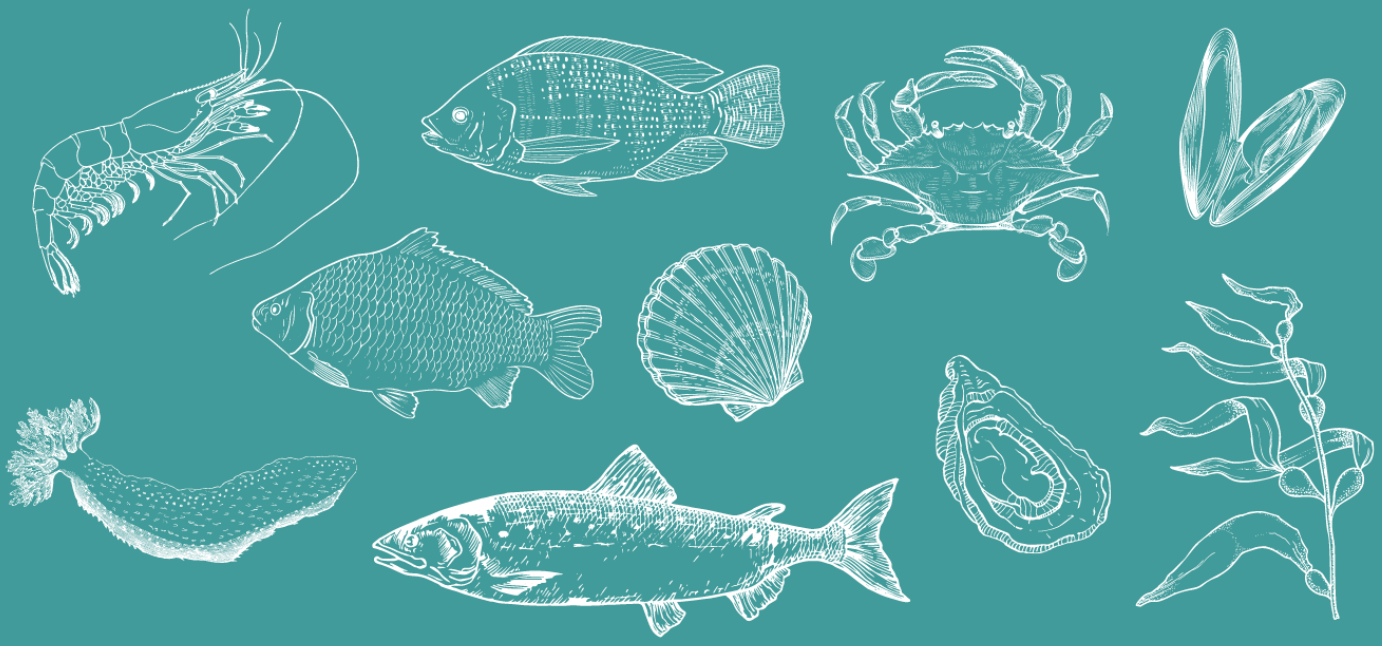

The Global Aquabusiness Investment Guide

A living framework to guide sustainable development in the world's fastest growing food sector

Summer 2024 Edition

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Executive Summary

The global aquaculture industry has seen considerable expansion in recent years, driven by rising consumer needs, a lack of growth from capture fisheries, progress in production technologies, and augmented investments from both private sector and governmental bodies. Presently, aquaculture is the world's fastest growing food sector and is anticipated to outgrow capture fisheries by 2027. Sustaining this growth will require continued industry support.

Recognising this, the World Bank Group (WBG) has established a Global Aquabusiness Investment Advisory Platform (AquaInvest Platform) that aims to develop and disseminate best practices in aquabusiness development, with a view to ensuring economic prosperity, social well-being, and environmental sustainability. By nurturing innovation and collaboration, the AquaInvest Platform seeks to empower aquaculture practitioners, investors, and governments to meet the challenges posed by stagnating fisheries production and the increasing demand for food from a rapidly growing human population.

The Platform is a Global Advisory Services and Analytics (ASA) task, which is funded by the multi-donor trust fund PROBLUE and administered by the World Bank. The task is a joint undertaking amongst WBG teams (Agriculture and Food (AGF), Environment, Natural Resources, and the Blue Economy (ENB) and the International Finance Corporation (IFC)), clients, and partners. A key component of the AquaInvest Platform is the preparation of a set of global principles to promote sustainable aquaculture growth through investment and business development. The WBG contracted Advance Africa Management Services to develop and disseminate **The Global Aquabusiness Investment Guide**.

The rapid growth of the aquaculture sector, coupled with various trends such as increasing demand, technological advancements, and supportive investments, presents numerous opportunities for stakeholders across the industry. These opportunities are relevant to producers, investors, policymakers, and consumers, offering avenues for economic growth, innovation, and food security. However, to fully harness these opportunities while safeguarding against potential challenges and negative social, ecological, and economic impacts, there is a critical need for a consolidated set of principles to guide sustainable commercial aquaculture development.

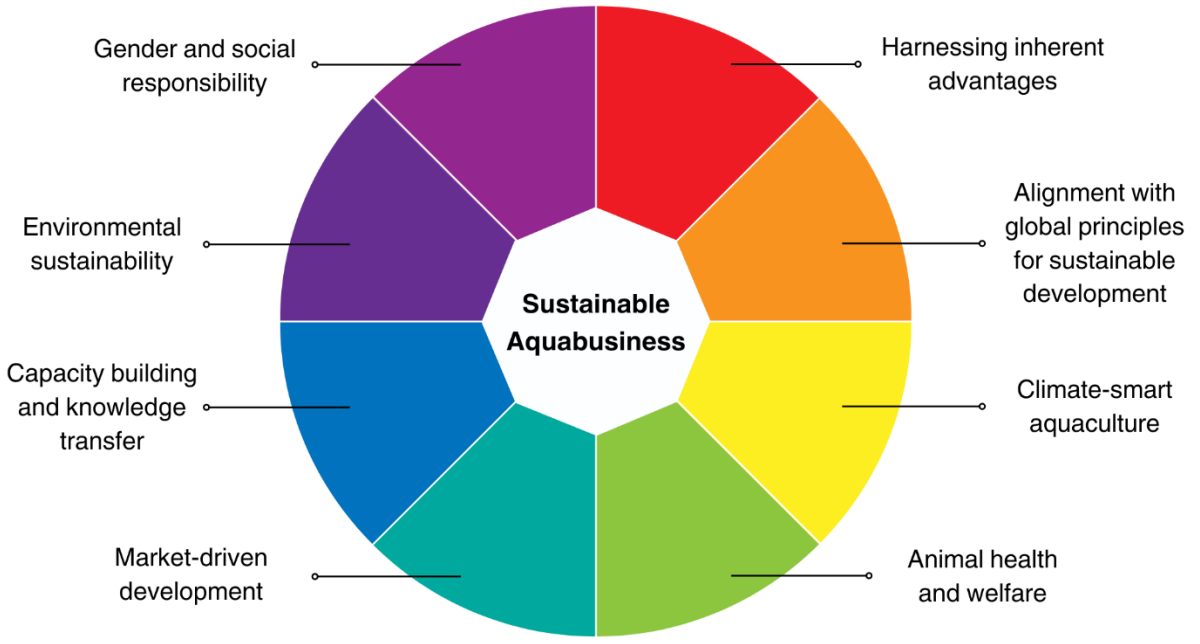
The Guide was formulated through a combination of 1) desktop-based reviews of the existing frameworks and best practices for aquaculture development and management, 2) a review of global case studies representing successes, challenges and lessons learnt in aquaculture investment and aquabusiness development, and 3) comprehensive stakeholder engagements with a variety of aquaculture industry actors. Through these activities, the needs of the intended users of the Guide, and commonalities driving sustainable aquabusiness development, were identified.

The Guide describes the necessary requirements and enabling factors that need to be in place to stimulate aquaculture investment and business growth that is socially, environmentally, and economically sustainable. The Guide is global in its geographic scope, and applies to all major aquaculture species groups, production systems and production scales. It encompasses activities along the entire value chain, from primary production to supporting industries and services (e.g., feed production and veterinary services) and the production of aquatic non-food products. It can be used by a diverse range of actors including national governments, private and public sector investors, private aquaculture operators seeking investment (primarily small and medium enterprises (SMEs)), development partners, non-governmental organisations (NGOs), donors, research organisations and

other stakeholders working on aquaculture, climate change, and socio-economic and environmental issues, and can be adapted to their specific contexts and needs. Importantly, the Guide is a publicly accessible "living document" (currently Summer 2024 Edition) that will be updated periodically as new learnings emerge.

These Guide does not duplicate existing frameworks, guidelines, principles, and Best Management Practices (BMPs) for sustainable and responsible aquaculture but builds on these in a practical way (providing specific recommendations), with a specific focus on investment and business development.

Part I of the Global Aquabusiness Investment Guide provides a review of the current state of global aquaculture, and highlights challenges to sectoral growth. This is followed by an overview of key elements of commercially driven aquaculture sector development, including aquaculture value chains, the respective roles of the public and private sectors, the importance of Small and Medium Enterprises (SMEs) in aquaculture, and challenges to sector development. Thereafter, Part I defines a set of key cross-cutting pillars for sustainable aquabusiness, which underpin the Guide. Finally, Part I outlines the approach to developing the Guide, and introduces the aim, scope, audience, intended use and structure of Part II of the Guide, which comprises a practical set of Guiding Principles for sustainable aquabusiness.



Cross-cutting pillars for sustainable aquabusiness, that underpin the Guiding Principles.

Part II presents a set of eight Guiding Principles for Sustainable Aquabusiness, each divided into a subset of practical components. Guiding Principles 1-7 are designed to support the Private Sector. Central to these Principles is the question **"How can an aquabusiness access funding?"**. Guiding Principle 8 is designed to support the Public Sector and supporting actors (e.g., NGOs, research institutions), to answer the question **"How can we create an environment conducive to aquabusiness investment and growth?"**.

Guiding Principle	Audience	Components	
1. Defining the Scope	**Private Sector**	1.1.	Product Selection: The Market Rationale
		1.2.	Species Selection: Regulations
		1.3.	Species and Site Selection: Biophysical Suitability
		1.4.	Site Selection: Non-biophysical Parameters
		1.5.	Selection of Farming Systems
		1.6.	Determining the Scale of Operations
		1.7.	Integration Across the Value Chain
		1.8.	Markets and Marketing
		1.9.	Processing and Value Addition
		1.10.	Aquaculture Certification and Standards
		1.11.	Technology and Innovation
		1.12.	Alignment with the UN SDGs
2. Assessing the Business Environment 	**Private Sector**	2.1.	Regulatory, Policy and Institutional Framework
		2.2.	Licensing and Permitting Framework
		2.3.	Zones for Commercial Aquaculture Development
		2.4.	Investment Incentives
		2.5.	Strategic Aquaculture Infrastructure and Services
		2.6.	Supporting Infrastructure and Services
		2.7.	Technology and Knowledge Transfer, Training, Innovation and R&D
		2.8.	Market Access and Promotion

Guiding Principle	Audience	Components	
3. Socially Responsible Practices 	**Private Sector**	3.1.	No Child Labour
		3.2.	Fair and Decent Work
		3.3.	Gender Equality and Mainstreaming
		3.4.	Wage Scales and Minimum Wage
		3.5.	Indigenous Communities and Customary Tenure
		3.6.	Assessing Social Carrying Capacity
4. Environmentally Sustainable Practices 	**Private Sector**	4.1	Environmental Legislation, Regulations, Certification and Standards
		4.2	Assessing Ecological Carrying Capacity
		4.3	Farming Non-native Species
		4.4	Waste Management
		4.5	Managing Feed Strategies
		4.6	Environmental Management and Monitoring
		4.7	Critical Habitats
5. Climate Change Adaptation and Mitigation 	**Private Sector**	5.1	Climate Standards
		5.2	Reducing GHG Emissions
		5.3	Alignment with the Paris Agreement
		5.4	Carbon Credits
		5.5	Adaptation and Long-term Planning
6. Aquatic Biosecurity and Health 	**Private Sector**	6.1	Management Plans and M&E
		6.2	Public Sector Support and Regulations
		6.3	Appropriate Use of Therapeutants and Other Chemicals
		6.4	Transboundary Biosecurity
		6.5	Opportunities for Investment in Aquatic Biosecurity and Health
		6.6	Health Innovation and R&D

Guiding Principle	Audience	Components	
7. Combatting Food Loss and Waste 	**Private Sector**	7.1	Harvesting and Post-harvest Handling
		7.2	Veterinary Medicines and Chemicals
		7.3	Managing Mortalities
		7.4	Processing and Storage
		7.5	Wholesale
		7.6	Retail
		7.7	Consumption
8. Creating an Enabling Environment for Aquabusiness 	**Public Sector and Supporting Actors**	8.1	Establishing an Enabling Regulatory, Policy and Institutional Framework for Aquabusiness
		8.2	Implementing an Enabling Licensing and Permitting Framework
		8.3	Establishing Zones for Commercial Aquaculture Development
		8.4	Providing Public Financing and Investment Incentives
		8.5	Strategic and Supporting Infrastructure and Services
		8.6	Promoting Technology and Knowledge Transfer, Innovation, Training and R&D
		8.7	Market Access and Promotion
		8.8	Promoting and Regulating Socially Responsible Practices
		8.9	Promoting and Regulating Environmentally Sustainable Practices
		8.10	Promoting Aquatic Biosecurity and Health

The Global Aquabusiness Investment Guide serves as a practical, operational, and user-friendly reference document for sustainable aquaculture investment and development (e.g., new developments, expansions and upgrades, diversification, value chain interventions, and consolidations). Widespread application of the Guiding Principles contained within the Guide is crucial for promoting sustainable aquaculture development, addressing challenges, and aligning practices with principles of economic prosperity, social well-being, and environmental sustainability.

Acknowledgements

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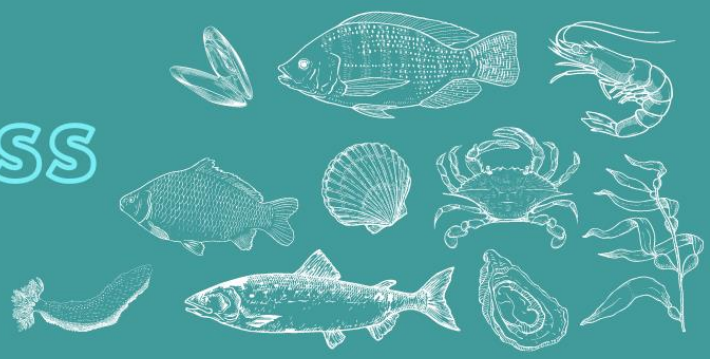
Acronyms and Abbreviations

ADZ	Aquaculture Development Zone
AGF	Agriculture and Food (WBG)
ASA	Advisory Services and Analytics
ASC	Aquaculture Stewardship Council
BMP	Best Management Practice / Better Management Practice
CCRF	Code of Conduct for Responsible Fisheries (FAO)
DO	Dissolved Oxygen
EAA	Ecosystem Approach to Aquaculture (FAO)
EMS	Early Mortality Syndrome
ENB	Environment, Natural Resources and the Blue Economy
ESAP	Environmental and Social Action Plan
ESF	Environmental and Social Framework
ESG	Environmental and Social Governance
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Standards
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAO GSA	FAO Guidelines for Sustainable Aquaculture
FCR	Food Conversion Ratio
GBV	Gender-based violence
GHG	Greenhouse Gas
GIFT	Genetically Improved Farmed Tilapia
GIP	Genetic Improvement Programme
GMO	Genetically Modified Organism

HAB	Harmful Algal Bloom
IDH	The Sustainable Trade Initiative
IFC	International Finance Corporation
ILO	International Labour Organisation
IMTA	Integrated Multitrophic Aquaculture
IPCC	Intergovernmental Panel on Climate Change
ISA	Infectious Salmon Anaemia
IUCN	International Union for the Conservation of Nature
M&E	Monitoring and Evaluation
MOU	Memorandum of Understanding
NBS	Nature-based Solution
NDC	Nationally Determined Contribution
NGO	Non-governmental Organisation
NNV	Nervous Necrosis Virus
NZKS	New Zealand King Salmon
OIE	Office International des Epizooties (now WOAH)
OHS	Occupational Health and Safety
PPP	Public-Private Partnership
RAS	Recirculating Aquaculture System
R&D	Research and Development
SADC	Southern African Development Community
SDGs	Sustainable Development Goals (UN)
SMEs	Small and Medium Enterprises
SOE	State-owned Enterprise
SOP	Standard Operating Procedure
SPF	Specific Pathogen Free

TCFD	Task Force on Climate-related Financial Disclosures
TiLV	Tilapia Lake Virus
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UTIDA	User-Friendly Tool for Decision Making in Aquaculture (FAO)
US	United States (of America)
WAPI	World Aquaculture Performance Indicators (FAO)
WAS	World Aquaculture Society
WBG	World Bank Group
WOAH	World Organisation for Animal Health
WSSV	White Spot Syndrome Virus
WWF	Worldwide Fund for Nature

The Global Aquabusiness Investment Guide



PART I: KEY ELEMENTS IN SUSTAINABLE AQUABUSINESS

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1. Aquaculture: The World's Fastest Growing Food Sector

Global aquaculture production in 2021 reached a record 126 million tonnes, valued at USD 297 billion, and contributed 57.7% to the total production of aquatic animals and seaweed (Figure 1) (FAO 2023a, b). This included 90.1 million tonnes of aquatic animals, valued at USD 281.1 billion, and 35.2 million tonnes of seaweed, valued at USD 15.5 billion. Inland aquaculture, and marine and coastal aquaculture, accounted for 56.3 million tonnes and 69.7 million tonnes of production, respectively (FAO, 2023a).

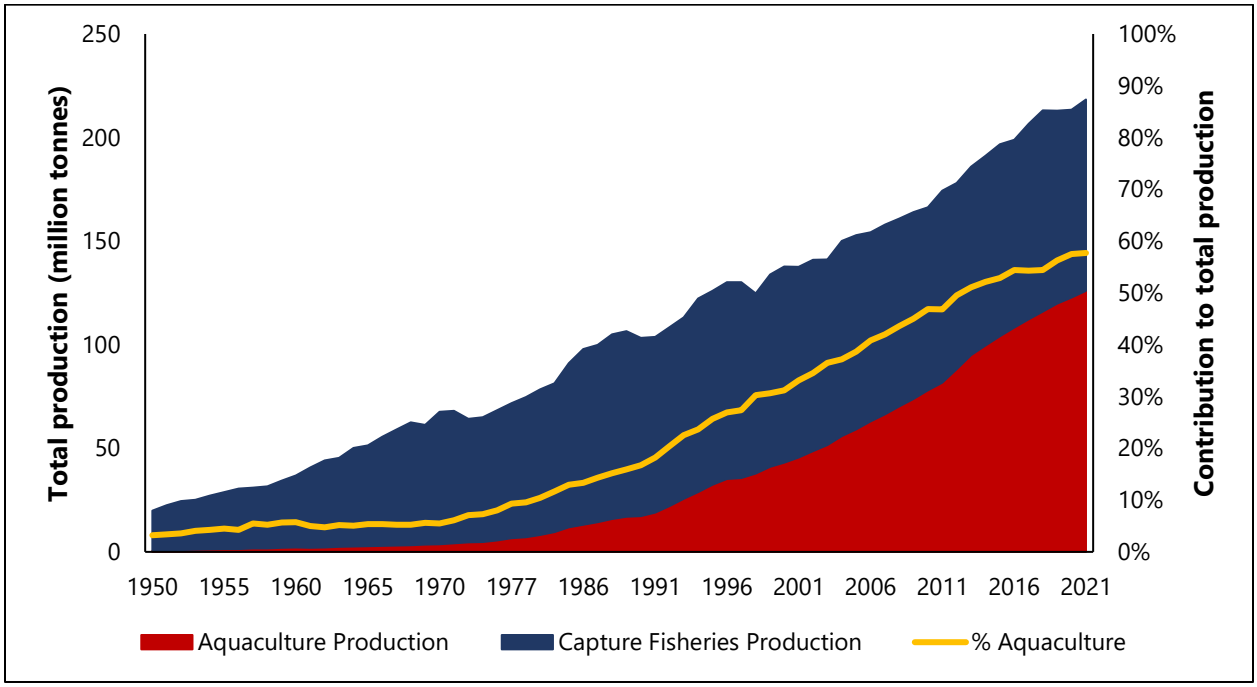


Figure 1: Global production of aquatic animals and seaweed, 1950-2021 (FAO, 2023a, b).

The global aquaculture sector produces a wide range of species (Figure 2). Of the seven major species groups, inland finfish, including carps, tilapias, catfishes, and salmonids, accounted for 40% of global aquaculture production volume in 2021, while marine and coastal finfish, such as seabass, seabream, and salmonids, contributed 7% (Figure 2) (FAO, 2023a). Coastal farming of crustaceans, such as marine shrimps and prawns, accounted for 6% of global aquaculture production, while inland farming of crustaceans, including freshwater prawns and crayfish, accounted for a further 4% of production (Figure 2) (FAO, 2023a). Aquatic plants, such as kelp and other seaweeds, accounted for 28% of global aquaculture production, while molluscs (e.g., mussels, oysters, and clams) and other aquatic animals (e.g., turtles, sea cucumbers, frogs, and jellyfish) contributed 15% and 0.4%, respectively (Figure 2) (FAO, 2023a). The importance of different species and species groups varies significantly from region to region; for example, carps constitute one of the most important aquaculture species in Asia while salmonids are a primary aquaculture species group in Europe.

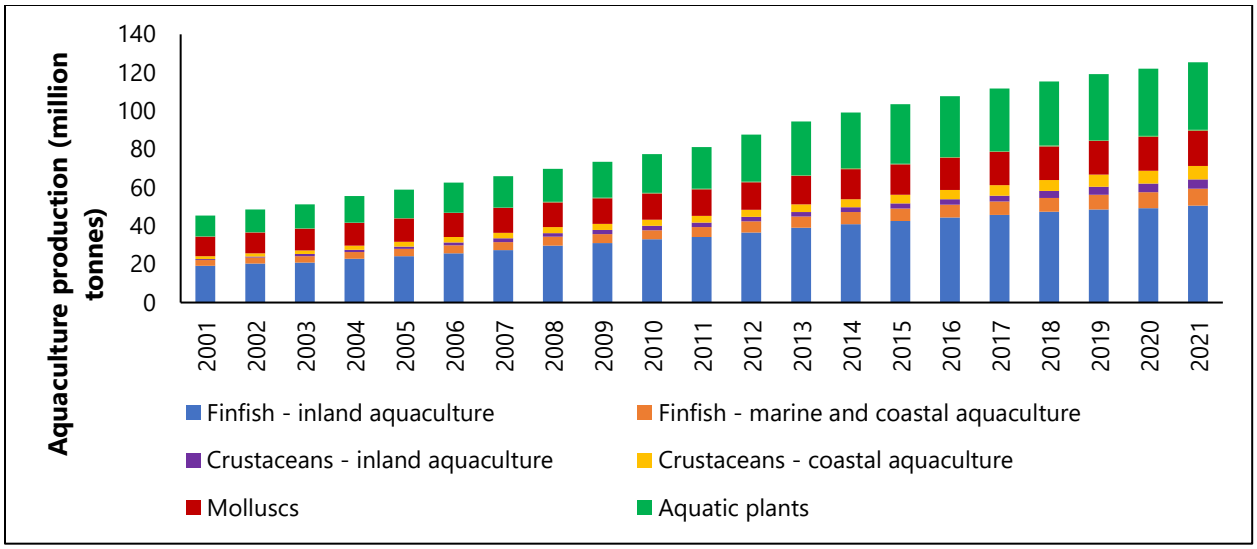


Figure 2: Global aquaculture production by major species group and production environment, 2001-2021 (FAO, 2023a).

In summary, the global aquaculture sector has experienced rapid growth in recent decades, driven by growing demand, stagnating supply from wild capture fisheries, advances in production technologies, as well as increasing private sector investment and government support. Presently, aquaculture is the world's fastest growing food sector and is anticipated to outgrow capture fisheries by 2027 (FAO, 2022).

The rapid growth of the aquaculture sector presents numerous opportunities for stakeholders across the industry. However, to fully harness these opportunities while safeguarding against potential challenges and negative impacts of sector growth, there is a critical need for a consolidated set of guiding principles to support sustainable commercial aquaculture development.

1.1. Environmental and socio-economic impacts of aquaculture

When implemented and practised responsibly, aquaculture generates significant environmental, social, and economic benefits. Aquaculture development has the potential to enhance ecosystem health through the provision of ecosystem services, including:

- water filtration (e.g., through bivalve production);
- carbon sequestration (e.g., through micro- and macroalgae production);
- biodiversity enhancement and conservation (e.g., restocking and/or stock enhancement of wild populations);
- climate change mitigation and adaptation (e.g., carbon footprint reduction through non-fed aquaculture);
- enhancing disaster risk management (e.g., flood control, coastal area protection through seaweed and bivalve production); and
- reducing fishing pressure on wild stocks of finfish, invertebrates, and aquatic plants by providing an alternative source of production to meet a growing global demand.

From a socio-economic perspective, aquaculture contributes significantly towards food and nutrition security; it is recognised that the consumption of fish and other aquatic products provides various health benefits that are not derived from plant-based and other animal-based products (USDA and USHHS, 2020; Liu and Ralston, 2021). Additionally, aquaculture development can create jobs, alleviate poverty, and

promote skills development in rural communities. Aquaculture also has the potential to foster social cohesion and improve bulk services and infrastructure, particularly in developing countries. The social and economic benefits of aquaculture development are particularly important in developing countries, which account for about 80% of global aquaculture production (Phillips et al., 2016; FAO, 2022).

However, when not managed responsibly, aquaculture operations may have various negative environmental and socio-economic impacts (FAO, 2010). These include (inter alia):

- Habitat, ecosystem, and biodiversity degradation/loss;
- Loss of environmental goods and services;
- Physicochemical degradation of water and land resources (both groundwater and effluent receiving ecosystems);
- Nutrient enrichment in receiving waterbodies and subsequent eutrophication and altered ecological states;
- Release or escape of farmed organisms into natural water bodies leading to the introduction of invasive species or genetically modified organisms (GMOs);
- Spread of disease and parasites into the natural environment;
- Loss of livelihoods, or displacement and resettlement;
- Risk of exposure to harmful chemicals (e.g., pesticides) for host communities;
- Operational health and safety (OHS) risks for workers; and
- Conflicts amongst different users of an area or water resource.

The consequences of these negative environmental impacts are varied and can include reduced ecosystem functionality, pollution, disease outbreaks, and social tension and conflict, particularly with different water and land users. Negative environmental impacts affect option value[1] and non-use/non-market values of aquatic ecosystems, particularly where the reduced quality of ecosystems influences the value that communities attribute to preserving resources, potentially leading to a decline in the willingness of communities to conserve ecosystems for the sake of future generations. Moreover, aquaculture has developed at a time of growing public environmental and social awareness where opinions and statements, that are in many instances unfounded, have been levelled against the industry (Froehlich *et al.,* 2017). Consequently, the industry has faced public backlash, threatening food and job security.

Women play a vital and diverse role throughout the aquaculture value chain. However, despite their crucial contributions, women in aquaculture are often marginalised and their specific needs and challenges are overlooked in government policies. As a result, women may be excluded from accessing resources, training, financial support, and decision-making processes that are critical for their success and advancement in aquaculture (UN WOMEN, 2021).

Irresponsible aquaculture development can also have negative social impacts. For example, it may cause human displacement and create land-use conflicts, exacerbate social inequality, pose health and safety risks for workers (particularly women and youth), and generate potential clashes with local traditions and

[1] Option value, in the context of common-pool natural resources (such as water bodies and the biodiversity they support) refers to the value individuals place on maintaining or preserving a public asset, such that they reserve the option to utilise it in future (even if there is little or no likelihood of them ever using it).

customs. Measures to address negative impacts often prioritise production and market access over human welfare and social equity. There is a need for a more comprehensive approach to ensure sustainable and equitable aquaculture development that considers both economic and social dimensions. (Brugere *et al.,* 2023).

It is important to realise that both the positive and negative impacts of aquaculture are strongly linked to management practices. Aligning aquaculture management with the FAO's Ecosystem Approach to Aquaculture (EAA), or other similar strategies, is critical for promoting positive impacts, and the mitigation of potential negative impacts. The principles of the EAA, defined as "a strategy for the integration of the activity within the wider ecosystem such that it promotes sustainable development, equity, and resilience of interlinked social-ecological systems" (FAO, 2010, p. 1), underpin the Global Principles for Sustainable Aquabusiness.

2. Aquaculture as a Business

2.1. The importance of promoting aquabusiness development

Aquaculture businesses (hereafter aquabusinesses) are market-led and private-sector-driven with the aim of generating profit (Jamu *et al.,* 2012). It is well recognised that the major global successes in aquaculture growth and development have been achieved by private sector-driven, commercial aquaculture ventures (Hecht, 2006; Brummett, 2008; Cai *et al.*, 2009; Jamu *et al.*, 2012); whereas "limited or lacking economic incentives for aquaculture activities has been one of the major causes of its poor, sluggish and short-lived performance" (Cai *et al.*, 2009). It is therefore clear that the promotion of sustainable (economically viable, environmentally responsible, and socially acceptable) aquabusinesses is critical for global aquaculture sector growth, and the realisation of the sector's social, economic, and environmental benefits. Although the development of the sector can be facilitated and supported by the public sector, it needs to be profitable to be sustainable in the long-term.

2.2. Aquabusiness value chains

Aquaculture value chains can be described as the complete end-to-end series of activities (processes and transactions) required to produce an aquaculture product and deliver it to a consumer (e.g., Ababouch *et al.*, 2023). They are typically characterised by a complex network of different activities and actors. Activities include not only primary production, processing, distribution, and marketing of aquaculture products, but also supporting services (e.g., diagnostic and health services) and feed production. While the specific characteristics of aquaculture value chains vary based on the production system, scale of production, culture species, and geographic location, several key commonalities can be identified. These include:

- **Diverse stakeholders:** Aquaculture value chains involve a wide range of stakeholders, which may include (depending on the products and markets) grow-out farmers, hatcheries, nurseries, health service providers, feed suppliers, processors, exporters, retailers, and consumers, among others.

- **Geographic location:** Aquaculture value chains often span multiple local, national, regional, and international locations. For example, farms may be in rural or isolated areas, while processing and distribution facilities may be in regions with access to ports or airports, and markets may be on different continents. These differences lead to very specific management and logistical challenges.

- **Fragmentation:** Fragmented aquaculture value chains are those that consist of many small suppliers or a combination of large and small suppliers that are usually not interconnected, resulting in a low level of connectivity within the value chain.

- **Input dependence:** Value chain actors and their associated aquaculture activities rely on various resources such as water, land, feed, and energy. Dependence on these inputs often dictates the value chain's characteristics, such as species, production systems and markets.

- **Market access:** Export-oriented and domestic-oriented value chains have contrasting characteristics and standards such as trade regulations and food safety standards.

- **Consumer preferences:** Consumer preferences for aquaculture products drive changes within the value chain. This includes demand for specific species, certification, assurances, and value-added products.

- **Women and youth:** An often-overlooked characteristic of the aquaculture value chain is the role of women and youth. Women and youth typically play an important role in post-harvest activities (processing and value addition) as well as in the early stages of production, such as hatcheries and nurseries. In some value chains, however, they play the dominant role in primary production (e.g., seaweed farming in East Africa).

Several enabling factors are critical in driving the growth and sustainability of aquaculture value chains. Firstly, a holistic and comprehensive governance framework, including robust policy, legislation, and standards, is essential. This provides a stable environment for aquabusinesses to operate in while ensuring compliance with environmental, social, and economic standards. Equally important is the availability of markets that offer proven opportunities for aquaculture products to be efficiently distributed and sold at a profit. Furthermore, a well-developed cold chain (for food products) and supply chain infrastructure, coupled with effective traceability systems, is critical for the effective and safe distribution of products, and is also important for consumers in discerning markets. Finally, investing in business literacy empowers aquaculture value chain actors with the knowledge and skills needed to effectively market their products, explore alternate product uses and opportunities, and navigate challenges, ultimately contributing to the success of the entire value chain.

2.3. The roles of different value chain actors in aquabusiness

2.3.1. Small and Medium Enterprises

Small and Medium Enterprises (SMEs) play a pivotal role in various aspects of the aquaculture value chain and the development of the industry (Allison, 2011; Phillips *et al.*, 2016). Firstly, SMEs may significantly contribute to domestic consumption by providing a diverse range of local aquaculture products to market. The presence of SMEs can also stimulate micro-economies, particularly in rural areas, providing an important source of income and food security for vulnerable communities often impacted by the effects of climate change and who lack alternative livelihoods. Moreover, SMEs may be instrumental in stimulating the use of local (or naturalised) farming species and aquafeed ingredients fostering product development, promoting sustainability, and reducing reliance on expensive imports such as feed and seed. These enterprises may also play a crucial role in local economic development, livelihood provision, and domestic job creation, offering employment opportunities at various levels of the aquaculture value chain. SMEs can serve as hubs of domestic product innovation, driving research and development to meet changing consumer preferences and market demands, ultimately propelling the growth and competitiveness of the aquaculture sector. Finally, SMEs can play an important role in informal training and capacity building. As

an SME, through a substantial amount of trial and error, valuable lessons are often learnt and can be shared and passed on to others.

Despite the important role of SMEs in aquabusiness value chains, their potential in many cases remains unrealised. SMEs in aquaculture often face challenges in securing investment for business development, creating the "missing middle" within the aquaculture investment and business landscape (e.g., see CASA, 2022; Kleih *et al*., 2013; OXFAM, 2009). One significant factor is the (real or perceived) risk associated with investing in SMEs, as they may lack the established governance, track record and collateral that larger corporate enterprises possess. Financial institutions often prefer to invest in larger enterprises with a proven history of stability and revenue, making it difficult for SMEs to access traditional lending avenues. Additionally, the relatively small investment requirements of SMEs can be a deterrent for financial institutions, as the cost of underwriting and servicing small investments may not justify the potential returns. Limited financial literacy among SME owners and a lack of awareness about alternative funding options further contribute to the challenge. Consequently, SMEs can experience slow growth and often fail to progress at an optimal pace, leading to stagnation and potential business failure. Conversely, micro and smallholder aquaculture enterprises, whilst also facing challenges, often do not encounter the investment hurdles common to SMEs; due largely to far smaller capital requirements and operational costs, community-based lending and use of personal savings, and Government and NGO support initiatives that allow for a higher level in risk in such funding and investment transactions.

2.3.2. *Private and public sectors*

The private sector plays a pivotal role in aquaculture investment and business development. The private sector ensures capital, technical expertise, and entrepreneurial skills are transferred into existing and new commercial, medium- and small-sized businesses. The private sector can make quick, well-informed investment decisions and is therefore largely responsible for the development of new aquabusinesses and the direction and expansion of the aquaculture industry. Similarly, the private sector can promote the development of new technologies and innovations, and guide research and development through funding.

The public sector is responsible for creating an enabling environment to encourage, attract, maintain, and support sustainable aquabusiness investment and development, through effective governance and the provision of support services. Some aspects linked to providing an enabling environment include sound/robust aquaculture legislation, regulations, policies, strategies, well-resourced and funded institutional departments, investment incentives, support to marketing efforts (e.g., at trade shows and through consulate offices), human resources, access to technology and innovation, and capital-raising instruments. This provides a foundation upon which environmentally, socially, and economically responsible and inclusive aquaculture growth can be achieved while promoting private sector investment and commercialisation.

The shifting roles of the public and private sectors in aquaculture development, as the industry matures, are well demonstrated by the case of Egypt's aquaculture sector, as presented in Box 1.

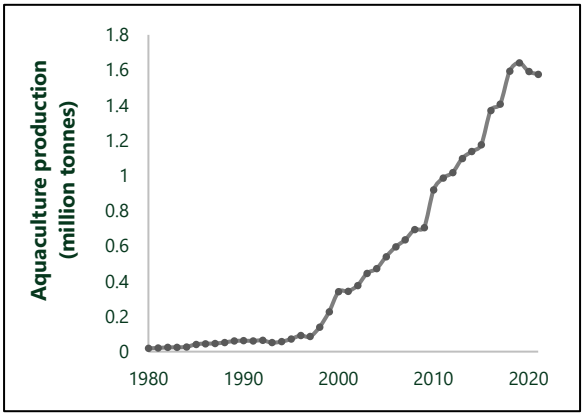
The role of the Global Aquabusiness Investment Guide in supporting both the private and public sectors is described in Section 4.2.

Box 1: The shifting roles of the public and private sectors in the development of the Egyptian aquaculture industry.

The Egyptian government prioritised the development of the aquaculture sector in the mid-1980s, prior to which aquaculture production was characterised by large extensive to semi-intensive ponds, with low yields (250-400 kg/ha) and low overall production (Soliman and Yacout, 2017). To encourage investment, the government allocated large tracts of land for aquaculture development, established support services in the form of feed mills, hatcheries, research farms and aquaculture training initiatives, and developed an enabling, commercially focused institutional framework (El-Gayar, 2003; Dickson *et al*., 2016). These interventions were very successful in attracting investment from small-scale farmers encouraged by high returns (Dickson *et al*., 2016; Soliman and Yacout, 2017).

Egypt's aquaculture industry is currently largely private sector-driven, with seed and feed inputs being provided by private sector operators (Soliman and Yacout, 2016). The shift to private sector-led industry support allowed for increased production, industry-driven development, and increased development and commercialisation of aquaculture value chains, creating opportunities for greater numbers of value chain actors.

By 2021, annual Egyptian aquaculture production was 1.58 million tonnes compared to 62 000 tonnes in 1990 (FAO, 2023a, b).



The growth of the Egyptian aquaculture sector from 1980-2021 (FAO, 2023a) (left); and a typical semi-intensive aerated earthen pond for tilapia farming in Egypt (El-Sayed, 2017) (right).

2.4. Challenges to sustainable aquabusiness development

Sustainable aquabusiness development faces several key challenges, ranging from regulatory issues to ecological impacts. Further complicating matters is that these challenges often act synergistically or in a compounding manner. Generally, these challenges are more acute in the case of SMEs.

The following are critical challenges that must be addressed to achieve a thriving aquaculture sector:

- The lack of an enabling institutional and legal environment. The importance of creating an enabling environment is often not acknowledged in the nascent and developing stages.
- Limited or no access to appropriate finance for start-ups and expansions (intensification and scale) and poor business literacy.
- The fragmentation of aquaculture value chains, which often consist of numerous small suppliers or a combination of large and small suppliers that are typically disconnected, which may increase vulnerability to external shocks (i.e., market dynamics and climate change related disturbances).
- Lack of access to affordable and sustainable aquafeeds.
- Threats posed by diseases and pests.
- The intensifying impact of climate change, extreme weather events, and natural disasters.
- Increasing resource-scarcity in relation to aquaculture, including aquafeed ingredients and suitable water sources (e.g., due to water pollution, groundwater depletion, and saline intrusion).
- A paucity of publicly available information on potential investments and cutting-edge innovations. Additionally, there is a lack of sustainability benchmarks and metrics, leaving investors without a standardised framework to gauge the impact (both financially and environmentally) of their investments on the broader social and environmental ecosystem.
- A lack of trained human capital (knowledgeable in aquabusiness) and knowledge transfer in certain high-potential areas for aquabusiness development.
- Limited access to high-potential innovations, or limited accessibility, scalability, and transferability of innovations; and a shortage of publicly available, industry-driven data from research institutions.

To address these challenges, both public- and private-sector stakeholders should recognise their long-term value and role in developing and supporting sustainable, viable, feasible and responsible aquaculture ventures.

3. Cross-cutting Pillars for Sustainable Aquabusiness

A set of cross-cutting pillars have been identified that underpin sustainable aquabusiness and hence form the foundation for the Global Aquabusiness Investment Guide. These pillars for sustainable aquabusiness are presented in Figure 3 and discussed in greater detail below.

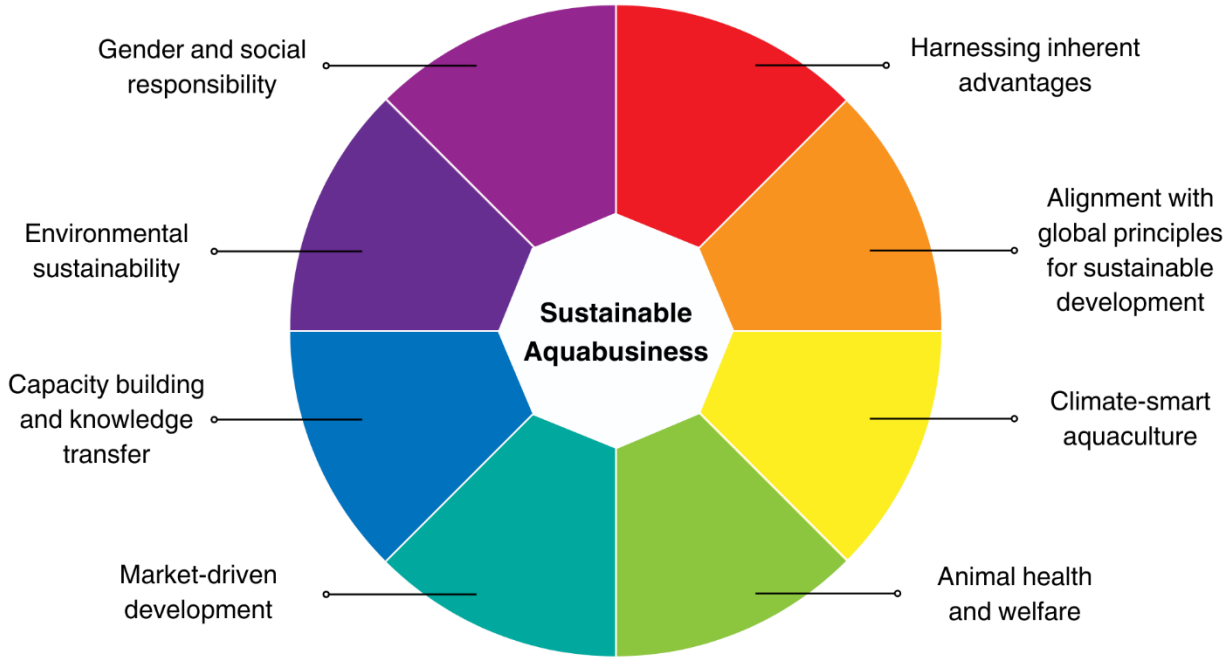


Figure 3: Cross-cutting pillars for sustainable aquabusiness, that underpin the Global Aquabusiness Investment Guide.

3.1. Gender and social responsibility

In line with key documents – including the World Bank Gender Strategy 2024-2030, the World Bank's Social Sustainability and Inclusion strategies, and FAO EAA – investments in aquaculture must be socially responsible and promote gender equality. This is not only important from an ethical perspective; investors run the risk of legal action, reputational damage, and financial losses in the case of social violations.

Women make a significant contribution to aquaculture value chains globally, accounting for 28% of the primary sector workforce and 50% of the workforce across pre- and post-harvest value chain segments (FAO, 2020, 2022). Their involvement varies across countries, cultural contexts, and technological settings. In certain regions, entrenched gender norms restrict women's engagement and participation due to traditional beliefs that prioritise men as primary income earners, affording them greater control over decision-making processes and household assets such as land (Aregu *et al.,* 2017). Conversely, in other regions, women participate more prominently in aquaculture decision-making alongside their male counterparts. Nonetheless, persistent challenges such as limited access to essential resources and technical expertise hinder women's empowerment in aquaculture across diverse contexts (Githukia *et al.,* 2020; Agbebi *et al.,* 2016). Women are often under-recognised in the industry, and face numerous challenges including limited access to information, extension services, financial services and resources, decent employment, and exclusion from decision-making and leadership positions (FAO, 2022).

Gender-based violence (GBV), including physical (such as human trafficking and substance abuse-related violence in fisheries), sexual (including transactional sex, prostitution, sex slavery, and harassment), and other forms of psychological, economic, and cultural abuse, is another overlooked yet serious issue. These forms of violence can be perpetuated and reinforced by policies, practices, and institutions. Traditionally, addressing GBV has been viewed as the domain of gender or social welfare practitioners, who are not typically involved in aquaculture. As a result, current aquaculture management practices can facilitate GBV, contradicting the objective of sustainable and equitable aquaculture development, particularly for low-income earners heavily reliant on aquaculture. It is essential for aquaculture practitioners to recognize GBV as part of their responsibility and identify ways to address it effectively within management frameworks. (Mangubhai *et al.,* 2023). Prioritising gender equality and mainstreaming in sustainable aquabusiness value chains is imperative to address these disparities and harness the full potential of women in aquaculture.

Another social issue that faces the aquaculture sector is child labour, which "impairs children's well-being or hinders their education, development and future livelihoods" (FAO and ILO, 2013; Ferdousi and Farouk, 2016). This is particularly prevalent in vulnerable communities where poverty may drive children into hazardous labour practices. Proactive measures to address and mitigate child labour in aquabusiness are the responsibility of both the private and public sectors. Rigorous risk analysis methodologies to identify, assess, and manage the risks associated with child labour in aquaculture should be considered along the entire aquaculture value chain. Additionally, forced or bonded labour poses another significant challenge, constituting a form of modern slavery and a violation of human rights, necessitating comprehensive measures to eradicate such practices from aquaculture operations.

3.2. Environmental sustainability

Both the private and public sectors should prioritise environmentally responsible aquaculture and implement measures and practices that minimise the impact of aquaculture on the ecosystem. Investors should also prioritise responsible waste management, sustainable water and land management, sustainable management of aquatic genetic resources, and sustainable sourcing of inputs such as feed, seed, and equipment. The public sector should develop regulations and provide incentives to promote environmentally responsible aquaculture development; an example of this is provided in Box 2.

Box 2: Environmental Responsibility in Aquaculture: The Seychelles Story.

Seychelles is committed to developing an environmentally responsible aquaculture industry, in line with global best practices and the FAO EAA. This is demonstrated by the establishment of a sound governance framework and the embedding of the aquaculture sector in the country's national strategy and planning, which has resulted in broad regulatory and institutional support, aligned with national development prerogatives and the conservation of the natural environment. Some of the elements of the country's aquaculture strategy and regulatory framework that promote environmentally responsible aquabusiness development include the establishment of ADZs with prescribed maximum carrying capacities, a focus on high-value, lower trophic level species (such as sea cucumbers and sea urchins), the use of indigenous species and locally harvested broodstock, and stringent environmental management, monitoring, and reporting requirements for operators.

The comprehensive commitment to environmentally responsible aquaculture, coupled with its global reputation for ecological sustainability, provides a strategic advantage for marketing its aquaculture products globally.

Strategic projects for the establishment of an environmentally responsible aquaculture industry in Seychelles: Growth and feeding trials for collector urchin at the Seychelles Fishing Authority (SFA) Sea Urchin Research Facility (SURF) (left), and the SFA Broodstock Acclimation Facility (BAQF).

3.3. Capacity building and knowledge transfer

The public sector, in conjunction with supporting actors (e.g., NGOs, education and research institutions), should provide knowledge and capacity building for farmers, in particular small- and medium-sized operators. This should be available in their local language. Investing in grassroots training and knowledge transfer will promote a professional approach to aquaculture among farmers. In this case, the public sector should engage with the private sector to support the dissemination of technical information (sharing and educating), particularly in cases where the public sector does not have the human capacity required. This is particularly relevant in many developing countries, where small- and medium-scale farmers are the suppliers for large-scale investors (e.g., the model of many shrimp production companies in Thailand and Vietnam).

Moreover, the public sector should not only invest in on-the-ground farmers; it must invest in placing knowledgeable persons in government positions. This is of particular importance for developing relevant and technically-sound policy and legislation.

In many developing countries, where aquaculture development remains nascent, local capacity is not available to guide the establishment and management of new aquaculture operations. These countries and operations can benefit from investment in capacity-building programmes, whereby foreign experts provide mentorship and training to local personnel. An example where knowledge transfer has been effectively implemented is in Lesotho, which until the early 2000s did not have any large-scale commercial aquaculture production, but now supports a successful export-based rainbow trout (*Oncorhynchus mykiss*) aquaculture industry (Box 3).

Box 3: The importance of knowledge transfer in developing Lesotho's aquaculture industry.

Recognising the natural strategic advantage for trout farming in the Lesotho Highlands Water Project (LHWP) reservoirs (specifically, a steady supply of high-quality water and an altitude that results in optimal water temperature for growth), Highlands Trout (now Sanlei Trout) was developed at Katse Dam between 2010 and 2016. Highlands Trout has a production capacity of 2 000 tonnes per annum and is vertically integrated from hatchery to processing. As a result of the high quality of the farm's production, Lesotho trout was positioned in discerning international markets, including directly into retail outlets in Japan.

Fully integrated commercial trout farming in the Katse Dam, Lesotho.

Critical to the success of the project **was the intensive training of over 100 local employees by international experts**, including aquaculture technical development specialists from Norway and cage culture specialists from Chile. These training efforts were effective in building Lesotho's technical skills base for aquaculture business development and operations, in a country that previously lacked any such expertise. Lesotho – which has a land area of only 30 355 km^2, and a water area of only ±80 km^2 – now produces an average of 2 000 tonnes of trout annually, with an average value of USD 18.9 million (2016-2021; FAO (2023a)). This demonstrates the importance of capacity building, particularly through knowledge transfer from established regions, in building successful aquabusiness ventures and industries to generate economic opportunities and improve livelihoods.

3.4. Market-driven development

A major challenge to aquaculture development cited by both public and private sector actors is the lack of suitable business planning expertise amongst developers and operators seeking investment.

Establishing the market potential for an aquaculture product is a critical component of business planning, that should be resolved prior to investment in aquaculture. If a product cannot be sold at the correct price and at the right time, within an accessible market, an aquaculture venture will fail, no matter how technically

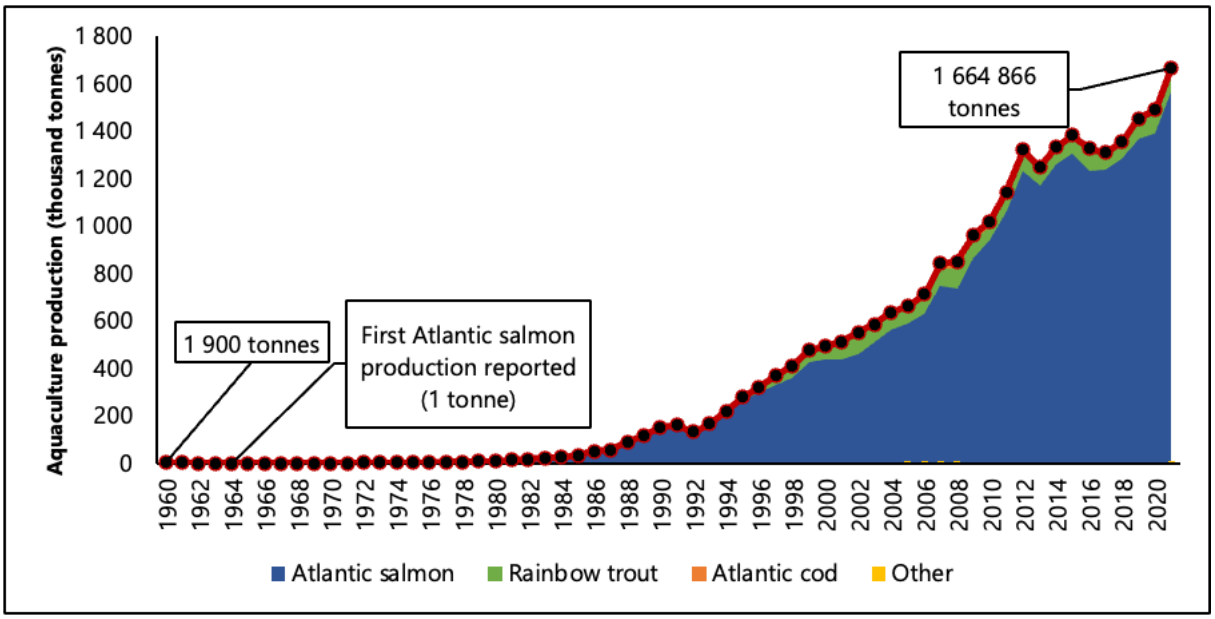
feasible the project is. The market for a product dictates every aspect of investment, from production scale to grow-out size and quality, source of inputs, processing requirements, and the need for certification of production and processing facilities. These factors, in turn, are key parameters that affect the technical and economic viability of an aquaculture investment and should therefore be understood from the outset. Many aquaculture investments have failed due to a mismatch between financial assumptions and market realities.

3.5. Harnessing inherent advantages

At the core of sustainable aquabusiness lies "natural strategic advantage", which can be defined as the inherent comparative advantages that are available to an aquaculture operation (Hargreaves, 2017). This may be derived through optimal environmental conditions, suitable candidate species, preferred market access, a skilled workforce, existing infrastructure or industries, and an enabling legal and institutional environment for aquabusiness. Norway's Atlantic salmon (*Salmo salar*) aquaculture industry provides an excellent example of harnessing natural strategic advantage to build successful aquabusinesses and value chains (Box 4).

Box 4: Harnessing natural strategic advantage for sustainable aquabusiness development in Norway.

Norway's coastal waters, characterised by cold, clear waters, strong currents, and deep fjords, offer excellent physical conditions for the farming of Atlantic salmon. This natural strategic advantage has provided a strong platform for the rapid growth and sustainability of Norwegian aquaculture. Since the inception of commercial Atlantic salmon farming in Norway in the 1960s, the country's aquaculture production has shown consistent growth, reaching a record high of 1.67 million tonnes in 2021, of which Atlantic salmon comprised 93.5% (1.56 million tonnes) (Bergheim, 2012; FAO, 2023a).



Norwegian aquaculture production (1960-2021) (FAO, 2023a).

Recognising that the sustainability of the aquaculture industry is dependent on maintaining favourable environmental conditions, the Norwegian government has prioritised environmentally responsible aquaculture in its policy and legislation. Some measures include a national standard for fish farm monitoring, a requirement for fallowing periods following farming cycles, and third-party benthic environmental inspections (Carroll *et al*., 2003; NSC, 2023). Recent monitoring programmes suggest that over 90% of Norwegian salmon farms have good or very good environmental conditions (NSC, 2023).

3.6. Alignment with global principles for sustainable development

In line with global strategies, an increasing number of investors in the agri-food business are profiling operations against the United Nations Sustainable Development Goals (UN SDGs) and the Paris Agreement for reducing global greenhouse gas (GHG) emissions. Therefore, public and private sector actors seeking to attract aquaculture investment are in many cases incentivised to align with these global frameworks.

The UN SDGs are a set of 17 goals that are central to the 2030 Agenda for Sustainable Development, adopted by all UN Member States in 2015, which provides "a shared blueprint for peace and prosperity for people and the planet, now and into the future", recognising that the eradication of poverty and deprivation

requires economic progress that is harmonised with efforts to combat climate change and protect natural environments (Figure 4).

Aquaculture has the potential to contribute significantly to the achievement of the UN SDGs, by supporting economic growth whilst addressing various aspects of human and planetary health, as outlined by Troell *et al.* (2023). Most notably, aquaculture systems are a critical component of food and nutrition security, and income generation, in many rural areas in developing countries, contributing directly to the SDGs that relate to the elimination of hunger and improvement of health (SDGs 2 and 3). Indirectly, sustainable aquaculture development contributes to SDGs 6, 12, 13, 14 and 15; as responsible food systems can enhance environmental sustainability of natural resources they rely on. Socially responsible aquaculture is associated with reducing poverty, reducing inequalities (including gender inequality), and improving livelihoods (SDGs 1, 5, 8 and 10).

Figure 4: The 17 United Nations Sustainable Development Goals (UN SDGs).

The Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) is a legally binding international treaty on climate change, which was adopted by 196 Parties at the UN Climate Change Conference (COP21) in 2015, and entered into force in 2016. Under this agreement, signatory countries have obligations to implement economic and social measures to reduce their GHG emissions, based on the best available science. This is done through Nationally Determined Contributions (NDCs), which refers to the commitments that countries make to implement the Paris Agreement by reducing their GHG emissions. Several countries have referred to mitigation actions in the aquaculture sector as a means to achieving their NDCs, including improved feed management, reduced energy use, and more efficient technologies (Strohmaier *et al.*, 2016; FAO, 2018).

3.7. Climate-smart aquaculture

Globally, there is increasing evidence of the risks and impacts of climate change on aquaculture (Dabaddie *et al.*, 2018; Maulu *et al.*, 2021); these include reduced and/or inconsistent yields, reduced profitability,

increased risk of physical damage to operations and infrastructure, enhanced pathogen exposure and vulnerability, increased vulnerability near the coast, and conflict because of resource deterioration. Climate risk is an intersection of hazards (i.e., the occurrence of negative acute and chronic weather due to natural or anthropogenic-driven variability), exposure (e.g., proximity to coast) and vulnerability (i.e., susceptibility to damage and capacity to cope with disturbances) (Figure 5). Transitioning from capture-based fisheries to aquaculture is commonly suggested as a climate adaptation measure for coastal communities as aquaculture can provide increased control over the potential impacts of climate change (Shelton, 2014; Soto *et al*., 2018). However, to reduce the exposure and vulnerability of aquaculture operations to climate change and its consequences, the integration of climate adaptation and resilience measures are imperative.

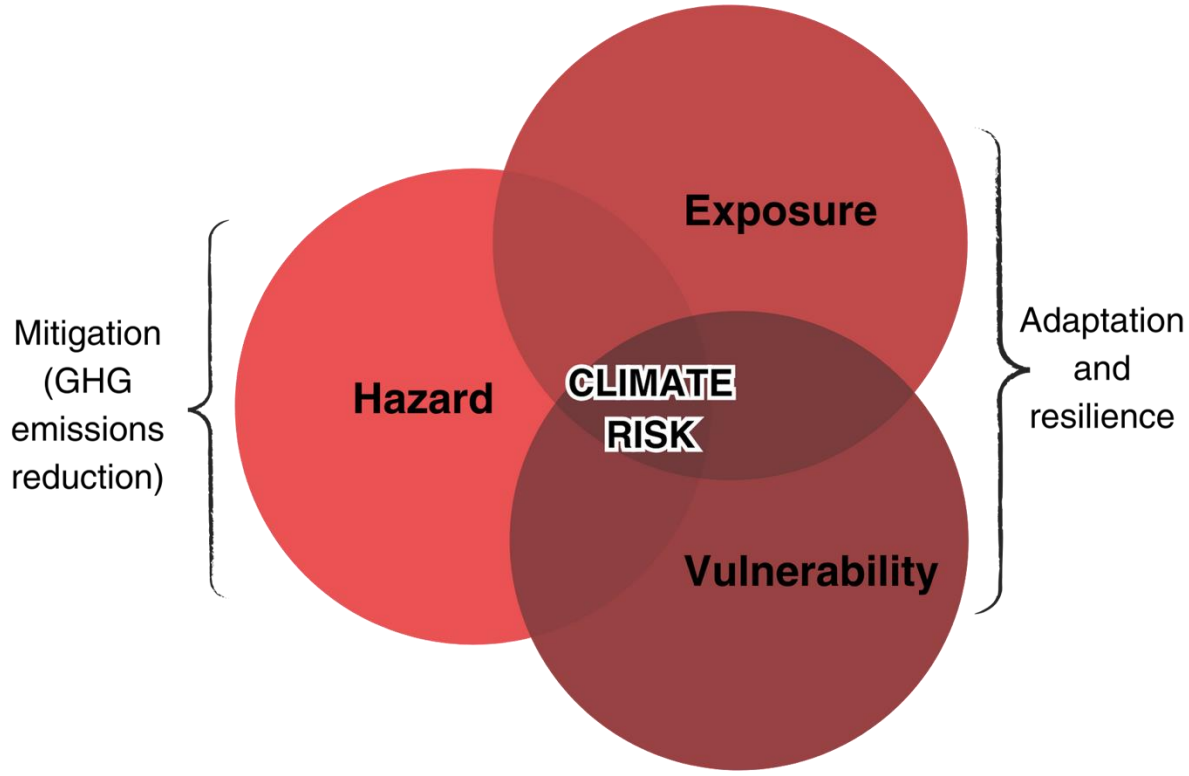


Figure 5: The relationship between hazards, vulnerability, and exposure in determining climate risk. Adapted from: IPCC (2014).

Moreover, when practiced in line with the EAA, aquaculture can serve as a nature-based solution (NBS) for climate change (Le Gouvello *et al*., 2022). According to the International Union for the Conservation of Nature (IUCN), NBSs "leverage nature and the power of healthy ecosystems to protect people, optimise infrastructure and safeguard a stable and biodiverse future"; and can contribute to climate change mitigation by:

- Decreasing greenhouse gas emissions related to deforestation and land use;
- Capturing and storing carbon dioxide from the atmosphere (e.g., seaweed aquaculture); and
- Enhancing the resilience of ecosystems, thus supporting societies in adapting to climate hazards.

In line with the Paris Agreement, aquaculture operators must take mitigation measures to reduce their GHG footprints. This not only serves to minimise the overall impact of aquaculture, but also increases their resilience to external factors associated with power supply, such as price increases and power cuts.

An example of a climate-smart aquaculture development is provided in Box 5.

Box 5: Climate-smart aquaculture in a large-scale aquabusiness.

The Buffeljags Abalone Farm in the Western Cape, South Africa provides a practical example of a climate-smart aquaculture facility designed to mitigate against increasing local energy costs, reduce reliance on formulated feed and reduce environmental impact. Located on the south coast of South Africa, the farm was strategically situated to harness the natural coastal environment. The farm's infrastructure incorporates key climate-smart elements; these include the utilisation of partially recirculated seawater and a low head (minimising energy required to pump water from the abstraction point), ensuring a consistent supply of cool, oxygen-rich water for the abalone and reducing energy consumption. To reduce the reliance on increasing electricity costs and unreliable power supply, the farm is supplemented with wind energy.

Additionally, the farm's dietary feeding program incorporates freshly harvested kelp, on-farm produced sea lettuce (*Ulva* sp.), and formulated feed, which minimises its ecological footprint and reduces its reliance on expensive feeds.

Buffeljags Abalone Farm in South Africa (Source: Buffeljags Abalone Farm).

3.8. Animal health and welfare

Addressing animal health and welfare concerns, which are closely linked to production parameters such as carrying capacity, water quality, transport, slaughtering, and handling and dispatching techniques, can lead to improved productivity and sustainability. Physiological and physical stress combined with poor living conditions can compromise fish health and growth, ultimately affecting economic viability. By implementing measures to improve fish welfare, such as optimising water quality, minimising overcrowding, ensuring proper nutrition, and implementing strict best handling practices, operators can uphold ethical standards and promote the long-term success of aquabusinesses. This is particularly important given that aquaculture

is under increasing public scrutiny due to perceived adverse ethical, ecological, and social impacts which are in many instances unfounded (Froehlich *et al.*, 2017). Ultimately, ensuring that animal welfare is considered in the investment and business development process is a win-win situation, benefiting both the fish and the aquaculture industry.

4. Developing the Global Aquabusiness Investment Guide

4.1. Aim and Scope of the Guide

While there is an existing body of aquaculture frameworks and publications (such as those developed by the FAO, third-party certification schemes, NGOs, and national and intergovernmental authorities) that cover certain aspects of aquaculture development and investment, **there is currently no global, consolidated, practical and adaptable set of guidelines that can serve as a "go-to" reference document to guide decisions and strategies in aquabusiness development.** This Guide is, therefore, designed to consolidate relevant information and recommendations from different sources and package them into a practical easy-to-use guide for public and private aquaculture investments.

The Guide is framed in such a way that its principles can be adapted by public and private sector aquaculture stakeholders at all levels, for developing sustainable aquabusiness plans and promoting aquabusiness development relevant to their specific needs. The Guide is a publicly accessible "living document" (currently Summer 2024 Edition) that will be updated periodically as new learnings emerge.

The Guide and its principles are global in their geographic scope and can be applied to all major aquaculture species groups, production systems and production scales. In the context of global aquaculture investment and business development, investment opportunities in supporting industries and services (e.g., feed production and veterinary services) must not be overlooked. Therefore, the Guide focuses on primary production and encompasses activities along the entire aquaculture value chain. Moreover, the Guide considers aquaculture for food uses as well as on the production of non-food products, which present increasingly attractive investment opportunities.

4.2. Approach to the development of the Guide

The Guide was formulated through a combination of 1) desktop-based reviews of the existing frameworks for aquaculture development and management, 2) a review of global case studies representing successes, challenges and lessons learnt in aquaculture investment and aquabusiness development, and 3) comprehensive stakeholder engagements with aquaculture industry actors.

The desktop-based review focused on assessing global aquaculture BMP frameworks, and other publications and resources focused on supporting investment in aquaculture, to identify key trends and gaps. These frameworks are referenced throughout this document. The review informed our identification and assessment of global case studies and examples that represented success stories, challenges, and failures in sustainable aquabusiness and aquaculture value chain development. These were evaluated to draw examples of best practices and lessons learnt in overcoming key challenges. Throughout this process, we engaged with a range of stakeholders from a variety of aquaculture backgrounds (see Appendix A). During our engagements, we aimed to be as inclusive and participatory as possible to ensure that we engaged with audiences from a range of backgrounds, levels of involvement in the sector and with broad expertise. Through these engagements, we aimed to understand the challenges faced by the intended users of the Guide, as well as commonalities driving sustainable aquabusiness development, to ensure the Guide and its principles address the needs of different users and provide a global picture.

4.3. Audience for the Guide

4.3.1. The Private Sector

The Guide and its principles are primarily directed at the private sector, with a specific focus on SME support. They present the elements that private sector actors should consider when assessing and formulating sustainable aquabusiness investments and developments.

Within the context of the Guide, the private sector refers to that segment of the value chain that is owned and operated by private individuals or entities and is generally profit-driven. This segment encompasses a range of actors, including (but not limited to):

- **Entrepreneurs:** Individuals who take the initiative to start and operate a new business venture, assuming the associated risks and rewards.
- **Businesses:** Independently owned and operated businesses, ranging from smallholders to SMEs and large corporations.
- **Investors:** Individuals or entities that provide capital to businesses in exchange for ownership stakes (equity) or the promise of future returns (debt). Investors can include venture capitalists, private equity firms, angel investors, and individual shareholders in companies.
- **Financial institutions:** Banks, credit unions and other financial organisations that provide a range of services, including loans, investment products, and financial advice, to individuals and businesses.

4.3.2. The Public Sector

The Guide is designed to support the Public Sector, by outlining the necessary requirements and enabling conditions that should be in place to attract and foster sustainable aquabusiness investments and developments that are aligned with the FAO EAA principles of social, environmental, and economic sustainability. The **public sector** refers to the segment of the economy that is government-owned, -funded and operated, and encompasses a range of entities and activities that provide public goods and services. Broadly, the public sector is responsible for fostering an enabling environment for aquaculture investment and business development. The public sector includes (but is not limited to):

- **Government agencies:** Various government bodies and departments at local, regional, and national levels responsible for administering and implementing public policies.
- **Regulatory bodies:** Government entities tasked with creating and enforcing regulations.
- **Public utilities:** Provide essential services such as water and electricity and are often owned or heavily regulated by the government to ensure widespread access and affordability.
- **Infrastructure development bodies:** Public sector involvement in the planning, financing, and maintenance of critical infrastructure that serves the broader community, such as roads, bridges, and utilities.
- **Public education institutions:** Government-funded and operated educational institutions at various levels, including schools, colleges, and universities.
- **State-owned Enterprises (SOEs):** Business entities that are wholly or partially owned by the state.

4.3.3. Supporting Actors

Finally, the Guide can also be used by the various actors that support both the public and private sectors in establishing, developing, and growing a sustainable aquabusiness sector. These include (but are not limited to):

- **Research and academic institutions** such as universities that provide aquaculture training, and industry-driven research and development (R&D) (e.g., technology development, nutrition and feed

development, genetic improvement programmes, disease management, policy recommendations, and international collaboration).

- **Non-governmental organisations (NGOs),** which also support the industry through R&D and capacity building and training, as well as community development and advocacy for socially responsible and environmentally sustainable practices.
- **Industry associations,** that represent the interests of businesses within specific industries or regions. These associations often engage in advocacy, provide resources, facilitate networking among businesses, and provide a link between industry and government.

4.4. Structure of the Guide

The Global Aquabusiness Investment Guide comprises a set of eight Guiding Principles for Sustainable Aquabusiness (Figure 6), each divided into a subset of practical components. Guiding Principles 1-7 are designed to support the Private Sector, while Guiding Principle 8 is for the Public Sector and Supporting Actors.

Figure 6: The eight Guiding Principles for Sustainable Aquabusiness. Each Guiding Principle comprises a set of practical components.

4.4.1. Guiding Principles for the Private Sector

Central to the Guiding Principles for the private sector (Principles 1-7), is the question **"How can an aquabusiness access funding?"** These Principles are based on the premise that funding sources are available, and this funding can be accessed by sustainable, economically viable aquabusinesses across the aquaculture value chain. There are two important steps involved in aquabusiness investment and development:

1. Undertaking a feasibility study and developing a business plan, or assessing a business's feasibility; and
2. Finding funding and/or making an investment.

Feasibility studies and business planning:
A feasibility study is a comprehensive analysis and evaluation of the practicality, viability, and potential success of a proposed project, business venture, or idea. The primary purpose of a feasibility study is to assess whether the project or business is technically, economically, and operationally feasible, whilst also being environmentally and socially responsible. It helps prospective investors make informed decisions about whether to proceed with a project or not.

Key components of an aquabusiness feasibility study typically include:

1. **Project description:** A detailed description and overall scope of the intended aquabusiness, including the project site, the product to be produced/sold, the type of production system, the final product and target markets, the production scale and volumes, and the level of vertical integration.
2. **Value chain and market analysis:** An in-depth examination of the upstream (e.g., input availability, price, logistics and cost of sourcing) and downstream (e.g., market demand, accessibility, logistics, sales price, and cost of sales; post-harvest activities) value chain components.
3. **Technical feasibility:** An evaluation of the technical aspects of the project, including the technology required, availability of resources, and potential challenges.
4. **Financial feasibility (viability):** An analysis of the financial aspects of the project, including cost estimates, revenue projections, return on investment (ROI), and financial risks, is important for determining whether the project is financially viable. This can be assessed through bio-economic modelling. Examples of bio-economic models for aquabusinesses include, amongst others, the FAO User-Friendly Tool for Investment Decision Making in Aquaculture (UTIDA).
5. **The regulatory environment:** This provides an overview of legal and regulatory requirements that the aquabusiness must comply with, and potential challenges that the project might face because of the legal and regulatory environment. This includes permits, licenses, and compliance with all relevant laws and regulations.
6. **Environmental impact:** This comprises an evaluation of the environmental implications of the aquabusiness, including its potential impacts (positive and/or negative) on the surrounding environment, and compliance with environmental regulations. This should also include an assessment of waste streams, and measures for their management or beneficiation.
7. **Social impact (social acceptance):** An assessment of the potential positive and/or negative social impacts that the project may have on the community or society; and measures to mitigate negative social impacts.
8. **Risk analysis and de-risking mechanisms:** An identification and analysis of the potential risks and uncertainties that could impact the success of the project. This involves assessing both internal and external factors that may pose a threat, in terms of both their likelihood and impact. Climate change is one of the major risks that should be considered in assessing the feasibility of aquabusiness. Feasibility studies are crucial for minimising risk and ensuring that resources are invested wisely. They serve as a foundation for making informed decisions about whether, or how, to proceed with a project.
9. **Recommendations and conclusion:** Based on the findings of the study, a set of recommendations is provided, along with a conclusion that summarises the overall feasibility of the project.

Following on from a feasibility study, a business plan is usually developed. Whilst a feasibility study is conducted at the initial stage of a project or business idea, to assess and refine the feasibility of an investment concept, a business plan outlines the detailed roadmap for implementing a project once it is

deemed viable (the who, how and when). It provides a comprehensive strategy for establishing and running the business and is often used for securing funding.

Funding aquabusiness:
The concept of "funding" in aquaculture varies widely and encompasses diverse models applicable to different financial or business relationships, each with distinct relevance in specific cases. However, establishing a formal financial relationship between investors and investees is often overlooked, particularly in developing nations where accessing financial support is challenging. Conventional financial services often perceive aquaculture as high-risk, exacerbating the difficulty of obtaining funding. In this context, both public and private sectors play crucial roles. The public sector promotes aquabusiness by offering mechanisms such as tax incentives, grants, and subsidies to create a favourable financial environment. They facilitate investor-aquabusiness engagement and enforce regulations fostering ethical practices and sustainability. Meanwhile, the private sector emphasises inclusivity, transparency, and alignment of goals between investors and operators, especially for conservation-focused organisations like NGOs. Encouraging education and ownership among production staff and management, commitment to third-party audits, and fostering cooperation among stakeholders are key elements in ensuring transparency, accountability, and trust within these investments.

Funding for aquabusiness encompasses various avenues that cater to different scales and objectives within the industry. Private sector funding often involves companies backing specific ventures or activities that align with their criteria and goals. Larger entities can rely on their internal resources for investment (e.g., commercial loans or equity against collateral), while SMEs seek alternative financing, such as bank loans or debt facilities, due to limited capital. Today, funding opportunities extend to regenerative/restorative operations and climate mitigation-focused projects, attracting investors inclined towards sustainable practices. Public sector funding plays a crucial role, aiming to develop sectors as part of a national strategy, offering incentives, capacity-building, mentorship, and training. Additionally, donor funding, often facilitated by NGOs, focuses on supporting grassroots aquaculture initiatives to enhance nutritional security. At a larger scale, investors may opt for shareholding or seek substantial investments from corporate entities. The choice of funding largely hinges on the specific context and circumstances of the aquaculture activity in question, influencing the sources from which funding can be acquired.

A wide range of funding models apply to financing an aquabusiness. These include, for example, joint ventures, public-private partnerships, shared equity, operating company, quasi-equity, contract farming, blended finance models, and Memoranda of Understanding (MOUs) with farmers (Table 1).

The private sector-targeted Guiding Principles for Sustainable Aquabusiness are thus designed to:

- assist in drafting feasibility studies and conducting business planning – towards finding sources of funding;
- guide the assessment of aquabusiness feasibility studies and business plans – towards making investments within the aquaculture value chain; and
- enhance aquabusinesses' viability and sustainability, based on the key components for assessing feasibility.

Table 1: Examples of investment, funding, financing, or business relationships that may be considered in aquabusiness.

Type of investment, financing, or business relationship	Description	Where is it most suitable?
Joint Venture (JV)	Collaborative effort between two or more entities, combining resources and expertise as well as risk sharing.	Between investors
Public-private Partnership (PPP)	Cooperation between government and private enterprises, leveraging public resources and private sector innovation and entrepreneurship.	Government-led aquaculture
Shared Equity	Investors and stakeholders jointly own and invest, spreading financial risk and encouraging collective responsibility.	Between investor and investee
Concessional Finance	Below-market rate finance provided by major financial institutions (e.g., development banks and multilateral funds) to developing countries, to accelerate development objectives.	Between investor and investee (often public sector beneficiary)
Debt and Working Capital Financing	Borrowing mechanisms (typically loans or bonds) to address operational and working capital needs, to sustain business operations during periods of no revenue (e.g., prior to first harvest).	Between investor and investee
Operating Company (Op-Co)	A business that uses multiple business entities in conducting operations, ensuring efficient production and management.	Between investor and investee
Quasi-equity	Provision of capital for equity, but with debt-like characteristics; allowing investors to support and have the potential for profit sharing.	Larger investments (USD 50 million +)
Contract Farming	Agreement between producers and buyers, ensuring a stable market for products.	Between producers and buyers
Outgrower Scheme	SMEs contracted by larger enterprises for production, providing necessary market access.	Between SME producers and buyers
Blended Finance Models	Combination of various sources of funding (e.g., public, private, philanthropic) to support sustainable businesses.	Public and private
Memorandum of Understanding (MOU)	Formal agreements between stakeholders, outlining their respective roles, responsibilities, and objectives.	Between investor and investee

Each component of the Guiding Principle for the private sector also specifies the value chain segment/s to which that component is applicable (Figure 6). The different value chain segments covered in the Guiding Principles for the private sector are as follows:

- **Primary production:** Aquaculture farmers involved in the grow-out of a farmed species. These operations may or may not include integrated upstream (e.g., hatchery, feed production) and downstream (e.g., processing, sales and marketing, logistics) value chain activities.
- **Input production/supply:** Upstream value chain actors that produce or supply aquaculture inputs, but do not participate in the grow-out of farmed species. This may include products (e.g., seed,

feed, veterinary supplies, equipment supplies) and services (e.g., veterinary services, equipment repair services, technical consulting services).

- **Post-harvest activities:** Downstream value chain actors, that provide post-harvest services, but do not participate in the grow-out of farmed species. This may include processing, value-addition, packaging, storage, logistics, sales, and marketing of aquaculture products.

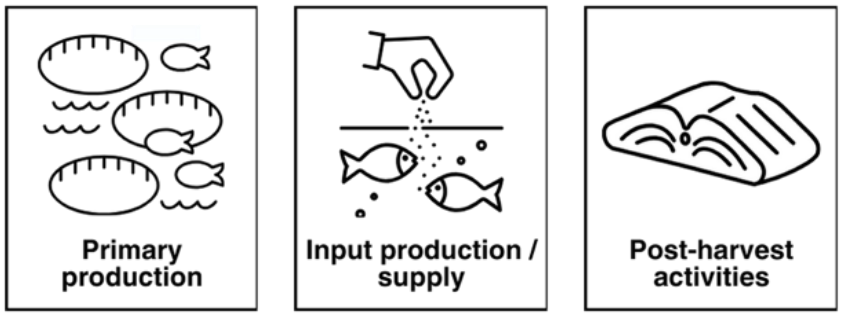


Figure 7: Icons to denote applicable value chain segment/s for each of the private sector Guiding Principle components.

4.4.2. *Guiding Principles for the Public Sector and Supporting Actors*

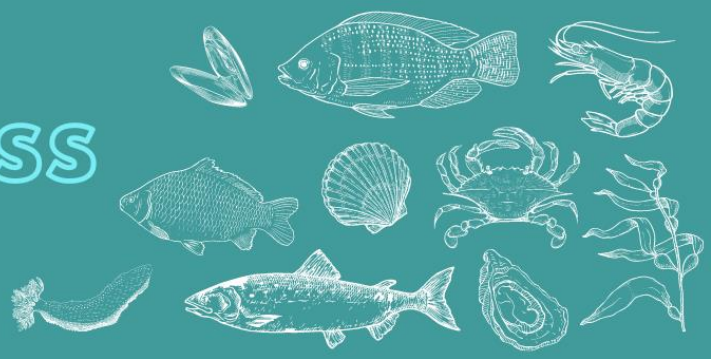
Creating an enabling environment in which sustainable aquabusinesses can develop and thrive is primarily a function of the government, often with support from other sector actors, such as NGOs, research institutions, and industry associations. Therefore, Guiding Principle 8 is designed to address the public sector's question **"How can we create an environment conducive to aquabusiness investment and growth?"**; and to guide supporting stakeholders in their support to the public and private sectors.

Each component of Principle 8 therefore specifies the sector actors to which it is applicable (Figure 8). The different actors covered in the Guiding Principle 8 (based on the definitions in Section 4.2 above) are:

- **Government (Public Sector)**
- **NGOs and research institutions**
- **Industry associations**

Figure 8: Icons to denote applicable audience/s for each of the public sector and supporting actor Guiding Principle components.

The Global Aquabusiness Investment Guide



PART II: THE GUIDING PRINCIPLES FOR SUSTAINABLE AQUABUSINESS

PROBLUE
HEALTHY OCEAN • HEALTHY ECONOMIES • HEALTHY COMMUNITIES

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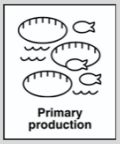
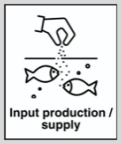
The Global Aquabusiness Investment Guide comprises a set of eight Guiding Principles for Sustainable Aquabusiness, each divided into a subset of practical components. Guiding Principles 1-7 are designed to support the Private Sector, while Guiding Principle 8 is for the Public Sector and Supporting Actors.

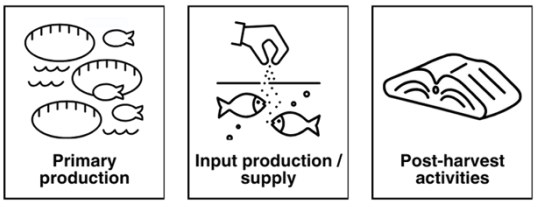
Guiding Principle 1: Defining the Scope

Audience: Private Sector

In aquabusiness development, the interdependent factors of species, site, and farming systems and scale of operations must be considered collectively and based on careful business planning and financial modelling. Although operators may often decide upon one element within this equation, and plan the remaining elements around it, it is crucial to recognise their interdependence in the business planning process. For instance, a site that is physically and environmentally ideal for the production of a certain species, using cost-effective systems, may not be feasible if there is no accessible market for that species within reasonable proximity and at the right price. Similarly, choosing a species based solely on market demand might be unfeasible if the available site lacks natural advantages for its production, necessitating complex and costly farming systems.

Guiding Principle 1: Defining the Scope				
Principle component	**Description**	**Value chain segments**		
				
1.1	Product Selection: The Market Rationale	**X**	**X**	**X**
1.2	Species Selection: Regulations	**X**		
1.3	Species and Site Selection: Biophysical Suitability	**X**		
1.4	Site Selection: Non-biophysical Parameters	**X**	**X**	**X**
1.5	Selection of Farming Systems	**X**		
1.6	Determining the Scale of Operations	**X**	**X**	**X**
1.7	Integration Across the Value Chain	**X**	**X**	**X**
1.8	Markets and Marketing	**X**	**X**	**X**
1.9	Processing and Value Addition	**X**		
1.10	Aquaculture Certification and Standards	**X**	**X**	**X**
1.11	Technology and Innovation	**X**	**X**	**X**
1.12	Alignment with the UN SDGs	**X**	**X**	**X**

Component 1.1. Product Selection: The Market Rationale



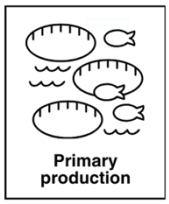
It is essential to conduct any business planning process on a market-driven basis. If the market equation does not make economic sense, a business will not be financially sustainable, irrespective of other factors (e.g., environmental conditions, species' growth rate, economic incentives) (see Box 12).

The market dictates almost all operational aspects of aquabusinesses – from product/species to size at harvest and processing, and certifications required, inter alia – and should therefore be resolved from the very early stages of the business planning process.

Questions to ask:	**Finding the answers:**

• What are the different products/ product forms that I need to consider? For example:
  ○ As a primary producer: What species could I produce, and in what form/s could I sell them?
  ○ As an input producer or supplier: What does the aquaculture value chain look like, and what inputs does it use and/or need?
• What are the consumer preferences relating to the different product/s in my target markets?
• At what price can the potential product/s be sold, and where?
• Given the costs of production (e.g., processing, packaging), does this make sense?
	• Conduct a market study to find information on market size, demand, competition with similar products (including competition with wild harvest production), and prices for different product/s of interest. This may require on-the-ground investigations and validation to comprehensively understand the market opportunity.
	• Conduct a financial modelling exercise for product/s of interest, considering:
	  ○ Cost of production (capital, fixed and variable costs);
	  ○ Production volumes and variability (e.g., seasonal, inter-annual) of production;
	  ○ Cost of sales (e.g., marketing, transport, duties); and
	  ○ Sales price.

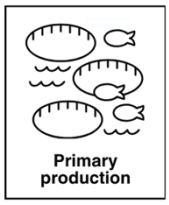
Component 1.2. Species Selection: Regulations



It is important to consider that the farming of certain species (or strains, varieties, or genotypes) that may otherwise have good aquaculture potential (e.g., from market and/or growth perspectives) may be prohibited in certain countries, regions, or catchments.

Questions to ask:	**Finding the answers:**
• Are there any restrictions in place in terms of permissible aquaculture species, strains, varieties, or genotypes in the area I am considering for my aquaculture operation? • Are there any specific conditions associated with the farming of any species (e.g., additional regulations or special permits) in the area I am considering for my aquaculture operation?	• Regulations pertaining to the farming of different species, strains, varieties and/or genotypes should be sourced from the relevant aquaculture authority or using online resources of a country or department.

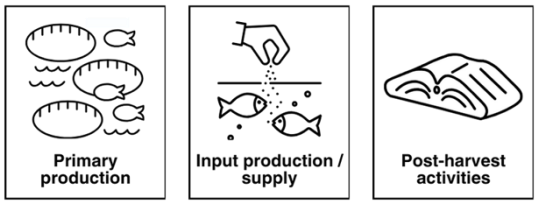
Component 1.3. Species and Site Selection: Biophysical Suitability



The natural strategic advantage of an area or site from an environmental and physical perspective is a key factor in determining the viability of an aquaculture operation. Different species have different biophysical requirements for survival, growth, health, and optimal Feed Conversion Ratios (FCRs), all of which underpin production performance and economic viability. Moreover, as a rule, a less suitable area for a certain candidate species will require more interventions to improve the farming environment, increasing capital and operational costs.

Questions to ask:	**Finding the answers:**
• Is the species I am interested in farmed successfully in similar environments? • Do the environmental parameters of the site that I am interested in fall within the optimal ranges for my candidate species? • Does my potential site offer good-quality water? • What is the ecological carrying capacity of my site – will it allow me to scale up production? • If relevant, does my potential site offer suitable soil for pond construction? • What interventions will be needed to account for non-optimal conditions, and will implementing these interventions be economically viable?	• Assess the current commercial production of your species of interest elsewhere in the world. Has it been successfully produced in a commercial context by other operators? • Investigate the optimal environment and environmental conditions for your species of interest, including temperature, salinity, pH, dissolved oxygen (DO), and water quality. • In water-based sites (e.g., for sea-based/lake-based cages), check for factors such as current speed, depth, and wave height that influence water quality as well as the feasibility of physically establishing and maintaining the necessary infrastructure. • In the case of pond farming, assess the suitability of soil type and composition. You may wish to refer to FAO's "Simple Methods for Aquaculture" Training Series. • Investigate and understand the potential effect of any pollution sources (e.g., run-off from factories or agriculture) on the water source. • Assess ecological carrying capacity of the site (see Guiding Principle Component 4.2). • Assess these parameters at your site/s of interest, to determine whether your intended site-species combination is suitable. • Investigate interventions (e.g., heating) to overcome any non-optimal parameters, and build these costs (capital and operational) into your financial model to assess economic viability.

Component 1.4. Site Selection: Non-biophysical Parameters



In addition to the biophysical parameters of a site, several other factors determine its suitability for the establishment of commercial aquaculture operations, such as the potential for conflict with other water/land user groups (i.e., social carrying capacity), the availability of bulk services infrastructure (e.g., electricity and roads providing market access), relevant logistics (e.g., distance to ports for export), and other basic services (e.g., waste management).

Additionally, if zones have been designated specifically for commercial aquaculture development (e.g., Aquaculture Development Zones (ADZs)), it is worth considering them as potential farming sites. Such sites may be advantageous as they will have already been identified as being suitable for certain aquabusinesses, and often carry benefits, such as tax incentives, and economies of scale in terms of input and market access. ADZs may also have already undergone any necessary Environmental and Social Impact Assessment (ESIA) processes and have Environmental Management Plans (EMPs) in place, thus negating the cost and time typically involved in such assessments. Finally, linked to the EMP, the carrying capacity of an ADZ will likely have been established, meaning that you will not have to conduct such an assessment, and will have a fixed maximum production volume upon which to base all financial modelling and business planning.

Questions to ask:

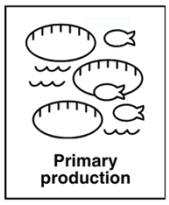
- Is the site suitable for the commercial aquabusiness that I am interested in, in the context of the value chain? For example:
  - As a primary producer, will I have access to inputs and markets?
  - As an input producer, will I have access to offtakers (primary producers)?
  - As a post-harvest operation, will I have a sufficient supply of raw material and access to markets?
- Is the site suitable for commercial aquabusiness activities in terms of its access to services and bulk infrastructure?
- Is commercial aquaculture development permissible at the site?
- Is an aquaculture operation at the site likely to lead to user conflicts?
- Have any zones for aquaculture development (e.g., ADZs) been established in the area/s that I am interested in?
- If so, what are the strategic advantages of these zones for my aquabusiness investment/development?

Finding the answers:

- Assess and map the value chain, to determine the suitability of the site in relation to upstream and downstream activities (including offtakers/markets) in terms of proximity, transportation methods, customs and duties (in the case of imports/exports) and other factors as relevant. Make sure that you factor any costs and lead times associated with transport to and from the site into your financial modelling and business planning process.
- Determine whether the site has access to bulk infrastructure and services, including:
  - Suitable road and cold chain networks (if relevant);
  - A suitable freshwater source (e.g., for cleaning) and electricity, in the case of land-based sites; and
  - Waste management services and a suitable site for the discharge of water.
- Approach the relevant planning authority to determine that the site is not restricted for commercial aquaculture development according to any regulations or bylaws. This

	usually forms part of the licence application process. • Identify other uses of the site (e.g., fishing, recreational activities, traditional community use) and assess the potential for user conflicts. This may require a social impact assessment. Ensure that any developments are harmonised with other existing uses and conduct comprehensive stakeholder engagement ahead of (and possibly during and after) development. See Guiding Principle Component 3.6. • The designation and establishment of zones for aquaculture development is a public sector function. As such, you should approach the relevant aquaculture authority to determine if any such zones have been established, and to understand the benefits that are associated with these zones. • Any benefits associated with zones of interest should be incorporated into your business planning and financial modelling processes, to determine the feasibility relative to other potential site/s.

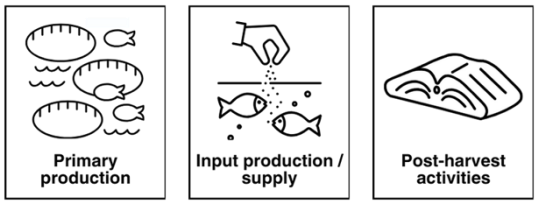
Component 1.5. Selection of Farming Systems



For any given aquaculture species, there is a range of farming technologies and techniques that can be used. The most suitable system/s are dependent on several interacting factors. As a rule, prioritise the selection of an environmentally and physically optimal site, whereafter the most appropriate system can be selected. Less optimal sites generally require costly interventions, which may only be feasible in the case of very high-value species.

Questions to ask	Finding the answers
• What are the options available to me, in terms of farming systems, for my candidate species? • What are the most sustainable options for my farming system? Are there any ways in which my farm can contribute to the provision of ecosystem services or nature-based solutions (NBSs)? • Which system best suits my aquabusiness situation in terms of environment, cost, and productivity?	• Research global/regional/national commercial production of your candidate species, to identify the production systems used for the species under similar environmental conditions and market contexts. • Assess the availability and commercial use of regenerative, restorative and integrated aquaculture systems for your species in similar environmental conditions and market contexts. • Assess the environments that different systems are best suited to and identify those which will be feasible for your site from a production point of view. • Incorporate capital costs and operational costs (e.g., electricity consumption; number of personnel and skill level required), as well as yield/productivity assumptions, of the system/s you are investigating into your economic modelling process, to determine viability based on your other assumptions (e.g., market price, production volumes).

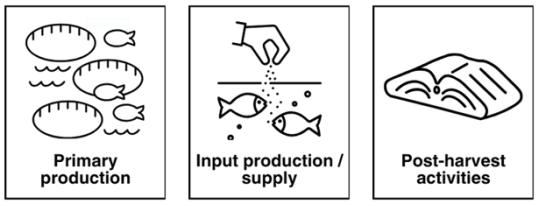
Component 1.6. Determining the Scale of Operations



Determining the operational scale of an aquabusiness requires consideration of several factors that can significantly impact its viability, and ultimately long-term success. Scale refers to the size and scope of the business, which can range from small-scale operations to large commercial enterprises. For primary producers, the feasible scale of operations will also depend on the social and environmental carrying capacity of the site. This may have been pre-determined (e.g., in the case of an ADZ), or may need to be established.

Questions to ask:	**Finding the answers:**
• What is the market demand for the product(s) I will be producing? • Is there a market cap or potential to flood the market if there are too many producers of the same product? • What resources (e.g., land, water, labour, and capital) and technologies are available to me? • Is there an opportunity for economies of scale and expansion? • What is the ecological carrying capacity of the site?	• Begin with pilot-scale production to test the business case, refine production techniques, establish markets, and learn lessons. Thereafter, determine an economically, socially, and environmentally feasible size to scale based on these factors. • If carrying capacity (e.g., maximum biomass or production) has already been established for a potential site, include it in business planning and financial modelling. • If carrying capacity (maximum biomass that your operation can sustainably hold) has not been established, undertake an assessment to determine your carrying capacity (see Guiding Principle Component 4.2). Incorporate the timeline, process and costs involved with this assessment into your business planning and financial modelling.

Component 1.7. Integration Across the Value Chain



Integration refers to the extent to which a company is involved in various stages of the value chain. In the case of aquaculture value chains, these stages include input production and supply (e.g., feed production, seed production), primary production (i.e., farming), and post-harvest activities (e.g., processing, value addition, packaging, storage, and marketing). Integration can allow for increased control over production, and improved efficiency and competitive advantage. Vertical integration combines different value chain components (e.g., hatcheries and nurseries, grow-out farms, processing facilities, distribution, and sales to market) under a single ownership or control. Horizontal integration involves the joining of similar or related activities within a particular stage of the value chain components; for example, through merging multiple farms that specialise in the same species or acquiring processing facilities for a variety of seafood products.

On the other hand, integration also carries challenges, such as increased complexity, higher capital costs and investment requirements, and potential risks associated with managing diverse business activities. Therefore, some aquabusinesses are not integrated but rather focus on their core business, providing one component of the larger aquaculture value chain. Box 6 provides an example of different approaches to integration.

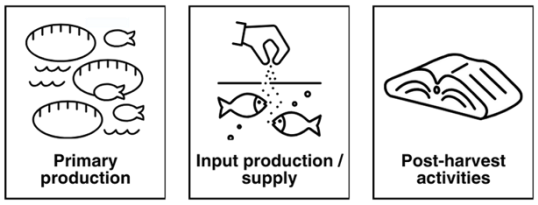
Questions to ask:	**Finding the answers:**
• Are the other value chain components accessible? • Will integration be economically viable and operationally feasible? • Will integration maximise operational efficiency and productivity, and lead to increased profit margins? • Will integration meet the original quality standards that have been set for individual components? • Are there any regulatory barriers that will be encountered during integration? • Will there be an environmental impact (positive and/or negative) following integration?	• Conduct a detailed feasibility study and develop a business plan under various scenarios using production and market assumptions. • Assess the existing value chain to understand if integration of certain value chain components will be necessary – for example, if there is no good quality seed available, hatchery integration may be critical. • Develop internal Standard Operating Procedures (SOPs) and conduct training based on best practices relevant to a specific processing procedure, or production protocol. If local extension services do not have these available, establish internal SOPs based on existing best practices in the relevant operation. • Regulations, policies, and national strategies/development plans can be obtained by approaching the relevant aquaculture authority or using online resources of a country or department. • Conduct an environmental impact assessment and approach relevant environmental authorities to assess the environmental impacts associated with integration.

Box 6: Integration in the Ecuadorian shrimp farming sector.

The Ecuadorian shrimp aquaculture sector, which in 2022 became the world's leading exporter of shrimp products, incorporates three primary models with regards to the integration of post-harvest (e.g., cleaning, grading, processing, value addition, packaging, storage and marketing and export) activities with primary production (farming). Small- and medium-scale producers, which constitute approximately 70% of the producers (but only 30% of production volume), generally do not integrate post-harvest activities into their business models. Instead, these producers sell harvested shrimp to larger companies for processing and subsequent export. Within the large-scale shrimp farms, some have opted for vertical integration of post-harvest activities; others have chosen not to invest in processing plants but rather engage in "co-packaging", wherein they outsource post-harvest activities to other companies whilst retaining ownership of their product. These diverse approaches across a successful industry underscore the absence of a universally "correct" method of integration in aquabusiness, emphasising that the decision to integrate or maintain separation within the value chain hinges on individual aquabusinesses' objectives and the feasibility of integration.

Shrimp farming (left) and post-harvest activities (middle and right) by Omarsa, a vertically integrated Ecuadorian shrimp production company.

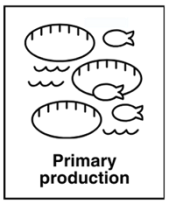
Component 1.8. Markets and Marketing



Identifying markets for an aquabusiness is one of the first steps in business planning. Once domestic and/or export markets have been considered, it is important to undertake marketing activities, and incorporate marketing into business planning. This is dependent on the level of integration of an aquabusiness, as marketing and distribution to markets may comprise part of an aquabusiness or form a downstream component of the greater value chain.

Questions to ask:	Finding the answers:
• How can my product(s) be placed in target market/s? • How will my product(s) reach their target markets? What are the logistics, ownership agreements and costs involved?	• Do not assume a market exists for your product – find out first. "The fact that you *can* produce a product, does not automatically mean that you *should* produce it". • Conduct comprehensive market research to identify your target market/s. This must include an assessment of supply and demand, consumers' preferences in terms of product forms and packaging, purchasing power of target consumers, and certification (including health and safety / phytosanitary) requirements and/or benefits. • For a business plan to reach a bankable stage, offtakers should be approached and in-principal offtake agreements should be secured in advance. • Develop, invest in, and implement a targeted market strategy for your aquabusiness, which should include promotion of your product as well as your business itself. It may be worthwhile approaching a marketing expert for assistance in developing this strategy. • Various logistics options should be explored to determine which is the most reliable and cost-effective. • Costs of marketing, as well as reaching markets (e.g., transport and logistics costs, customs costs, insurance) must be determined and included in business planning and financial modelling. • You will need to decide whether sales will be Free on Board (FOB) Origin (i.e., the purchaser takes ownership of and responsibility for the product when it is shipped and pays for shipping costs) or FOB Destination (i.e., the seller owns and is responsible for the product until it reaches the destination, including shipping costs). These agreements must be reached with the offtaker/s and incorporated into the business planning process.

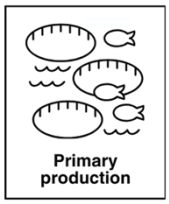
Component 1.9. Processing and Value Addition

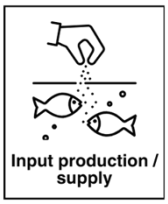


Linked to the end market/s is the final product form(s) that will be produced. This is also related to the level of integration, as processing and value addition to reach the final product(s) may comprise part of an aquabusiness or form a downstream component of the greater value chain.

Questions to ask:	**Finding the answers:**
• What processing and/or value addition needs to take place in my aquabusiness? • How does this fit in with the overall aquabusiness plan?	• Determine the final product(s) based on a market study (see Principle 1.9). • Understand processing, value addition and packaging needs, and determine whether this will be vertically integrated into the aquabusiness or not (see Principle 1.8). • The level of processing, value addition and packaging that will take place must be decided, and the costs associated with this should be factored into business planning and financial modelling.

Component 1.10. Aquaculture Certification and Standards





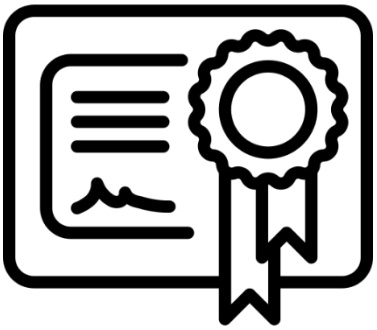
Certification for aquaculture products can confer various practical benefits. For one, certain markets demand specific social, environmental, and/or food safety/quality standards or certification with regard to production and/or processing. However, another potential value of certification is "de-risking"; the third-party auditing and monitoring that underpins certification of existing operations allows investors to assess the responsibility of their investment without having to invest in their own due diligence processes. Additionally, compliance with certain standards (e.g., national standards) may be a necessary condition of aquabusiness licences; or may be a requirement to qualify certain investment incentives.
In addition to these standards, there is a growing need for farms to meet standards that address climate change mitigation and adaptation promotion through climate-smart farming practices (see Principle 5.1).

Questions to ask:	**Finding the answers:**

• Does my aquabusiness require or benefit from certification or standards against any aspects of production?
• If so, which certification/s are most appropriate?
• What is the cost-benefit of different certification options?
	• Approach the relevant aquaculture authority to find out if there are any mandatory standards/certifications with which your aquabusiness is obliged to obtain and comply, or if any standards/certifications are specified in your operating licence.
	• If applying for any investment incentives (see Principle 2.4), approach the relevant body (e.g., the national board of investment) to find out if there are any certifications/standards that your aquabusiness needs to be eligible for these incentives.
	• Once target markets and offtakers have been determined, assess the type of production and/or product certification required to access these markets (if any).
	• In the case that there are different certification options to obtain a required market standard, assess the different options and their associated costs and benefits. Questions to ask include:
	  ○ What is the cost of certification? How often will it need to be renewed, and at what cost?
	  ○ What will need to be implemented within my aquabusiness to obtain this certification, and at what cost?

	○ Will I need to employ specific personnel to ensure compliance with this standard? What will be the cost? ○ Will this standard allow my product access to a specific market? What is the benefit of this new market and does this justify the cost? ○ Will the certification confer any price premiums for my product? • Factor the costs of production and/or product certification into the business planning and financial modelling process.

Box 7: To certify or not to certify?

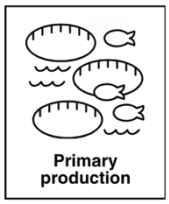


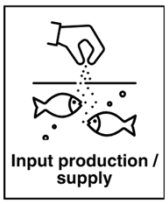
Aquaculture certification schemes are in most cases voluntary initiatives aimed at promoting sustainable and responsible practices in the aquaculture industry while facilitating market access. These schemes are adaptable and can be utilised as needed and tailored to specific circumstances. It's important to distinguish them from mandatory standards, such as food safety.

The cost of certification, its necessity for market access, its potential to improve practices, and its role as a framework for meeting standards or regulations are significant considerations which should be taken into account when assessing the need for pursuing a specific certification. While certification has its place in the growing aquaculture industry, many regions and businesses simply do not have the means to be certified and their market does not require the need for certification. Nevertheless, the principles that certification are founded on (i.e., improved environmental and social practices) should be implemented to promote more responsible aquaculture practices, even when not seeking a certification. As such, it will be important for SMEs and other aquabusiness to critically evaluate the cost-benefit, need, purpose and intended outcomes of certification.

In contrast, food safety standards should be essential and non-negotiable across the aquaculture industry to safeguard food security and health. While various certification options cater to market preferences, food safety standards are universally mandated to ensure consumer safety. It is crucial to differentiate between mandatory compliance with licensing requirements and optional adherence driven by market preferences. Emphasising food safety standards is recommended due to its critical role in protecting public health.

Component 1.11. Technology and Innovation

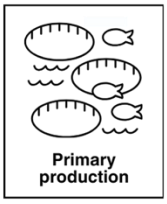


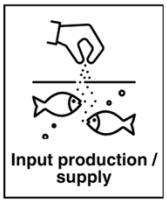


Ongoing technological advancements and innovation are increasingly optimising efficiency, improving productivity, and enhancing the sustainability of aquabusinesses. For example, the promotion, adoption, and use of digital technologies such as artificial intelligence (AI) and machine learning (ML) tools can improve operational efficiency as well as unlock new trends and insights (e.g., feed conversion and waste, disease identification, water quality monitoring etc.). Moreover, engaging with industry experts in knowledge transfer programmes can accelerate the ability to use and/or get the correct production systems/methods without reinventing the wheel.

Questions to ask:	**Finding the answers:**
• Will the adoption of a new technology improve operational efficiency? • Is new technology readily validated, available, transferable, and accessible? • Is the new technology cost-effective and innovative? • What are the necessary human skills to manage and maintain the new technology? • Are there experts available to assist in the adoption and guidance of a technology? • Are there research institutions working with innovative technological solutions that could improve operational efficiency?	• Research possible technologies which may be affordable and suitable. • Conduct a pilot trial of the technology to compare its efficiency and impact on productivity/efficiency/sustainability. • If relevant, undertake training on technology to maximise its benefit as well as equip staff with necessary in-house skills. • Establish knowledge transfer programmes. • Approach research institutions to better understand innovations in technology/ production techniques that are being explored and determine the value and feasibility of collaborating in trials for new innovations.

Component 1.12. Alignment with the UN SDGs





Alignment with the SDGs provides a comprehensive framework for addressing key challenges, such as ensuring food security (SDG 2), promoting sustainable economic growth (SDG 8), and conserving aquatic ecosystems (SDG 14) (Figure 9). By aligning with these goals, aquabusinesses can enhance their operational efficiency, innovate towards eco-friendly practices, contribute to local economies, and address social inequalities, ultimately working towards a more resilient, equitable, and environmentally conscious industry.

Questions to ask:	**Finding the answers:**
• What SDGs can be aligned with? • What impacts will alignment have on my aquabusiness operation?	• The ASC has established a framework with which to assess responsible aquaculture and how it can contribute to the UN SDGs.

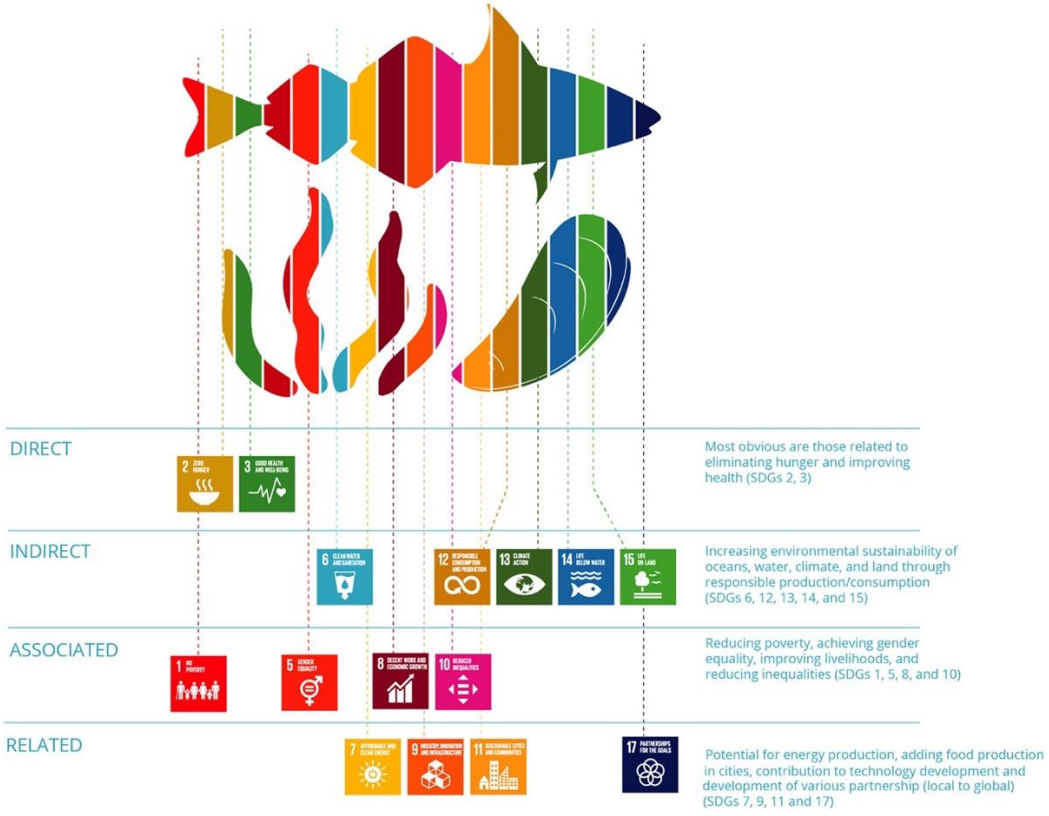


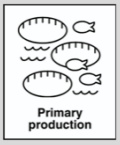
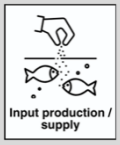
Figure 9: Aquabusiness has the potential to contribute to or support all 17 UN SDGs (Source: Troell et al., 2023).

Guiding Principle 2: Assessing the Business Environment

Audience: Private Sector

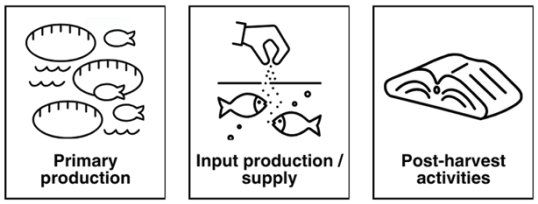
A supportive business environment established by the relevant public sector entities is essential for ensuring the long-term, sustainable development of a country's aquaculture industry. An enabling business environment for aquaculture attracts investment, fosters innovation, encourages responsible practices, limits onerous application processes, and ensures that the industry contributes positively to economic development while minimising negative social and environmental impacts.

Prior to making aquaculture investments or pursuing business development, the prevailing environment for aquabusiness must be assessed carefully.

Guiding Principle 2: Assessing the Business Environment				
Principle component	**Description**	**Value chain segments**		
				
2.1	Regulatory, Policy and Institutional Framework	**X**	**X**	**X**
2.2	Licensing and Permitting Framework	**X**	**X**	**X**
2.3	Zones for Commercial Aquaculture Development	**X**	**X**	**X**
2.4	Investment Incentives	**X**	**X**	**X**
2.5	Strategic Aquaculture Infrastructure and Services	**X**	**X**	**X**
2.6	Supporting Infrastructure and Services	**X**	**X**	**X**
2.7	Technology and Knowledge Transfer, Training, Innovation and R&D	**X**	**X**	**X**
2.8	Market Access and Promotion	**X**	**X**	**X**

Note: Guiding Principle 2 is directed at the private sector, to guide the assessment of a country's business environment for commercial aquaculture value chain investment or development. Guiding Principle 8 ("Creating an Enabling Environment for Sustainable Aquabusiness") is designed to support the public sector (and stakeholders who support public sector initiatives) in improving the business environment for aquaculture, to attract sustainable investment and foster sustainable growth. These two Guiding Principles complement each other but have different objectives for their respective audiences.

Component 2.1. Regulatory, Policy and Institutional Framework



The regulatory, policy and institutional framework for a country's aquaculture sector set out the "rules of the game" for commercial aquabusinesses. Ideally, this framework should create an enabling environment for aquabusiness, by enhancing the ease of investment into the aquaculture value chain and providing a supporting structure for aquabusinesses' operations, growth, and development. An enabling environment for aquabusiness may be characterised by the prioritisation of commercial aquaculture in national policies and strategies, primary legislation that minimises barriers to entry whilst also enforcing responsible development (e.g., strong environmental regulations), and the presence of a well-capacitated dedicated aquaculture authority.

Questions to ask:

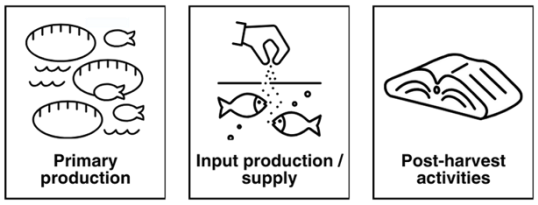
- What legislation is in place with regards to the aquaculture sector, and will this legislation enable or hinder my aquabusiness?
- Has sustainable aquaculture development been prioritised in national policy or strategies? Are there plans in place to further improve support to the sector?
- Is the authority responsible for regulating and supporting aquaculture sufficiently capacitated to support my aquabusiness?
- Is the macro-level (e.g., national, regional) political environment stable enough for long-term planning?

Finding the answers:

- Regulations, policies, and national strategies/development plans can be obtained by approaching the relevant authorities (e.g., aquaculture and/or environmental authorities) or using online resources such as the FAOLEX Database.
- You will need to carefully review the relevant legislation – firstly to understand the relative ease of doing business that you will encounter, and secondly to ensure that your aquabusiness plan is compliant with all legal requirements. You will need to understand, for example:
    - Permit and licence requirements, access, and costs (this is covered in further detail in Guiding Principle Component 2.2);
    - Access to land and/water space for commercial aquaculture development, and associated costs and regulations (see Guiding Principle Components 2.2 and 2.3);
    - Water abstraction rights and usage regulations, if relevant;
    - Applicable environmental regulations (see Guiding Principle Component 4.1) including any environmental assessments or authorisations that you will require;
    - Species-specific regulations (see Guiding Principle Component 1.2);
    - Market access and trade regulations, including restrictions or preferential trade agreements for imports of aquaculture inputs (e.g., feed, equipment) and export of

	aquaculture products, if relevant (see Guiding Principle Component 2.8); o Labour laws, including foreign labour regulations if relevant; and o Reporting and monitoring requirements. • Information on the authority mandated to manage the aquaculture sector can be obtained by approaching the relevant authority. Discussions with the authority may reveal the level of support that the authority is mandated to provide and can provide. These may include, for example, veterinary monitoring, diagnosis and treatment services, environmental monitoring, R&D, and emergency response. • Discussions with other private sector aquabusiness stakeholders may also allow you to better understand any regulatory challenges that your aquabusiness is likely to face, and the level of support and promotion that you can expect the aquaculture authority to provide, especially if the political environment is unstable.

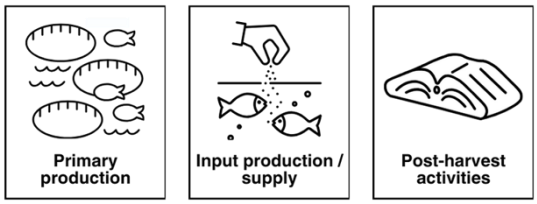
Component 2.2. Licensing and Permitting Framework



Obtaining an aquaculture license can be an onerous and time-consuming process and may involve several authorities, such as those responsible for environmental management, water rights, land rights, and business and trading permits. A transparent, efficient, and streamlined aquaculture licensing/permitting process reduces bureaucratic hurdles and the approval timeline for projects and allows for more efficient project planning and implementation. Longer-term rights (e.g., water and land) and business permits/licences also allow for effective long-term business planning and minimise the administrative burden on operators.

Questions to ask:	**Finding the answers:**
• What permits and/or licences are required for my aquaculture operation? • What is the process for obtaining relevant permits and/or licences, including renewable processes and associated fees? • Is there any assistance available with regards to the aquabusiness registration, permitting and/or licensing? • What is the duration of relevant permits and licences?	• The relevant aquaculture authority should be approached to understand the permits and/or licences required for your specific aquabusiness, and the process and costs involved in obtaining these, as well as renewal requirements. These may include, for example, business permits, processing permits, export permits, and land and water rights. If the permitting process is not centralised, the various relevant authority/ies (e.g., land, water and environmental) will need to be approached. • The lead time and costs associated with permit and/or licence applications, approvals and renewals will need to be factored into your business plan and feasibility study. • The duration of permits and licences can be determined by approaching the relevant authorities. Longer-term business, land and water rights (of at least 10 years) to allow for preferable long-term planning. • Other aquaculture operators in the area, who have recently undergone the licensing/permitting process and have a similar business model, can be approached to understand their experience in terms of the process and timeline associated with obtaining a licence.

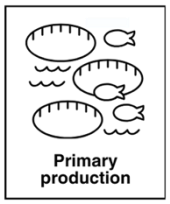
Component 2.3. Zones for Commercial Aquaculture Development

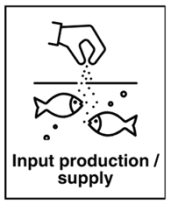


Closely linked to licensing and permitting, the presence of designated zones for commercial aquaculture development (e.g., ADZs) can be a major advantage for aquaculture investment. For example, commercial aquaculture zones may already carry land and/or water rights for aquabusiness, thus allowing for a simplified licensing/permitting process; they may have already undergone an Environmental Impact Assessment (EIA), negating the time and cost this would usually require; and they are likely to provide economies of scale and value chain linkages. Therefore, the private sector should understand the options available in terms of aquaculture zones.

Questions to ask:	**Finding the answers:**
• Have any zones for aquaculture development (e.g., ADZs) been established in your area/s of interest and, if so, what strategic advantages do these zones offer?	• The designation and establishment of zones for aquaculture development is a public sector function. As such, the presence and benefits of such zones can be determined by approaching the relevant aquaculture authority. • While the presence of zones for commercial aquaculture development does enhance the attractiveness of a country's environment for aquaculture, the establishment of aquabusinesses in these zones may not necessarily be the most feasible option for all businesses; site-specific business planning and economic modelling is therefore important (see Guiding Principle Component 1.4).

Component 2.4. Investment Incentives

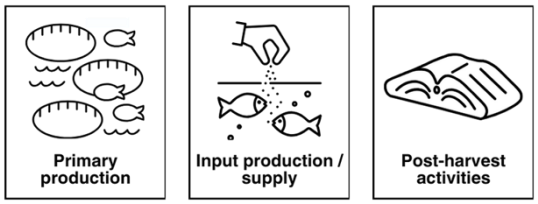




Some countries provide incentives to promote sustainable investment in aquaculture value chains. These may be tax incentives (e.g., exemption/reduction of corporate income tax, import duties on equipment and other production materials), or non-tax incentives (e.g., permits for foreign nationals to own land, technical support to operators). These incentives are usually dependent on certain conditions, such as a minimum percentage of local ownership, or certification against specific standard/s, to promote responsible sector development. The private sector must be aware of and understand the investment incentives available to them.

Questions to ask:	**Finding the answers:**
• Are there any investment incentives or support programmes for aquabusiness in the country of interest? • How do these incentives benefit the business plan? • What are the eligibility criteria for these incentives, and what does the application process entail? • Does my investment qualify and, if not, is it worth adjusting the business plan to qualify for incentives?	• Investment incentives for aquabusiness can be identified by approaching the relevant aquaculture authority or national investment board. • Incorporate investment incentives into your business plan and feasibility study, to understand their impact on your business plan. In this way, you can determine whether these are attractive incentives and whether it is worth applying for them.

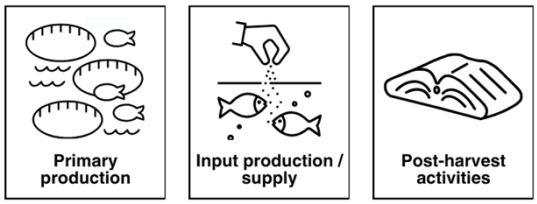
Component 2.5. Strategic Aquaculture Infrastructure and Services



Functional, well-equipped state-run aquaculture facilities, such as hatcheries or broodstock facilities, and research laboratories, can be valuable for supporting a private sector aquaculture operation. The provision of support services, such as disease diagnosis and treatment, environmental monitoring, and general extension services can also assist the private sector. The relevance of these services to private sector actors is dependent on their level of integration within the value chain.

Questions to ask:	**Finding the answers:**
• If applicable, are there any state-run aquaculture facilities in reasonable proximity to your site/s of interest? Do these facilities meet your needs? • If so, are these facilities functional and are they effective in supporting the private sector? • What support services are offered by the aquaculture authority? Do these services meet the needs? • How effective are the support services offered (e.g., how fast does the authority respond to requests for diagnostic services)? • If the public sector does not meet your requirements for supporting aquaculture facilities and services, are these met by the private sector? If so, what are the costs involved and are these feasible?	• Information on aquaculture support facilities and services can be obtained by approaching the relevant aquaculture authority. • Additionally, engage public sector actors to understand the degree of quality and reliability of state-run services and facilities. For example, if fingerlings supplied by a state hatchery are of poor quality (e.g., poor growth, high mortality, high susceptibility to disease) and are not consistently available (impacting operational schedules and cashflow), it would be preferable to investigate private sector options or consider vertical integration of seed production. • Obtain quotations for the costs of different inputs and support services and incorporate these into your business planning and financial modelling process to understand the feasibility.

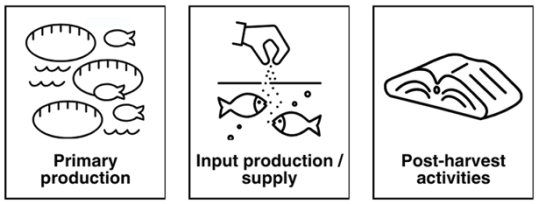
Component 2.6. Supporting Infrastructure and Services



In addition to aquaculture-specific infrastructure and services, reliable supporting infrastructure (e.g., roads, cold chain facilities) and services (e.g., water and electricity supply, waste management systems) are critical for aquabusinesses. In many commercial aquaculture cases, most notably those with a high degree of vertical integration, effective supporting infrastructure and services may be more important than the presence of state-run aquaculture facilities, in assessing a country's aquabusiness environment.

Questions to ask:	**Finding the answers:**
• Are the public infrastructure and services that you require in place? • If not, which services can be provided through the private sector suppliers, or integrated within your aquabusiness? What are the costs associated with acquiring these services?	• Assess the presence, capacity, and functional state of supporting public services and infrastructure by engaging with the relevant authorities and regulatory entities, as well as by conducting site visits and engaging with other private sector stakeholders who rely on these services and infrastructure.

Component 2.7. Technology and Knowledge Transfer, Training, Innovation and R&D

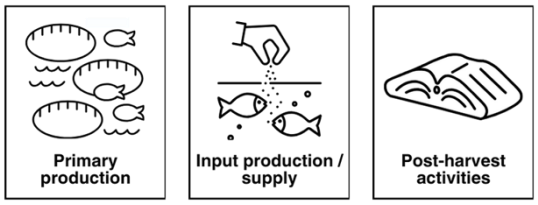


The public sector can support the development of commercial aquaculture by facilitating the transfer of knowledge in aquaculture technologies, skills, and methods through partnerships with international research institutions and industry experts. The public sector can also support the industry by offering training programs (e.g., through public learning institutions and practical demonstration facilities) to enhance the skills of the local workforce in aquaculture practices.

Additionally, R&D facilities and programmes (e.g., genetic improvement) offer valuable support to the private sector. The easiest method to accomplish this is by obtaining the inputs (seed, feed) and expertise of individuals with experience in the specific matter, if available. These may be government-led or -supported, and may also involve collaboration with NGOs, industry actors, and public/private research institutions.

Questions to ask:	**Finding the answers:**
• Are there practical and theoretical learning centres (including primary, secondary, tertiary, vocational and informal education institutions) and programmes for aquaculture in the country? • Is there a skilled aquaculture workforce in the country of interest (for example, because of training provided by the public sector)? If not, does the government allow foreign nationals to be employed in the sector? If so, what is the cost associated with employing foreign nationals? • Does the public sector have any ongoing collaborative aquaculture programmes with international research institutions or experts?	• Engage with the relevant aquaculture authority and/or local research institutions to understand the management and labour training available. You may also wish to approach these institutions to identify personnel to resource your aquabusiness. • If there is a lack of skilled resources to fill management and labour positions, consider implementing a knowledge transfer programme whereby an expert/s provides early management, and implements a training and capacity building programme for local resources (e.g., train the trainer programmes). • Promote continuous skills development, including transfer programmes, amongst your resources.

Component 2.8. Market Access and Promotion



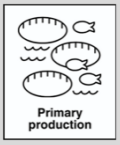
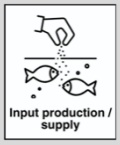
By developing marketing strategies, or promoting brand awareness, the public sector can support aquabusinesses in accessing both domestic and export markets. Moreover, access to international markets is dependent on the competent authority (CA; the government agency or regulatory body with the legal authority and expertise to ensure and enforce food safety regulations and standards) in the country of origin being recognised by the recipient country. Finally, access to export markets can also be enhanced by preferential trade agreements with other countries.

Questions to ask:	**Finding the answers:**
• Has the public sector made any progress in establishing the country's aquaculture products in global markets? • Does the export country have food safety or other production standards (e.g., environmental or social) that must be met? • If applicable, is the CA in the country of interest approved in my intended export market/s? • Does the country meet the World Organisation for Animal Health (WOAH) standards required in my intended export market/s? • If applicable, does the country have preferential trade agreements with any other countries that I am interested in exporting to? • Are there any bilateral and/or intercontinental market agreements?	• Undertake an in-depth market assessment (online and/or by visiting relevant markets) to understand the position that similar products hold in your markets of interest. • Enquire with the relevant CA to understand which markets the country's aquaculture products have access to. Alternatively, enquire in the target markets what requirements, certifications or standards are required to obtain access. Incorporate the costs of any necessary certifications, biosecurity requirements and/or food safety testing into your business planning and financial modelling process. • Enquire with the relevant export authority, to identify which markets your country of interest has preferential trade agreements with, and what the benefits of these agreements are. Consider these in your business planning and financial modelling process. • Enquire with the relevant authorities, to understand what bilateral trade agreements are established.

Guiding Principle 3: Socially Responsible Practices

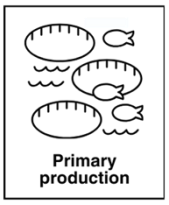
Audience: Private Sector

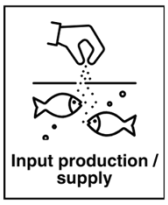
To ensure socially responsible investments, investors must critically assess the social safeguards in the country of investment. These safeguards include, for example, labour laws (e.g., core labour standards promoting decent work, legislation of minimum age for employment, and sector-specific legislation on minimum occupational health and safety (OHS) measures) and land tenure laws (e.g., customary rights recognition and access to coastal areas and EEZs). In the case that certain social safeguards are not in place, investors should take measures to ensure that their investments do not violate best practices about social responsibility. Moreover, investors in existing aquabusinesses should assess the social responsibility of these operations. This can be done, for example, through an external certification or audit process.

Guiding Principle 3: Socially Responsible Practices				
Principle component	**Description**	**Value chain segments**		
				
3.1	No Child Labour	**X**	**X**	**X**
3.2	Fair and Decent Work	**X**	**X**	**X**
3.3	Gender Equality and Mainstreaming	**X**	**X**	**X**
3.4	Wage Scales and Minimum Wage	**X**	**X**	**X**
3.5	Indigenous Communities and Customary Tenure	**X**	**X**	**X**
3.6	Assessing Social Carrying Capacity	**X**	**X**	**X**

Guiding Principle 3 should be used in combination with The World Bank Environmental and Social Framework (ESF) which supports resilient and inclusive development by strengthening protections for people and the environment. Projects can further be assessed for compliance with applicable environmental and social policies by making use of the IFC's Procedure For Environmental and Social Review of Projects.

Component 3.1. No Child Labour

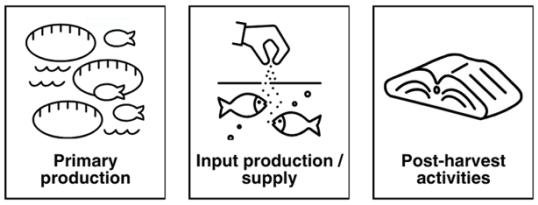




Child labour is unacceptable for several reasons. It denies children their basic rights to protection and the opportunity to enjoy a safe and healthy childhood. Labour interferes with children receiving a proper education, thus limiting their future opportunities and perpetuating the cycle of poverty. Children engaged in labour are often exposed to hazardous working conditions that can impact their physical and mental health; and are often vulnerable to various forms of exploitation and abuse. Child labour also interferes with normal physical, cognitive, and emotional development. Given its detrimental impact on individuals and society, child labour violates international standards; including the International Labour Organization (ILO)'s two conventions against child labour. These have been ratified by most countries; however, the practice of child labour persists in various sectors, including aquaculture, in many countries, particularly those with poor labour regulations (or poor enforcement of labour regulations), and economic conditions that drive families to rely on the income generated by their children.

Questions to ask:	**Finding the answers:**
• Have the ILO conventions on the elimination of child labour been ratified in the country of interest, and has a national action plan been put in place to address the issue of child labour? • Does the country of interest have legislation that effectively mitigates and prevents the use of child labour in aquabusinesses? • If no such legislation exists (or if it is not adequately enforced), how can it be ensured that an aquabusiness investment/development does not involve child labour of any kind? • In the case of an existing aquabusiness, are child labour concerns adequately addressed?	• Refer to the ILO database to identify which countries have ratified the ILO Minimum Age Convention, 1973 and the ILO Worst Forms of Child Labour Convention, 1999 (note: the latter Convention has been universally ratified). • Legislation and policies pertaining to child labour can be identified by approaching the authority responsible for labour or using online resources such as ILO's NATLEX. Relevant labour laws should be examined and ideally should contain clause/s that ban child labour practices. • In the case that no legislation is in place to prevent child labour (or that such legislation is not enforced), an internal policy for child labour should be developed, including risk assessment, safeguards, mitigation, and monitoring measures, by consulting the technical guidance materials on child labour in aquaculture. • In the case of an existing aquabusiness, the suitability of social safeguards regarding child labour can be assessed by reviewing internal policies against seminal documents and, where necessary, through third-party certifications.

Component 3.2. Fair and Decent Work

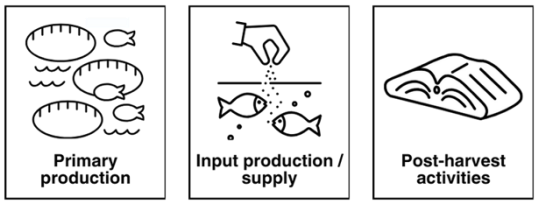


Aside from child labour, there are several other manifestations of socially irresponsible labour practices stemming from fragmented labour laws and weak enforcement capacities. These include exposure to poor or unsafe working conditions, low wages or a lack of a minimum wage, limited access to social protection services and schemes, a lack of rights for migrant workers, and prevention of the right to association and collective bargaining (e.g., formation of trade unions).

To be socially responsible, labour practices should adhere to core labour standards as defined in ILO conventions. The ILO sets the global standards for fair labour practices through a series of conventions and recommendations. One of the key standards is the ILO Declaration on Fundamental Principles and Rights at Work, adopted in 1998 and amended in 2022, which encompasses five core principles that are considered fundamental to ensuring fair and decent work, namely freedom of association and the right to collective bargaining, elimination of forced or compulsory labour, abolition of child labour, elimination of discrimination in employment and occupation, and a safe and healthy working environment.

Questions to ask:	**Finding the answers:**
• What labour laws are in place, and do these effectively promote safe and equitable labour in the aquaculture sector? • How can I ensure that my aquabusiness investment or development promotes equitable labour practices?	• Labour legislation can be obtained by approaching the authority responsible for labour or using online resources such as ILO's NATLEX. • All relevant labour laws must be incorporated into aquabusinesses' planning and implementation, for example, through the establishment of internal SOPs or policies. • In addition to prevailing labour laws, you should ensure that your aquabusiness is aligned with international standards for equitable labour, e.g., the ILO Declaration on Fundamental Principles and Rights at Work, and the World Bank Environmental and Social Standards (ESS), the Aquaculture Stewardship Council's (ASC) Standards, and the Seafood Task Force Code of Conduct. • In the case of an existing aquabusiness, the suitability of social safeguards regarding overall labour laws can be assessed by reviewing internal policies against seminal documents and, where necessary, through third-party certifications (e.g., ASC Standards, which are aligned with the ILO Declaration).

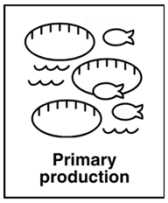
Component 3.3. Gender Equality and Mainstreaming

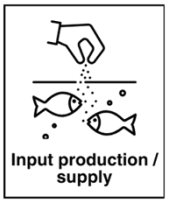


Gender-based disparities may exist within aquaculture industries and businesses, for example with regard to wages, employment opportunities, access to land, and access to leadership roles. Promoting gender equality in aquabusiness is essential for creating a more inclusive and equitable work environment, where all workers, regardless of gender, have equal access to opportunities, rights, and responsibilities. Diversity in aquabusiness (including gender diversity) is not only important from a social justice perspective; it is also strategic as it contributes to better decision-making and increased innovation.

Questions to ask:	**Finding the answers:**
• What policies, regulations and programmes exist at the national and local levels to promote gender equality in the aquaculture sector? • What is the gender breakdown of the workforce in the aquaculture sector in the country of interest? • Are there any disparities in terms of access to benefits, wages, types of roles held by men and women? • Are there any barriers preventing women from accessing employment opportunities in aquabusiness, such as discriminatory hiring practices or lack of training programs? • How can aquabusiness investment or development promote gender equality and mainstreaming? • In the case of an existing aquabusiness, are gender equality and mainstreaming policies in place?	• Legislation and policies pertaining to gender equality and mainstreaming can be identified by approaching the authority responsible for labour or using online resources such as ILO's NATLEX. • New and existing aquabusinesses can ensure gender equality and mainstreaming by developing internal policies surrounding gender issues. These can be developed based on the four ILO Conventions on gender equality: the Equal Remuneration Convention, 1951, the Discrimination (Employment and Occupation) Convention, 1958, the Workers with Family Responsibilities Convention, 1981, and the Maternity Protection Convention, 2000.

Component 3.4. Wage Scales and Minimum Wage



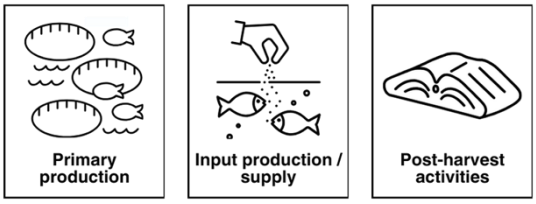


Wage scales refer to a structured system that determines the wages or salaries paid to employees based on various factors such as job responsibilities, experience, education, and skills. These contribute to a transparent and equitable compensation system within an organisation, and provide a framework for consistent decision-making, help in managing and forecasting operational costs (of which HR costs are a major component in aquabusiness), and ensure that employees are compensated fairly based on factors relevant to their roles and contributions.

At the government level, a minimum wage is the lowest legally permitted wage that employers must pay their employees for work performed, to ensure that workers receive a baseline level of compensation that allows them to meet their basic needs. Minimum wage rates can vary significantly between countries and regions, and some areas may have different minimum wage levels for specific industries or categories of workers. Several countries do not have a minimum wage in place; but in some cases (notably developed countries), this is overcome by the setting of wage standards through collective bargaining agreements. Aquabusinesses need to adhere to the host country's acceptable minimum wage guidelines.

Questions to ask:	**Finding the answers:**
• Does the labour legislation in the country of interest include a minimum wage; and, if not, does it include a mechanism (e.g., collective bargaining) for setting equitable wage standards? • In the case that a country does not set minimum wages, how can fair wage scales be established to avoid forced or bonded labour taking place?	• Legislation pertaining to minimum wages, or other wage standard-setting mechanisms, can be obtained by approaching the authority responsible for labour. All legislation pertaining to wages must be incorporated into aquabusinesses' planning (e.g., economic modelling) and implementation. • Wage scales for an aquabusiness, to ensure equitable remuneration for employees whilst managing production costs, should be developed in consultation with labour specialist/s in the country of interest, as fair wages vary widely amongst regions and countries. Moreover, any other benefits (e.g., healthcare, housing) that are being offered as part of an employment package will impact the wage scales that are considered fair.

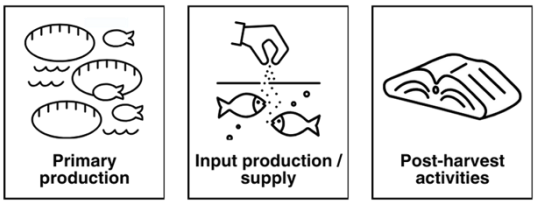
Component 3.5. Indigenous Communities and Customary Tenure



Customary tenure refers to systems of land ownership and land-use rights that are based on traditional or customary practices within a specific community or culture. In some countries, customary tenure may have been legally recognised and protected within formal legal frameworks. Recognition and protection of indigenous communities' traditional customs, through clearly defined and enforced legislation, are important for ensuring that aquabusiness and investment and development do not infringe upon community rights.

Questions to ask:	**Finding the answers:**
• Are there formalised and effective customary tenure laws in place in my country of interest, to ensure that my aquabusiness will not lead to the displacement of indigenous communities? • If there are no such laws in place, how can I ensure that my aquabusiness does not infringe upon indigenous communities' customary rights?	• Legislation pertaining to customary tenure may be embedded in laws governing land ownership and access rights, laws that relate specifically to traditional affairs, or other laws. The relevant authority should therefore be identified and approached, to identify these laws. • If the law does not guarantee the upholding of customary rights, an expert in indigenous communities in the area of interest should be consulted, to ensure that an intended aquabusiness investment or development does not infringe on any traditional laws or rights.

Component 3.6. Assessing Social Carrying Capacity



Social carrying capacity refers to the size of an aquaculture enitity that can be developed without incurring adverse social impacts, e.g., impacting on artisanal fishing or aesthetic characteristics of importance to tourism. Social capacity for aquaculture is also affected by perceived or actual ecological degradation, the extent to which aquaculture impacts other livelihoods, exclusion of legitimate stakeholders from decision-making, and incompatibility of aquaculture with alternative uses, which are all potential sources of social conflict. Social conflicts can be minimised through good engagement in the development and management of aquabusinesses. Fair business practices and the creation of opportunities for local communities in the aquaculture value chain also builds valuable support amongst local communities for an aquabusiness development.

It will be critical that new entrants into aquaculture value chains engage comprehensively with communities to establish sustainable social carrying capacity for mutual benefit.

Questions to ask:	**Finding the answers:**
• What potential social conflicts will my aquabusiness face? • How can these be mitigated?	• Identify other uses of the site (e.g., fishing, recreational activities, traditional community use) and assess the potential for user conflicts. This may require a social impact assessment. Ensure that any developments are harmonised with other existing uses and conduct comprehensive stakeholder engagement ahead of (and possibly during and after) development. • Engage in comprehensive stakeholder engagement before and throughout development and operations. Consider and mitigate communities' concerns regarding social impacts. • Where possible, provide employment opportunities within local communities.

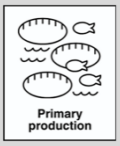
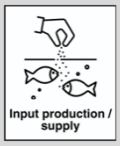
Guiding Principle 4: Environmentally Sustainable Practices

Audience: Private Sector

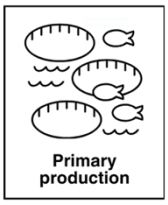
Promoting environmentally sustainable aquaculture involves a holistic approach that integrates ecosystem-based management, stringent regulatory frameworks, technological innovation, and knowledge sharing. This includes the promotion and adoption of research, certification programmes, and stakeholder engagement to optimise resource use, minimise environmental impact, and ensure responsible practices. Monitoring, enforcement, and financial incentives can support the transition to sustainable methods, while education and awareness initiatives will raise public consciousness about the significance of environmentally friendly aquaculture. The synergy of these efforts is pivotal in achieving a balance between economic growth and environmental preservation (and environmental enhancement in the case of specific farming strategies), in both public and private sectors engaged in aquaculture.

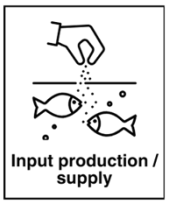
Embracing environmentally sustainable aquaculture practices presents a multitude of compelling opportunities. Investors seeking resilient, future-proof ventures recognise sustainable aquaculture as an attractive avenue for long-term returns, aligning with growing consumer demand for eco-conscious products. Entrepreneurs exploring this sector can leverage sustainability as a cornerstone for innovation, gaining a competitive edge and fostering market differentiation. Engaging in environmentally friendly practices not only mitigates operational risks but also enhances access to funding, partnerships, and market opportunities. This commitment not only ensures compliance with evolving regulations but also bolsters a company's social and environmental credibility, fostering consumer trust and loyalty. Ultimately, integrating sustainability into aquabusinesses is a pathway to unlocking economic growth, attracting investment, and driving positive environmental impact, aligning financial success with responsible environmental stewardship.

Guiding Principle 4 should be used in combination with The World Bank Environmental and Social Framework (ESF) which supports resilient and inclusive development by strengthening protections for people and the environment. Projects can further be assessed for compliance with applicable environmental and social policies by making use of the IFC's Procedure For Environmental and Social Review of Projects.

Guiding Principle 4: Environmentally Sustainable Practices				
Principle component	**Description**	**Value chain segments**		
				
4.1	Environmental Legislation, Regulations, Certification and Standards	**X**	**X**	**X**
4.2	Assessing Ecological Carrying Capacity	**X**		
4.3	Farming Non-native Species	**X**		
4.4	Waste Management	**X**	**X**	**X**
4.5	Managing Feed Strategies	**X**	**X**	
4.6	Environmental Management and Monitoring	**X**	**X**	**X**
4.7	Critical Habitats	**X**	**X**	**X**

Component 4.1. Environmental Legislation, Regulations, Certification and Standards





Environmental legislation, regulations and standards establish clear guidelines for responsible environmental practices in aquabusiness, covering site selection, water quality management, feed composition, feeding regimes, waste management and disposal, food losses, integration, and disease control, among others. The private sector must be aware of, and comply with, any environmental legislation, regulations and/or standards in place for aquaculture.

Moreover, various voluntary environmental certification programmes exist for aquaculture value chains (see Guiding Principle Component 1.1), which serve to recognise the efforts invested in ensuring the long-term environmental sustainability of aquabusinesses. The advantages of environmental certification may include elevated reputation, promotional opportunities, preferential market access, and premium prices.

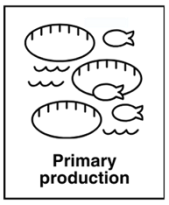
Questions to ask:

- What are the national, regional, or international environmental laws and regulations that govern the relevant component/s of the aquaculture value chain? Are there any minimum environmental standards or certifications that my aquabusiness must attain (regardless of the target market)?
- How can I ensure that my aquabusiness promotes environmentally responsible practices in line with relevant laws and standards?
- Does my product require or benefit from any specific environmental certification in my target market?

Finding the answers:

- Environmental legislation, regulations, and standards pertinent to your component/s of the aquaculture chain can be acquired through direct engagement with the relevant authority/ies, or through online resources such as the FAOLEX Database. Make sure to find out if there are any specific environmental regulations in place for the farming/production of your species/product (e.g., non-native species may be subject to additional environmental standards).
- All relevant environmental laws and standards must be incorporated into aquabusinesses' planning and implementation, for example, through the establishment of internal SOPs or policies.
- In addition to mandatory environmental laws and standards, you should ensure that your aquabusiness is aligned with international standards for environmentally responsible aquaculture, e.g., the World Bank ESS, the FAO's Ecosystem Approach to Aquaculture Management Handbook, and the FAO Guidelines for Sustainable Aquaculture (GSA).
- Assess the applicability (cost/benefit) of attaining a specific environmental certification, as outlined in Guiding Principle Component 1.11.

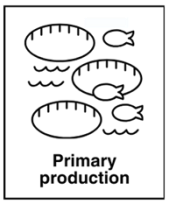
Component 4.2. Assessing Ecological Carrying Capacity



Assessing ecological carrying capacity in aquaculture is crucial to maintaining ecological balance and preventing environmental degradation. It involves determining the maximum sustainable level of aquaculture production a specific area or water body can support without causing harm to the environment. By evaluating factors such as water quality, nutrient levels, habitat suitability, and ecological impacts, this assessment helps ensure that aquaculture operations remain within the capacity of the environment, minimising negative consequences such as habitat destruction or pollution while promoting long-term sustainability in the industry.

Questions to ask:	**Finding the answers:**
• How much can be farmed or produced most efficiently in the current scenario? • How does increasing/reducing capacity influence environmental impacts such as water quality and discharge? • How does increasing/decreasing capacity influence fish welfare? • How will my operation's profitability be affected by changes in carrying capacity (sensitivity analysis)?	• Consult the relevant aquaculture ministry or governing body to establish whether any aquaculture zoning has been conducted and, if so, if any carrying capacity assessments have been undertaken (relevant for larger water bodies like lakes and oceans). • Adhere to environmental standards and requirements for the area as mandated by the aquaculture authority or ministry. • Where no information is available, conduct a carrying capacity assessment based on best practices described in the literature. This will require a specialist study. • For inland farming in ponds, literature on the culture species should be consulted to identify appropriate stocking densities (for good growth performance and fish welfare).

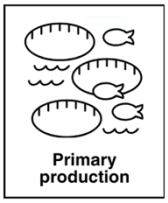
Component 4.3. Farming Non-native Species

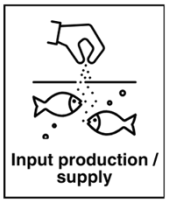


The introduction and farming of non-native species in aquaculture has the potential to cause significant environmental harm. Escapees of non-native invasive species can result in cascading negative impacts on ecosystems, by interbreeding with and outcompeting native species, and by introducing diseases, all of which contribute to a negative perception of the aquaculture sector by the public. On the other hand, with comprehensive risk assessments and appropriate management practices, non-native species can be farmed responsibly in certain contexts. In fact, several of the most widely farmed species are not native to many of the regions in which they are produced (e.g., Nile tilapia, Atlantic salmon, rainbow trout, whiteleg shrimp). The private sector should thus be aware of and comply with any regulations pertaining to farming of non-native species.

Questions to ask:	**Finding the answers:**
• If my species is non-native, am I allowed to produce it? If so, what specific conditions apply to the farming of my species? • If my species is non-native, is it considered invasive? What are the potential impacts of farming this species (particularly in the case of escapes)? • Is there a market rationale for producing a non-native species?	• Approach the local regulatory aquaculture authority for aquaculture management to determine whether farming of your species is permitted, and what specific conditions are in place for your species (see Guiding Principle Component 1.2). Ensure that your business plan and operations are compliant with all such regulations. • If your species is non-native (but is permitted), conduct a thorough analysis to understand the potential impacts associated with its farming; for example, its ability to establish wild populations, and compete with or hybridise with native species, and the possibility for the introduction and transmission of diseases to surrounding ecosystems. • Ensure that adequate mitigation measures (e.g., escapee control strategies, use of infertile fish etc.) are in place to minimise any negative impacts. • Adhere to BMPs such as the Sea Grant Law Center's Regulating Invasive Species In Aquaculture and the FAO "Guidelines on assessing and minimizing the possible impacts from the use of non-indigenous species in aquaculture". • Understand if you will be competing with well-established competitors from other countries. It may not be worthwhile to produce a non-native species, simply because there is a global demand for that species.

Component 4.4. Waste Management

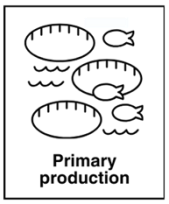


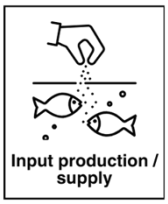


One of the major challenges facing the aquaculture industry is managing the waste generated by operations. The effective management of aquaculture waste is essential for maintaining the health of aquatic ecosystems and ensuring the long-term sustainability of the industry. Managing waste can be a costly exercise for a business. Implementing effective management practices to handle waste products, such as mortalities, uneaten feed, faeces, chemicals, and wastewater (effluents), is crucial to the long-term success of an aquabusiness. Several existing and emerging methods can improve waste management practices, such as integrated aquaculture strategies, including recirculating aquaculture systems (RAS) to minimise waste, nutrient recycling, integrated multitrophic aquaculture (IMTA), system design and improvements in biofiltration, among others.

Questions to ask:	**Finding the answers:**
• What regulations govern waste management? • What technologies are available for waste management? • Is there an opportunity to integrate waste management into the operation? Or is there a third-party service provider who can handle waste management needs? • How will the waste management plan impact local communities and the surrounding environment?	• Consult the local regulatory authority to understand what regulations govern waste management. • Ensure that waste does not negatively influence the surrounding environment or any local communities. • Engage with stakeholders locally and internationally who have successfully integrated waste management solutions into their operations. • Explore the use of improved technologies to improve waste management solutions, including an economic assessment.

Component 4.5. Managing Feed Strategies

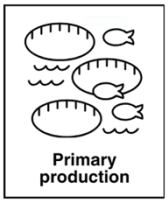


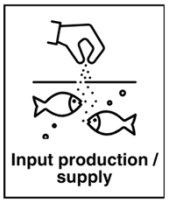


There is a growing demand for more environmentally sustainable feeds in aquaculture, due to environmental concerns amongst consumers regarding the use of wild fish to produce farmed fish (see Box 9). Alternative protein sources (most notably soybean meal and extracts and now also black fly meal) are therefore being increasingly used in commercial aquafeeds, and R&D into other alternative protein ingredients for aquafeed is ongoing. The use of sustainable and high-quality feed is essential to minimise the environmental impacts of farming of fed species.

Questions to ask:	**Finding the answers:**
• What are the core feed ingredients/additives that are required in the production of the feed that I will use in my operation? • How can my aquabusiness make use of more sustainable feeds and feed ingredients? • Is there a database of available aquafeed ingredients in your country? • Are there any regulations governing the composition, formulation and raw material quality and origin of aquafeed? • Are there any regulations governing the use of aquafeed additives? • What impact does the feeding strategy have on the environment?	• If you are planning to use farm or self-made feeds, then investigate alternative protein sources that are available in your area and consult with a nutritionist to assist in the formulation and manufacture of a viable feed. • Consult with commercial feed manufacturers to develop new, environmentally responsible feeds. • Consider using a tool, such as WWF's Environmental and Social Governance (ESG) Risk-based Feed Ingredient Decision Support Tool, to understand the sustainability of different feed and feed ingredients.

Component 4.6. Environmental Management and Monitoring

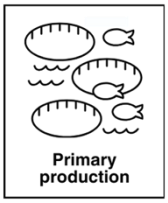


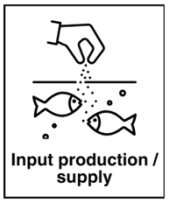


Environmental management and monitoring in aquaculture are vital to proactively address and mitigate potential ecological impacts. This involves implementing measures to preserve water quality, minimise pollution, and safeguard natural habitats. Regular monitoring allows for the assessment of environmental parameters, enabling early detection of issues, prompt corrective actions, and the maintenance of sustainable aquaculture practices, ensuring long-term viability while minimising adverse effects on surrounding ecosystems.

Questions to ask:	**Finding the answers:**
• What environmental and production data needs to be collected, compiled, and analysed? • What environmental data needs to be reported to the aquaculture authority? • What technology or tools are available to establish an environmental monitoring programme?	• Develop a SOP for environmental monitoring and management, in line with all relevant legislation, regulations, standards, and certifications. • Appoint a team (or individual) to routinely monitor environmental parameters (e.g., discharge water quality, benthic nutrient levels), to assess environmental impact. • Implement systems to mitigate environmental impacts (i.e., early warning systems, alarms etc). • Implement an Environmental and Social Action Plan (ESAP) describing environmental mitigation and monitoring measures.

Component 4.7. Critical Habitats





Poorly managed aquaculture operations can inflict significant harm on vital and vulnerable habitats like mangroves, estuaries, seagrass beds, and nursery areas. Ecosystem damage also impacts the long-term financial sustainability of operations (e.g., due to water quality issues) and adversely affects the public perception of aquaculture. To ensure the success of an aquabusiness, it is essential to establish strict agreements regarding the preservation and, in certain cases, the restoration of the surrounding environment.

Questions to ask:	**Finding the answers:**
• What critical habitats does the activity come into contact with and how will the activity impact these habitats? • What environmental regulations are in place that need to be adhered to? • Are there any local public organisations or NGOs working on these habitats in the local area? • Are there any local communities that rely on these habitats for livelihood activities?	• Engage with and partner with local organisations and the community to establish a plan to safeguard contiguous critical habitats. • Consult the local governing authority to align with and meet any regulations. • Mitigate any negative environmental impact on critical habitats through proper site selection, waste management and other operational procedures.

Guiding Principle 5: Climate Change Adaptation and Mitigation

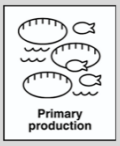
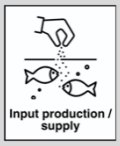
Audience: Private Sector

Climate risk in aquaculture pertains to the effects of climate change, encompassing hazards resulting from natural or human-induced changes, exposure (such as proximity to coastlines), and vulnerability (susceptibility to damage and ability to cope). To address climate change impacts, adapting aquaculture by implementing resilience measures is crucial, considering general resilience over specific climate forecasts. Shifting from capture-based fisheries to aquaculture is suggested as a more adaptable approach, along with adopting climate-smart technologies and systems to reduce vulnerabilities, particularly for coastal aquaculture.

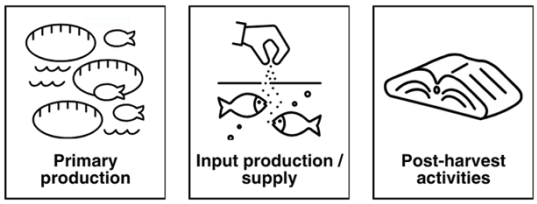
Aquaculture faces climate change impacts globally. Changes in weather patterns significantly affect inland aquaculture, causing fluctuations in water conditions, impacting productivity, increasing disease risks, and damaging infrastructure. Coastal aquaculture operators encounter threats like extreme weather events, erosion, and the loss of natural barriers. Acidification affects shell formation in molluscs, while higher temperatures pose disease risks for seaweed farming and increase incidents of harmful algal blooms and fish mortality.

Climate change response strategies can be categorised into adaptation and mitigation. Adaptation involves managing climate risks by adjusting societal and environmental systems to reduce vulnerability and enhance resilience. It includes fortifying infrastructure, efficient water management, early warning systems, and potentially relocating production from high-risk areas. Mitigation, on the other hand, targets reducing greenhouse gas emissions by transitioning to cleaner energy, reducing operating costs, improving industrial efficiency, enhancing carbon capture, advocating for sustainable practices, and encouraging lifestyle changes to limit climate change's extent.

Both adaptation and mitigation are critical components of a comprehensive strategy to address the multifaceted challenges posed by climate change. Moreover, responsibly practiced aquaculture can contribute to both climate change mitigation and adaptation through carbon capture and emissions reduction (e.g., Jones *et al*., 2022).

Guiding Principle 5: Climate Change Adaptation and Mitigation				
Principle component	**Description**	**Value chain segments**		
				
5.1	Climate Standards	**X**	**X**	**X**
5.2	Reducing GHG Emissions	**X**	**X**	**X**
5.3	Alignment with the Paris Agreement	**X**	**X**	**X**
5.4	Carbon Credits	**X**	**X**	**X**
5.5	Adaptation and Long-term Planning	**X**	**X**	**X**

Component 5.1. Climate Standards



Climate standards are increasing in value for financing and investment, offering businesses a means to recognise and reveal, within their financial disclosures, sustainability reports, and annual reports, the risks, opportunities, and plausible financial consequences linked to climate change. These recommendations hold broad applicability across various industries, encompassing financial sector entities such as banks, insurance firms, asset management firms, and other related organisations. Financial institutions bear an additional responsibility beyond disclosing their climate-related risks; they are also accountable for disclosing the risks encountered by the companies in which they invest.

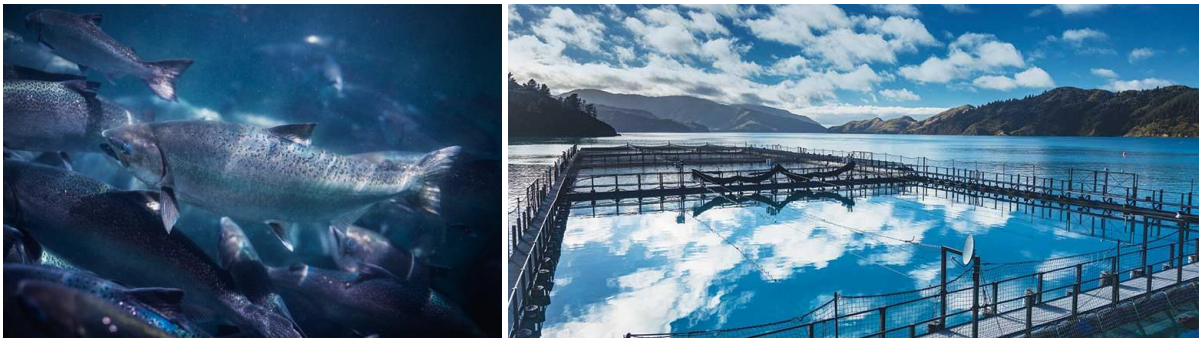
Questions to ask:	**Finding the answers:**
• What climate standard is relevant to the investment or business? • How do I access and align with a climate standard? • What implications can I expect when aligning with a climate standard?	• The Task Force on Climate-related Financial Disclosures (TCFD) can guide climate-related financial standards and principles. The recommendations are structured around four thematic areas that represent core elements of how organisations operate: governance, strategy, risk management, and metrics and targets. Box 8 provides an example of the incorporation of the TCFD principles into a successful aquabusiness.

Box 8: New Zealand King Salmon prepares for Aotearoa New Zealand Climate Reporting Standards.

New Zealand King Salmon (NZKS) will soon join the 200 entities in New Zealand that comply with the Aotearoa New Zealand Climate Reporting Standards, issued by the External Reporting Board (XRB). These Climate Standards are based on recommendations made by the Task Force on Climate-related Financial Disclosures (TCFD) after thorough public consultation.

The goals of mandatory climate-related disclosures are to:

- Ensure the effects of climate change are routinely considered in business, investment, lending and insurance underwriting decisions;
- Help climate reporting entities better demonstrate responsibility and foresight in their consideration of climate issues;
- Lead to more efficient allocation of capital; and
- Assist in the smooth transition to a more sustainable, low-emissions economy.

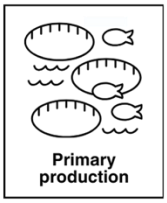


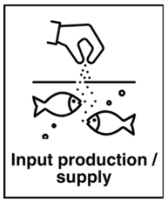
Net pen salmon farming by New Zealand King Salmon (Source: NZKS).

NZKS has collaborated with industry stakeholders to exchange insights and lessons on the requirements and has onboarded a dedicated resource to pinpoint their climate-related risks and opportunities while better understanding their business model and strategy's resilience to climate change. Recognising the necessity for specialised data-capturing software, they have partnered with an external organisation. Throughout 2024, they will leverage their carbon tool to capture operational metrics and convert them into emissions in carbon dioxide equivalent. This specialised software also functions as a reporting and management platform, streamlining the collection, dissemination, and reporting of critical data.

Mandatory climate-related disclosures will help New Zealand meet its international obligations and achieve its target of net zero carbon by 2050. By improving transparency and revealing climate-related information within financial markets, NZKS anticipates that its financial system will become more resilient, and that climate change risks outlined in the National Climate Change Risk Assessment will be addressed.

Component 5.2. Reducing GHG Emissions





Reducing GHG emissions is increasingly becoming a norm and a necessity for numerous investors and policymakers. By evaluating aquaculture operations, farmers and investors can identify and implement effective strategies to significantly reduce GHG emissions. Moreover, it should be recognised that there are opportunities to attract funding based on "climate change accounting or ecological balance sheets", or the calculation of the volume of GHGs that an entity emits.

Questions to ask:	**Finding the answers:**
• What are the primary sources of GHG emissions in the aquaculture operation? • How can the efficiency of inputs (feed, energy etc.) be improved? • Are there opportunities for carbon sequestration or offsetting emissions? • Is it worthwhile to undertake GHG accounting?	• In most aquaculture operations, fertiliser, feed and feed ingredients can be major contributors to the GHG footprint of the end product. Therefore, consider sustainable aquafeed and fertiliser (with lower carbon to nitrogen ratios) alternatives to reduce GHG emissions (see Box 9). • Where applicable, install solar power and wind energy systems to reduce the reliance on non-renewable energy sources. • Where applicable, avoid the clearing of natural carbon sinks (i.e., mangroves, vegetated land) and in some cases, re-plant areas previously cleared. • Where applicable grow and produce feed alternatives/supplements (e.g., *Ulva* on abalone farms). • Where applicable, utilise one component in multiple forms (e.g., *Ulva* as a biological filter and as an abalone feed in a RAS system). • Integration should also be explored as a means of reducing GHG emissions. • Assess whether GHG accounting is relevant given the intended market/s and source/s of funding. If relevant, approach an expert professional in this field to implement this, and take the cost and benefit of such an exercise into account in your business planning process.

Box 9: Sustainable aquafeed.

Sustainable aquafeed, raw materials, and ingredients refer to the use of nutritionally optimised feeds, raw feed materials, and ingredients from the most sustainable sources that serve to promote (1) environmentally conscious utilisation of raw materials that respect biodiversity and ecosystems, (2) a considered land-based production footprint, (3) considered attempts to minimise GHG emissions, (4) the use of feed supplements where beneficial, (5) efficient feed management, and (6) respect for the health and wellbeing of the farmed animal.

Sustainable aquafeeds and raw materials can often only be adjudicated at the local level by understanding the situation, sourcing potential, operations and activities of aquaculture producers. The incorporation or use of waste and/or by-products produced by other industries (e.g., fish processing), for example, can promote resource circulations for a common good (improved economic benefits, food production and nutrition) and limit the transport requirements of alternate feed/ingredients (increased GHG emissions).

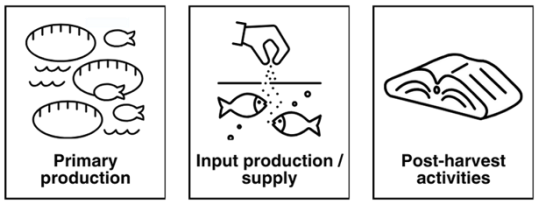
Acknowledging trade-offs within the pursuit of sustainable aquafeeds and raw materials/ingredients is important and inevitable, however, this should not detract from vigilant adjudication and adjustment which seek to better sustainability outcomes of feed producers and users. Alternative proteins for producers, for example, may not be available locally (leading to increased GHG emission footprints for their import and incorporation into feed) or prohibitive in price and/or quality (leading to economic and nutritional effects), whereas offcuts and by-products from wild-caught fish stocks processed locally may be available at an economically beneficial price (leading to increased reliance on wild stocks and resource-intensive production). In such a scenario, the feed and raw ingredients choices of an aquaculture operation will need to incorporate economic, environmental, and social considerations to ultimately justify feed choice, seeking to balance the pros and cons of each option in the pursuit of sustainability.

Commercial feeds reliance on wild fish stocks has led to resource intensive feed production and the overexploitation of certain wild fish stocks. Fish meat and oil from alternate sources (e.g., fish processing) provides one such alternative source to wild stocks and presents opportunities for establishing circular economic processes within aquaculture. Acknowledging aquaculture's efficiency in converting feed to protein, the use of fishmeal and oil, because they represent an almost perfect balance of essential nutrients that certain animals need to be healthy and grow, should be used responsibly, to benefit the environment, farmed animals and humans who consume responsibly produced cultured seafood. Additionally, the adoption of sustainable, highly efficient feed practices can play a significant role in GHG emissions reduction and environmental impacts in aquaculture through the minimisation of wastage.

Key guidelines for aquafeed users include:

- Use feed ingredients that are respectful of ecosystems and biodiversity.
- Ensure the health and welfare of the animals.
- Limit feed producers' reliance on fish meal and fish oil from wild stocks
- Use alternative protein ingredients such as algae, insects, or waste from other industries; to reduce pressure on wild fish stocks
- Use feed supplements only when deemed beneficial.
- Implement efficient feed-management systems.

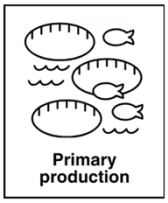
Component 5.3. Alignment with the Paris Agreement

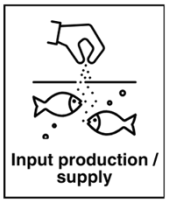


Paris Alignment is starting to become a standard requirement in accessing finance. For investees and investors, aligning with the Paris Agreement involves integrating its principles into business strategies and investment decisions. This alignment includes setting science-based emission reduction targets, transitioning to renewable energy sources, adopting climate-smart practices, engaging in carbon offsetting initiatives, and ensuring transparent disclosures about climate-related risks and progress. Businesses embracing these practices align not only with the Agreement's objectives but also position themselves to attract capital from environmentally conscious investors, comply with evolving regulatory standards, tap into emerging market opportunities, and better manage climate-related risks, fostering a sustainable and resilient business approach.

Questions to ask:	**Finding the answers:**
• As a business or investor, can you evaluate the company's emissions and climate strategies? • Is the project/activity having a positive/negligible/negative impact on the climate? • Is this project expanding or promoting expansion into areas of high carbon stocks or high biodiversity areas?	• Access pathways to alignment and how-to guides via the World Bank Joint MDB Methodological Principles for Assessment of Paris Agreement Alignment. • While aquaculture is considered aligned with the Paris Agreement's mitigation goals, there are exceptions for operations that expand or promote expansion into areas of high carbon stocks or high biodiversity areas. Therefore, projects falling under these exceptions should be approached with caution.

Component 5.4. Carbon Credits

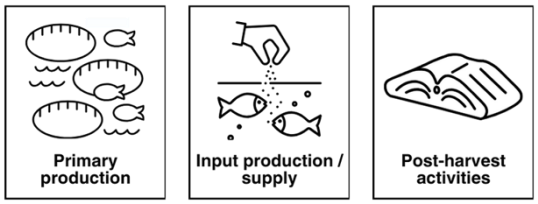




Carbon credits generated from blue carbon projects can be used by companies to neutralise their carbon footprint or by governments to support their Nationally Determined Contribution (NDC) commitments under the Paris Agreement. Furthermore, SMEs could sell their carbon credits to authorised and credible carbon traders, which may allow them to allocate more funds to developing their operations. Importantly, the explanation of climate change accounting, knowledge gaps, methods of monitoring and ecological outcome verification, accountability, and validated data will need to be improved.

Questions to ask:	**Finding the answers:**
• Are carbon credits or blue bonds available and relevant to the aquaculture operation? • How measurable and verifiable are the emission reductions achieved through these strategies? • Are there specific methodologies or protocols that need to be followed to qualify for carbon credits?	• The IFCs Opportunities for BLUE CARBON FINANCE in coastal ecosystems report provides an overview of the emerging blue carbon market and how financial Institutions can play an important role in developing this as an avenue of climate finance. • Engage with carbon finance and project development companies that can facilitate the sale of carbon credits. • Implement farming/production practices that allow for carbon sequestration and subsequent sale of carbon credits.

Component 5.5. Adaptation and Long-term Planning



Climate change poses a major risk to aquaculture development and, as such, it is critical that climate risk adaptation must be developed alongside mitigation measures to minimise the environmental impacts of aquaculture. Make sure that farms can adapt and be at the cutting edge of climate technologies to cope with unforeseen and uncontrollable external challenges such as increasing frequency of natural disasters and temperatures, extreme weather events, policy change, and consumer demands.

Questions to ask:	**Finding the answers:**
• Is the operation dynamic (i.e., can it adapt based on changing external factors such as precipitation, temperature, wave action, drought etc.)? • Does the integration improve the operation's longevity and adaptability in the context of these changing external factors? • Is the operation able to sufficiently supply high-quality water? • Are the current or proposed expansions at risk from strong rains, flooding, strong winds, temperature fluctuations/extremes and other environmental factors? • Where is the energy supply dependent on (i.e., coal, solar, wind, hydro)?	• Ensure that all conceptual ideas and strategies are adaptable in the short-, medium- and long-term to change with an increasingly more volatile climate. • Upgrade aquaculture facilities to withstand extreme weather events and natural disasters. • Encourage the integration of operations (aquaculture and agriculture, IMTA). • Refer to and consider recommendations for adaptation measures to minimise vulnerability and exposure to the specific impacts of climate change, for example, those outlined in Box 10.

Box 10: Examples of management practices to address the impacts of climate change on aquabusiness operations.

Potential risk	Examples of recommended management practices for adaptation
Reduction in yield	➢ Access higher value markets, for example, by diversifying into production of high-value species (e.g., sea cucumber, sea urchin) and integration of multi-species operations. ➢ Focus on non-carnivorous candidate species. ➢ Introduce or selectively breed high-resilient species and strains (e.g., salt-tolerant tilapia). ➢ Move production facilities (e.g., seaweed) to more stable offshore waters, whilst considering potential safety risks and increased production costs. ➢ Conduct robust site assessments and employ spatial planning and risk-based assessments. ➢ Invest in climate-smart aquaculture facilities and infrastructure (e.g., nylon netting and raised dykes in flood-prone pond systems; deeper ponds to provide thermal refuge and DO reserves). ➢ Introduce fish meal and fish oil replacement in feeds.
Increased variability in yield	➢ Establish hatcheries to reduce reliance on wild-harvested seed. ➢ Introduce SOPs (feeding schedule, harvest schedule, fertilising etc.) to ensure costs are maintained to mitigate against unpredictable yields. ➢ Diversify species (e.g., IMTA). ➢ Introduce harvesting strategy to stabilise yield variability. ➢ Practice precautionary management.
Reduced profitability	➢ Diversify species, products and/or markets. ➢ Plan and implement appropriate feed management strategies. ➢ Reduce operational costs to increase efficiency.
Increased environmental risk	➢ Facilitate weather forecasts, surveillance, and monitoring for early detection of negative climatic events (e.g., harmful algal blooms (HABs)). ➢ Adjust farming practices and/or calendar to reduce exposure to HABs. ➢ Move sea- or pond-based aquaculture into land-based RAS for greater degree of control (Note: this increases capital operational costs, and expertise requirements, and may not be possible for many small-scale operations). ➢ Introduce early warning systems and improved communication networks (e.g., via mobile phones). ➢ Facilitate workshops/training on data collection, interpretation and decision-making. ➢ Invest in protecting infrastructure against sea level rise (e.g., dams and dikes to reduce saline intrusions). ➢ Invest in resilient systems (e.g., stronger cages and mooring systems). ➢ Weather warning systems. ➢ Improved vessel safety/stability. ➢ Insurance/compensation for impacts.
Increased vulnerability near to coast	➢ Introduce hard defences such as sea walls (Note: risks affecting local ecosystem processes and/or local livelihoods). ➢ Introduce soft defences such as mangrove rehabilitation and restoration (Note: risks affecting local livelihoods). ➢ Implement early warning systems and education. ➢ Invest in infrastructure provision built to withstand increased storm damage, tidal surges, and wave action. ➢ Support rehabilitation, disaster response, and post-disaster recovery. ➢ Use native species to reduce impacts in the case of escapees from damaged facilities.
Conflict as a result of resource deterioration	➢ Livelihood diversification. ➢ Strategies to manage conflict (e.g., resource or area allocation). ➢ Social safety nets.

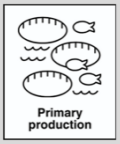
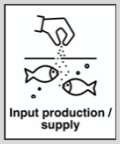
Recommendations adapted from: IPCC (2014), Shelton (2014), Dabbadie et al. (2018), Poulain et al. (2018) and Reid et al. (2019)

Guiding Principle 6: Aquatic Biosecurity and Health

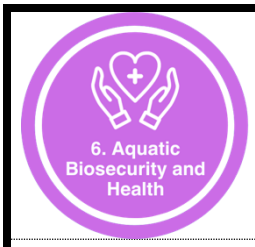
Audience: Private Sector

Biosecurity risks are commonly cited by aquaculture stakeholders as the main challenge to aquabusiness development. The risk of pathogen outbreaks is a major factor that hinders investment in aquaculture, and results in aquabusiness failures. A plethora of case studies across geographic regions, species groups and production systems demonstrate this. Some of the most well-known include the infectious salmon anaemia (ISA) virus outbreak in Chile in 2007 (e.g., Bachmann-Vargas *et al.*, 2021), the shrimp early mortality syndrome (EMS) outbreak in South and Southeast Asia in 2009 (e.g., Shinn *et al.*, 2018), the white spot syndrome virus (WSSV) outbreak amongst shrimp farms in Madagascar and Mozambique in 2012 (e.g., Responsible Aquaculture Foundation, 2013), and outbreaks of Tilapia Lake Virus (TiLV) in various countries across Asia, Africa, and the Americas since 2014 (e.g., Abbadi *et al.*, 2023)). In all cases, these outbreaks resulted in major industry losses and highlighted the potential risks involved in aquaculture investments.

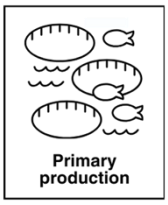
Private sector functions in maintaining biosecurity and the health of farmed organisms include identifying, managing, mitigating risks, and communicating risks associated with biosecurity and disease in aquabusinesses. This can primarily be addressed through appropriate Standard Operating Procedures (SOPs), and by working closely with the public sector in managing biosecurity and mitigating disease in aquaculture.

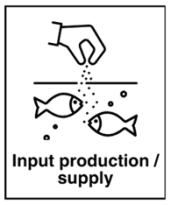
Guiding Principle 6: Aquatic Biosecurity and Health				
Principle component	**Description**	**Value chain segments**		
				
6.1	Management Plans and M&E	**X**	**X**	
6.2	Public Sector Support and Regulations	**X**	**X**	**X**
6.3	Appropriate Use of Therapeutants and Other Chemicals	**X**	**X**	
6.4	Transboundary Biosecurity	**X**	**X**	

6.5	Opportunities for Investment in Aquatic Biosecurity and Health		**X**	
6.6	Health Innovation and R&D	**X**	**X**	



Component 6.1. Management Plans and M&E





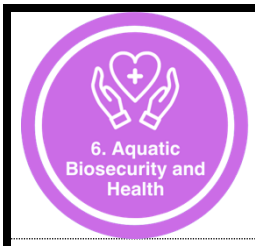
The development of SOPs to integrate biosecurity, health management, and disease response measures into aquabusinesses is essential towards mitigating the risk and impacts of pathogen introduction and spread. Biosecurity and health management are an intersection of different factors, i.e., the host (i.e., the well-being and relative susceptibility of the farmed organism), the pathogen/s (i.e., the presence of a virus, bacteria, parasite, or fungus) and the environment (i.e., the quality of the production system); each of these factors must be adequately considered in SOPs.

On the one hand, it is essential to manage aquaculture production systems to minimise the risk of pathogen introduction. On the other hand, plans need to be in place for handling outbreaks of pathogens, as no prevention plan can ever be completely effective.

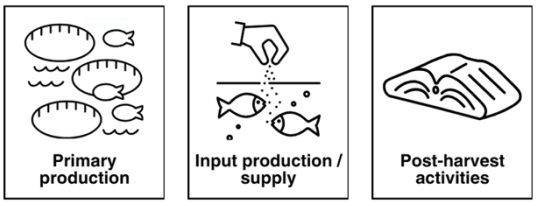
Questions to ask:	**Finding the answers:**

• Which pathogens and/or parasites pose the greatest risk (likelihood of introduction and spread, and impact) to my aquabusiness?
• How can the likelihood of pathogens/parasites entering and spreading within my production system be minimised?
• How can I best manage my production environment to minimise the risk of pathogen/parasite introduction and spread?
• In the case that a pathogen/parasite does enter the system, how can I manage and minimise/contain its spread?
• What is my legal responsibility for reporting disease incidences?
	• Undertake a biosecurity risk analysis: Research the pathogens and parasites that commonly affect your farmed species, in the system being used. Develop a list of potential pathogens/parasites and specify those that are World Organisation for Animal Health (WOAH) -listed and may affect trade or export market access in the case of an outbreak.
	• Identify suppliers of disease-free broodstock and seed. If there is a need to use specific pathogen-free (SPF) animals, identify SPF-certified facilities for seed and/or broodstock.
	• If possible, obtain or produce specific pathogen-resistant (SPR) seed.
	• Ensure that suitable SOPs are in place for managing and monitoring biosecurity and health, in line with any relevant regulations and BMPs (e.g., FAO's Progressive Management Pathway for Aquaculture Biosecurity and WOAH's Aquatic Animal Health Code) suitable to the species and production system/s. Biosecurity and health management SOPs should include (but not be limited to) the following:
	  ○ Use of reliable input suppliers (e.g., juveniles, broodstock, feed, live feed, etc)
	  ○ Quarantine procedures
	  ○ Epidemiological surveillance
	  ○ Hygiene practices and access restrictions
	  ○ Record keeping and reporting
	  ○ Water quality management
	  ○ Early warning systems
	  ○ Water quality monitoring and testing for early detection of pathogens in the system

	○ Observation of farmed organisms' behaviour, health, and general well-being, for early detection of pathogens ○ Feed management ○ Stocking densities ○ Vaccination protocols ○ Use of therapeutants and other chemicals ○ Treatment protocols ○ Emergency procedures and preparedness • Ensure appropriate training of all relevant personnel, in implementing SOPs.

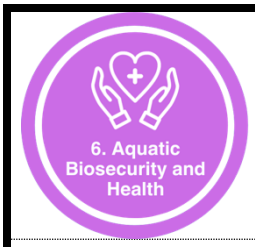


Component 6.2. Public Sector Support and Regulations

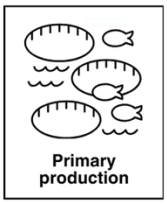


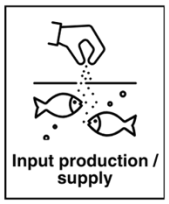
There are many ways in which the public sector (and support sector, e.g., research institutions and NGOs) may support the private sector in managing biosecurity and health in aquabusiness. This level of support should be assessed, to understand ways in which it can be used, as well as areas where it is lacking. Moreover, any existing regulations in place regarding biosecurity and health management must be understood so that they can be complied with by aquabusinesses.

Questions to ask:	Finding the answers:
• Is the relevant aquaculture authority suitably equipped, in terms of training and personnel, to provide veterinary services (e.g., diagnostic and treatment advisory services, epidemiological surveillance programmes)? • If the public sector cannot provide veterinary support, are there private sector operators that can suitably provide this? What are the associated costs? • What systems need to be in place, for an aquabusiness to comply with the current aquaculture biosecurity and health regulations? • Is there a list of communicable diseases in place in the country of interest?	• To understand the veterinary services offered by the public sector, the relevant aquaculture authority should be approached. To understand if the authority is effective (e.g., quality and timeliness) in providing these services, other aquabusiness operators in the area can be engaged with. • Where public sector services are unavailable or inadequate, identify suitable private sector providers of veterinary services. Factor the costs of relying on private sector veterinary services into business planning and financial modelling. • To understand the current regulations that must be complied with in terms of biosecurity and health management (e.g., record-keeping and reporting, measures relating to the use of therapeutants), consult the relevant aquaculture authority. Ensure that biosecurity SOPs are designed such that they comply with these regulations. • If there is a list of communicable diseases in the country, ensure that this is known and that reporting of any outbreaks of these diseases, through the appropriate channels, is incorporated into biosecurity SOPs. Ensure that this list remains up to date amongst the relevant personnel in the aquabusiness.



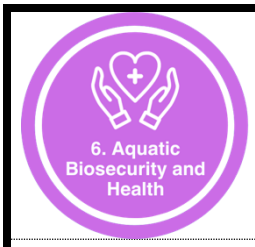
Component 6.3. Appropriate Use of Therapeutants and Other Chemicals



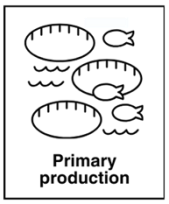


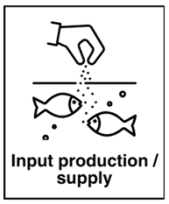
Inappropriate use of veterinary medications (e.g., antibiotics, parasiticides, etc.) and chemicals (e.g., chlorine, formalin, etc.) in aquaculture poses significant risks to aquabusinesses. Incorrect use of therapeutants can lead to food safety issues and negative environmental impacts, erode consumer confidence, and lead to the negative portrayal of the aquaculture sector in the public image. For example, overuse and misuse use of therapeutants can lead to the development of drug-resistance pathogens, drug residues in aquaculture food products, contamination of water bodies, disruption of the balance of microorganisms important for maintaining water quality, harm to wild populations, and adverse effects on growth and development, as well as legal consequences and economic losses.

Questions to ask:	Finding the answers:
• In the specific case of a pathogen outbreak, what is the suitable approach to treatment? • How can this be incorporated into SOPs? • Is there a regulatory framework for authorised/prohibited veterinary medicines and chemicals (including treatment procedures, dosages, withdrawal period, and other important considerations) and standards for their use? • Is there an existing database documenting the use of (and results) veterinary medicines on relevant species? • Is there an antimicrobial use monitoring program at the national level?	• The management of pathogen outbreaks should be handled on a case-by-case basis. General SOPs should be in place regarding outbreak responses, however, these should require that a qualified veterinary professional (either in-house personnel, or outsourced public sector or private sector personnel, depending on the level of integration) manages such events. Such professionals should be responsible for diagnosis of the outbreak, and the prescription and management of suitable treatments. • Consult the local veterinary or aquaculture authority to access any regulatory frameworks, SOPs, or databases relevant to the use of veterinary medicines and chemicals. • All workers should be trained on the correct use of chemicals, and should be informed of the different routes of exposure and means to protect themselves.



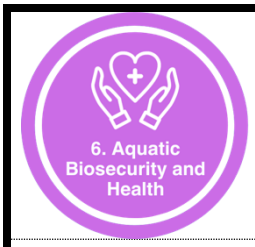
Component 6.4. Transboundary Biosecurity



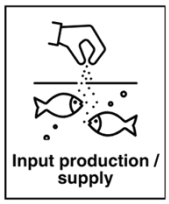


In the case of aquaculture in shared water bodies (e.g., cages in a lake used by several operators), it is not always possible to fully manage the production environment, as the activities of other operators may impact aspects such as water quality and the presence of pathogens. This becomes more complicated when a water body is shared amongst two or more riparian countries, which may have differing levels of biosecurity-related regulations and enforcement. In these cases, it is important for aquabusinesses to assess and manage the specific risks present.

Questions to ask:	**Finding the answers:**
• Is there an existing regulatory framework for transboundary aquatic animal disease/pathogens and transport? • How can biosecurity be managed when the production environment is exposed to the actions of other operators (aquaculture and other industries) in the same body of water?	• Site selection is an important factor when establishing an aquabusiness. As part of the business planning process, the specific biosecurity and health-related risks of any site of interest should be assessed. The likelihood and impacts of risks should be an important factor in assessing the viability of an aquabusiness investment or development. • In the case that a site of interest is in a water body that is shared between two or more riparian countries, this risk assessment should extend to an investigation of robustness of the biosecurity regulations in place in the other country/ies, and the enforcement thereof.

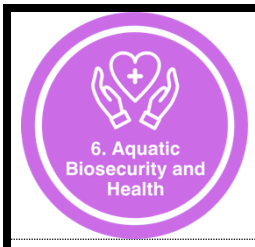


Component 6.5. Opportunities for Investment in Aquatic Biosecurity and Health

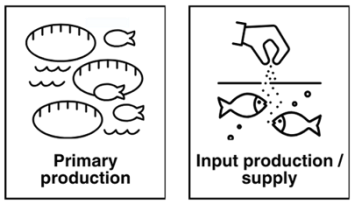


Given the importance of biosecurity and health management in aquaculture, this is an important and growing component of aquaculture value chains, with opportunities for private sector investment and business development.

Questions to ask:	Finding the answers:
• What are the opportunities for investment and business development in the biosecurity and health component of aquaculture value chains?	• Identify innovations, such as fish health start-ups, that are seeking investment, and assess the economic opportunity for investment. • Consider entering into PPPs with research institutions, towards commercialising their industry-driven aquaculture biosecurity and health innovations.



Component 6.6. Health Innovation and R&D



Collaborative industry- and public sector-driven R&D programmes are fundamental for addressing challenges relating to disease management and treatment. For example, such R&D programmes can contribute to developing innovative and effective treatments for the pathogens that affect an industry, developing suitable vaccines to minimise the prevalence of common bacteria and the need for antibiotics, and understanding host-pathogen interactions to improve treatment regimes.

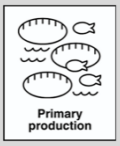
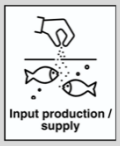
Questions to ask:	**Finding the answers:**
• How can an aquabusiness contribute to, and benefit from, aquaculture health R&D programmes?	• Identify public sector research and how it supports the aquaculture industry in your area of interest, for your farmed species. • Identify opportunities for collaboration on industry-driven research to improve (e.g., provision of samples).

Guiding Principle 7: Combatting Food Loss and Waste

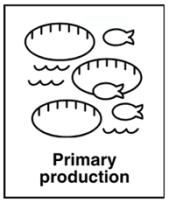
Audience: Private Sector

Food loss and waste within aquaculture arise from various factors, notably poor harvesting practices, fish mortality during live marketing, inadequate handling leading to contamination, absence of a cold chain, and product rejection due to safety concerns. These scenarios typically occur during post-harvest handling. Issues like the misuse of veterinary drugs result in contaminants in harvested fish, prompting safety concerns and product rejection. Moreover, problems during fish growth, handling, and water quality contribute to losses. Addressing these challenges is crucial to mitigate food loss and waste in aquaculture, as it significantly impacts climate and production costs. Strategies such as integrating processes, diversifying income streams, and enhancing processing techniques, including cold storage, are vital to minimise these losses and maximise profitability in aquabusinesses. Additionally, exploring avenues for multi-product development, utilising by-products, and engaging in practices like collagen and fish leather production are examples of enhancing the value of aquaculture products.

The private sector plays a pivotal role in addressing food loss and waste within the aquaculture industry through multifaceted contributions. Research and Development (R&D) initiatives spearheaded by private enterprises drive innovative technologies and practices aimed at reducing waste at various stages of aquaculture production. Moreover, the private sector's involvement in driving interest and investment in sustainable aquaculture practices is instrumental. By providing finance and support to start-ups and SMEs exploring alternative products derived from aquaculture by-products or developing waste reduction technologies, they catalyse the emergence of novel solutions.

Guiding Principle 7: Combatting Food Loss and Waste				
Principle component	**Description**	**Value chain segments**		
				
7.1	Harvesting and Post-harvest Handling	**X**		**X**
7.2	Veterinary Medicines and Chemicals	**X**	**X**	**X**
7.3	Managing Mortalities	**X**		
7.4	Processing and Storage			**X**
7.5	Wholesale	**X**		**X**
7.6	Retail	**X**	**X**	**X**
7.7	Consumption	**X**	**X**	**X**

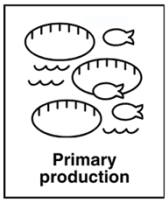
Component 7.1. Harvesting and Post-harvest Handling

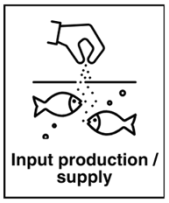


Harvesting is a critical stage in fish farming. Aquaculture facilities have diverse production techniques, investment levels, and size, and utilise land-based or sea/open water-based culture methods. As a result, post-harvest handling procedures are in many cases different. Without adequate training and associated SOPs, it is difficult to maintain proper handling practices.

Questions to ask:	**Finding the answers:**
• How much handling is required from harvest to market? • Are there any SOPs for improving post-harvest handling? • Is the handling area clean and safe from contaminants? • How can unreliable power supply be addressed?	• Undertake a review of operational harvest practices to identify efficiency gaps and establish workable solutions. • Consult best practices on post-harvest processing and handling. • Ensure that back-up energy sources are available to maintain appropriate temperatures.

Component 7.2. Veterinary Medicines and Chemicals

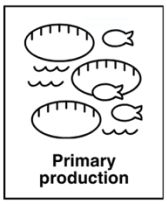




The use of veterinary medicines (antibiotics, parasiticide drugs, antivirals, hormones, anaesthetics, and vaccines) can cause high levels of contaminants in animals, leading to food safety concerns, negative environmental impacts, and the rejection of harvested products in targeted markets (see Principle 6.3).

Questions to ask:	**Finding the answers:**
• What antibiotics and veterinary drugs are essential for the operation? • Are these antibiotics and drugs safe and free of harmful chemicals? • What is the mandatory withdrawal period (i.e., how long before a product is safe to consume after antibiotics or drugs have been administered)?	• Consult local extension services to identify the most responsible antibiotics and veterinary drugs. • Ensure that drugs and antibiotics are free from chemicals that threaten the safety of the product. • Consult local veterinary services to ensure the mandatory withdrawal period is known and adhered to.

Component 7.3. Managing Mortalities



Problems related to handling fish, water quality, and algal blooms can all lead to stress, and disease and ultimately cause mortality before harvesting.

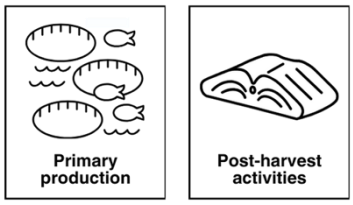
Questions to ask:	**Finding the answers:**
• Are there feed strategies and water quality testing protocols in place? And are they stringently monitored? • Where do mortalities get discarded? • Are there other uses for discarded products?	• Establish monitoring protocols for fish health, for early detection of potential mortalities, as outlined in Principle 6.1.

Component 7.4. Processing and Storage

Processing and storage play critical roles in mitigating food waste and loss in the context of artisanal fish products. Techniques like drying, salting, and smoking are traditional methods used for preservation before sale and consumption, allowing fish to endure storage periods. Canning is also used as a means of storing food for prolonged periods. Additionally, investments in cold storage systems prove highly effective in preventing perishable food loss, especially in developed countries. Freezing is another important storage procedure that extends the storage life of foods by impeding spoilage reactions. Moreover, fish processing plants, whether labour-intensive or highly automated, are essential in converting fresh or frozen fish into various product types, emphasising the importance of efficient processing methods to curtail food waste and loss in the fish industry.

Questions to ask:	**Finding the answers:**
• What process is required to take the product from harvest to consumption? • What storage requirements are needed to ensure a premium product? • Does the operation require improved or maintained processing and storage infrastructure? • Are there any alternate methods for processing and storing waste for further use? • Is there any R&D that could utilise any food waste?	• Explore investment into new and emerging technologies and processes that allow for the extraction and production of food products such as leather, collagen, protein and others (see The Mission of the 100% Fish Project at the Iceland Ocean Cluster for a comprehensive list of alternative products and methods). • Implement strategies to maximise the value retention of these food and food products within an operation.

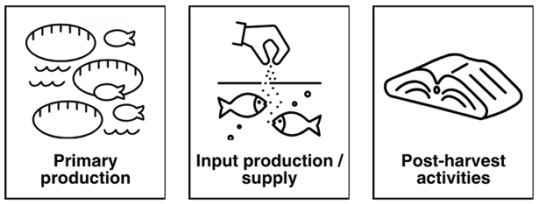
Component 7.5. Wholesale



Wholesale practices in the food sector significantly influence food waste and loss. Market centres serve as the initial point of sale for small-scale marine and inland producers, facilitating the first transaction of food. Urban wholesale markets, located in coastal and inland areas, act as hubs for the sale of products, catering to various sources of supply. Additionally, refrigerated road transport serves as a crucial link in the cold chain, ensuring the safe delivery of high-quality products to consumers, underscoring the importance of efficient wholesale practices in reducing food waste and loss within the industry.

Questions to ask:	**Finding the answers:**
• Does the product need to be sold to a wholesale distributor or can it be sold locally direct from the operation? • Does the wholesale operation have any food standards? • What does the wholesale operation do with product that does not meet a set quality criteria/standard	• Engage with wholesalers to understand quality requirements. • Establish an agreement to store/return products that do not meet a certain quality requirement. • Conduct a cost-benefit and market analysis to determine whether selling wholesale or directly to consumers reduces food waste and the cost implications of this.

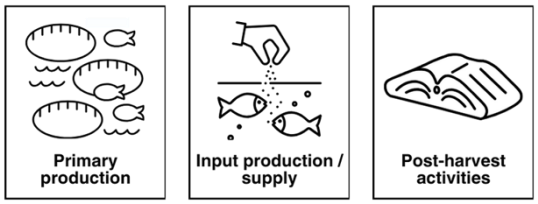
Component 7.6. Retail



Retail plays a crucial role in mitigating food waste and loss, particularly in the aquaculture industry. The retail sector offers various products, ranging from whole, unprocessed, and unpackaged to prepared varieties in modified atmosphere packs. Notably, a considerable portion of food is distributed through major retailers in specific countries, some of which are vertically integrated and hence, exerting substantial control over upstream supply chain activities like production and processing. Moreover, retailers contribute significantly to waste through leftovers, plate waste and product that do not meet a certain quality.

Questions to ask:	**Finding the answers:**
• What traditional and non-traditional markets are currently being retailed? • Are there any other retail products that could be produced with food waste and loss? • What do retailers do with food waste and loss?	• Engage with retailers to understand quality requirements. • Establish an agreement to store/return products that do not meet a certain quality requirement.

Component 7.7. Consumption



There is considerable food waste at the consumer level, including fish and other aquatic products, occurring in both industrialised and developing countries.

Questions to ask:	**Finding the answers:**
• How are products packaged, transported, and stored? • What products would consumers be willing to buy (that could be made from food loss and waste)?	• Engage with consumers to understand their quality expectations. • Promote the use of alternate food loss and waste products. • Promote and advocate for less food waste and loss by consumers.

Guiding Principle 8: Creating an Enabling Environment for Aquabusiness

Audience: Public Sector and Support Sectors

Creating an enabling environment in which sustainable aquabusinesses can develop and thrive is primarily a function of the Government, while supporting actors, such as NGOs, research institutions and industry associations, play an important role in assisting the Government in its creation of an enabling environment for aquabusiness, through initiatives that address public and private sector needs.

The creation of an enabling environment for aquabusiness includes the development of a sound, supportive legislative and regulatory environment (including social and environmental) that is aligned with global best practices; facilitating the establishment and growth of aquabusinesses through a streamlined and efficient licencing process, the establishment of Aquaculture Development Zones (ADZ), the provision of public financing and investment incentives, and the establishment of strategic infrastructure; promoting and providing knowledge transfer, training and innovation in the industry; and facilitating market access through trade agreements and alignment with key markets' requirements for production and processing standards or certification.

Guiding Principle 8: Creating an Enabling Environment for Aquaculture				
Principle component	**Description**	**Sector actors**		
		Government	NGOs and research institutions	Industry associations
8.1	Establishing an Enabling Regulatory, Policy and Institutional Framework for Aquabusiness	**X**	**X**	**X**
8.2	Implementing an Enabling Licensing and Permitting Framework	**X**		**X**
8.3	Establishing Zones for Commercial Aquaculture Development	**X**	**X**	**X**
8.4	Providing Public Financing and Investment Incentives	**X**		**X**

8.5	Strategic and Supporting Infrastructure and Services	X	X	X
8.6	Promoting Technology and Knowledge Transfer, Innovation, Training and R&D	X	X	X
8.7	Market Access and Promotion	X	X	X
8.8	Promoting and Regulating Socially Responsible Practices	X	X	X
8.9	Promoting and Regulating Environmentally Sustainable Practices	X	X	X
8.10	Promoting Aquatic Biosecurity and Health	X	X	X

Component 8.1. Establishing an Enabling Regulatory, Policy and Institutional Framework for Aquabusiness

The regulatory, policy and institutional frameworks must set out the "rules of the game" to provide clarity for investors on key issues that define risk and opportunity in the sector, reduce ambiguity, and ensure that all stakeholders understand their rights and responsibilities (see Box 11). It is a fundamental requirement that a strong legislative foundation for the sector has been established and that this is supported by legislative bodies (e.g., government departments that are well-trained, resourced and capable of performing administrative functions that underpin sustainable and responsible aquaculture). When aquaculture development is incorporated into national policies or strategies, it creates an environment conducive to investment by conveying to prospective investors that the sector is a developmental priority and is supported and promoted by government. Finally, the presence of a well-capacitated, dedicated aquaculture authority is important for the effective management, monitoring, regulation, support, and promotion of the aquaculture sector, for example, through capacity building, R&D support, regulatory oversight, market access and promotion, and policy advocacy.

Responsibilities of the Public Sector (and where support can be provided):

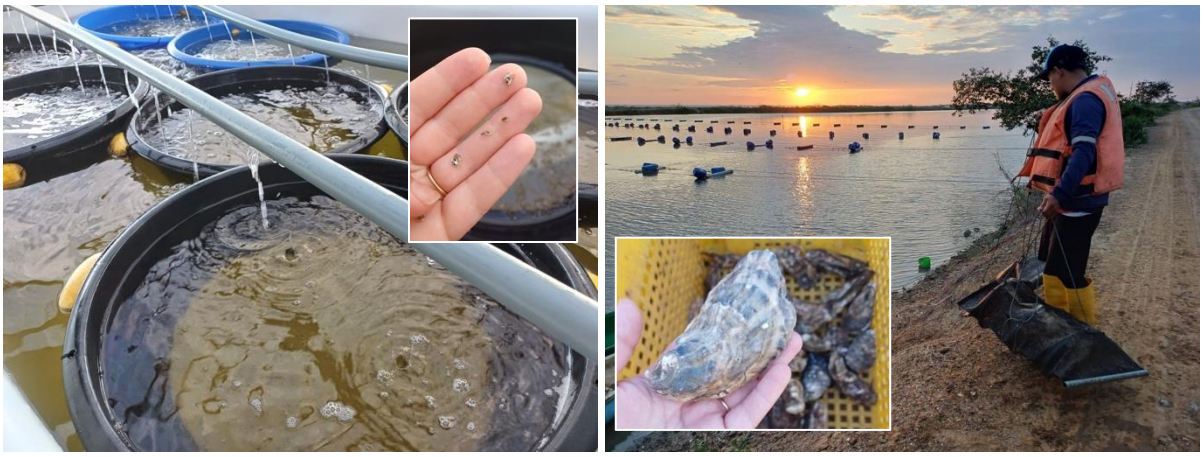
- Draft regulations, policies, standards, and national strategies/development for gazetting into law, based on international best practices with support from countries with enabling legislation.
- Clearly define and prioritise aquaculture in national policy documents, and differentiate it from other primary industries (e.g., fisheries and agriculture).
- Include and engage the private sector in the drafting of regulations included in legislation.
- Consider the establishment of a dedicated aquaculture authority tasked with the orderly and sustainable development of the sector, including monitoring and data collection. This may require concerted human resourcing and capacity-building efforts and investment.
- Establish transboundary cooperation for transboundary water resource management where relevant, to ensure standardised biosecurity, animal health and waste management measures are adhered to.

Box 11: The importance of a robust regulatory framework for sector growth – the new Ecuadorian regulations for oyster farming.

Recognising the opportunity for diversification of Ecuador's aquaculture sector – which is currently based almost entirely (>99%) on whiteleg shrimp (*Litopenaeus vannamei*) production – a growing number of producers are investing in the farming and processing of bivalves, most notably Pacific oyster (*Crassotrea gigas*).

Until recently, the lack of regulations specific to bivalve farming presented a major challenge to both the governance and growth of the bivalve value chain. From 2019 to 2021, the Undersecretariat of Aquaculture within the Ministry of Production, Foreign Trade, Investment and Fisheries worked closely with the private sector to develop a set of regulations ("*Normativa Técnica para la Categorización y Depuración de Moluscos Bivalvos procedentes de la actividad acuícola"*) for bivalve farming and processing. The regulations outline, inter alia, the process that must be followed for the categorisation of a marine site as a bivalve farming area, including the submission of water monitoring, phytosanitary, and contingency plans for the site.

The new phytosanitary regulations allow bivalve producers to market their products and, in the near future, reach international markets. For the government, the new regulations contribute towards ensuring the responsible growth of bivalve farming in Ecuador.



Hatchery production of Pacific oyster spat (left) and pond-based grow-out of Pacific oysters in inlet canals (right), Lanec, Ecuador.

Component 8.2. Implementing an Enabling Licensing and Permitting Framework

Obtaining an aquaculture license is often an onerous and time-consuming process that involves several authorities, such as those responsible for environmental management, water rights, land rights, and business and trading permits. A streamlined, transparent, and simple aquaculture licensing/permitting process reduces bureaucratic hurdles and the approval timeline for projects and allows for more efficient project planning and implementation. The public sector should also consider the duration of business licences/permits, and water and land use rights, for aquabusinesses. Long-term rights allow for effective long-term business planning and minimise the administrative burden on operators.

Responsibilities of the Public Sector (and where support can be provided):

- Streamline the permitting and licensing system for aquabusiness as a "One-Stop Shop" that handles all aspects of the license application process. This typically involves a single department or case officer taking applicants through the approval process and advising on the application process and associated timelines.
- Train administrative staff in the application process.
- Provide the private sector with all relevant paperwork and information pertaining to application requirements and provide support during the preparation of the application.
- Allow long-term aquabusiness licences/permits and land and water rights, to allow private sector establishment – noting that for many species, primary production aquabusinesses may only reach full commercial production in five years or more.
- Establish Aquaculture Development Zones (ADZs), for which relevant rights are already established (see Principle 8.3).

Component 8.3. Establishing Zones for Commercial Aquaculture Development

Closely linked to licensing and permitting, the presence of designated zones for commercial aquaculture development can be a big plus for prospective investors. Benefits of such zones may include existing land and/or water rights and a simplified licensing/permitting process; a previously completed Environmental Impact Assessment (EIA) process, negating the time and fees this would usually cost private sector operators; and previously completed carrying capacity assessments for suitable species at various scales of production, allowing investors to plan their businesses more easily.

The process of zonation for commercial aquaculture can range from identifying suitable land- and water-based areas for aquaculture developments, to establishing legally mandated Aquaculture Development Zones (ADZs). The establishment of ADZs allows for the development of commercial aquaculture in a productive and environmentally responsible manner. Such zones provide the mechanisms for effective monitoring and control to operate within the assimilative capacity of specific sites. Moreover, ADZs provide 'investment ready' platforms with strategic environmental approvals and management policies already in place, allowing commercial aquaculture operations to be established without the need for lengthy, complex, and expensive approval processes. It must be noted that the selection of ADZs such that they are socially acceptable and commercially and ecologically sustainable is a complex and multifaceted process. Box 12 provides an overview of considerations and guidelines for establishing ADZs, including the roles of different public and private sector actors; while Box 13 provides a basic practical outline of the steps the public sector can take towards establishing ADZs.

Responsibilities of the Public Sector (and where support can be provided):

- Undertake a zoning exercise to identify which zones would be suitable to establish an ADZ. This exercise could be undertaken by a third party, depending on capacity within your institution.
- Undertake extensive stakeholder consultation to obtain their inputs on the proposed ADZs.
- Obtain necessary environmental and planning approvals.
- Resolve the appropriate legal documents and processes for establishing ADZs.
- Designate and establish ADZs in strategic locations, including undertaking necessary environmental and carrying capacity assessments.

Box 12: Aquaculture Development Zones – Challenges and Lessons.

Aquaculture development zones (ADZs) can foster the expansion of the aquaculture sector. However, their success hinges on meeting stringent requirements and, crucially, attracting feasible aquaculture investments. Otherwise, they risk falling short of their developmental objectives.

For instance, the ADZ in the East London Industrial Development Zone (IDZ) in South Africa was strategically positioned to cultivate a marine aquaculture cluster aimed at bolstering sectoral growth. The ADZ boasts access to high-quality seawater and leverages existing municipal infrastructure for its delivery to potential land-based farms and hatcheries. Moreover, its location provides optimal conditions for establishing grow-out facilities, benefiting from temperate waters conducive to robust growth rates for several marine species. Specifically, the advantages of the ADZ include:

- A supportive institutional environment, with favourable policies and incentives.
- A dedicated 32-hectare marine aquaculture cluster specialising in recirculating systems.
- Agricultural zoning with 11 fully serviced sites already established.
- EIA approval for indigenous marine fish farming, allowing for an annual production capacity of at least 10 000 tons; and environmental authorisation for various non-native finfish species including barramundi, rainbow trout, and Atlantic salmon.
- Ample access to high-quality bulk seawater supply, and efficient effluent handling.
- Implementation of a Seawater Quality Monitoring Program.

However, despite having all the necessary infrastructure, resources, and support systems in place, the ADZ is challenged by a mismatch between the operational cost of the RAS systems and the market price and demand for the species under production, dusky kob (*Argyrosomus japonicus*) and yellowtail (*Seriola lalandi*). This serves as a valuable lesson in the importance of planning ADZs around carefully selected growing systems and species.

Based on these lessons, the following should serve as Guidelines to the public sector for establishing ADZs:

- The sustainability of an ADZ is fundamentally based on the provision of suitable infrastructure that will support growing systems for selected species at a feasible production cost.
- Local and global market demand for target species is to be carefully assessed, prior to launching ADZs.
- Production costs must be optimised through encouraging investment in ADZs by actors throughout the value chain, allowing for beneficial input and processing costs.
- ADZs can serve as a very important means by which to accelerate investment in an aquaculture sector. However, the ADZ's business plan must align with the overall Aquaculture Sector Plan for that geographic region.

Aquaculture sector stakeholders must collaborate closely to ensure that ADZs are designed and managed feasibly and sustainably. This may involve diversifying species, IMTA to offset certain costs, cost-effective production techniques, and fostering strong market linkages to create sustainable and successful aquaculture ventures. Lastly, it is also essential for the public sector to collaborate with the private sector to assess the viability of establishing ADZs. Essentially, this involves determining whether private sector investment would be forthcoming if the public sector were to develop ADZs complete with attractive incentives. If the private sector expresses reluctance or disinterest, this would signal the need for reconsideration by the public sector.

Box 13: A practical protocol for establishing Aquaculture Development Zones (ADZs).

The process of establishing ADZs requires high-resolution biological, environmental, and physical spatial data, and a first-rate understanding of local socio-economic conditions, dynamics, and perceptions. It involves the consideration of certain preconditions and culminates in the proclamation of zones and subsequent management requirements. Hence, the ADZ selection and establishment process comprises the following steps:

1. Defining the industry	ADZs should be aligned with an all-inclusive understanding of the size and shape of a future aquaculture industry. All relevant stakeholders should participate in setting the national or regional agenda for aquaculture development. Ideally, the request for an ADZ should be industry-driven and not independently decided upon by the public sector.
2. Policy, legal and regulatory framework	All development strategies and policies, legislation (including bylaws and customary laws), regulations tenure systems and access rights applicable to enterprise development in the area must be reviewed. Areas of conflict must be identified and, where necessary, should be adapted or strengthened to provide a clear and firm legal and political framework aligned with sector development requirements.
3. Defining the basic requirements and minimum criteria for ADZs	This provides the baseline information upon which to select potential areas for possible ADZs. For example, basic land-based requirements would include aspects such as suitable topography, proximity to a suitable water source, proximity to infrastructure and roads, and availability of basic services; while water-based minimum criteria would include aspects such as depth zones, substrata with suitable assimilative capacity, and exclusion conflicting use areas (e.g., fishing grounds, recreational areas).
4. Preliminary Zone identification	The basic requirements and minimum criteria should be used to select the first approximations of possible ADZ areas. Tools with which to undertake this exercise include satellite imagery (e.g., Google Earth), topographic maps and any available navigational charts and land/water use plans. The objective is to rapidly select some areas for detailed analysis, which already conform with the basic requirements and minimum criteria.
5. Spatial planning	This process must consider relevant spatial development plans, to determine how aquaculture can best fit in with such plans.
6. Comprehensive scoping	This is a multifaceted process through which preliminary zones are examined and categorised, concluding with the selection of the most appropriate ADZs. A simple scoring system (e.g., 1-5) should be used to categorise parameters from excellent to poor. Parameters within the following categories should be assessed and scored: Infrastructure and technical; Hydrological/limnological; Socio-economic; Economic and HR; and Ecological and social carrying capacity.
7. Impact assessments	To incentivise investment, the Government should undertake and pay for Environmental and Social Impact Assessments (ESIAs) of the selected ADZs. The cost of the ESIAs can ultimately be recovered by license fees and production levies.
8. Proclamation of ADZs	This is the final step in zoning. It is the legal process that proclaims the ADZs as areas dedicated solely to aquaculture activities. This process must be developed by the relevant Government departments and may require an amendment to primary legislation.
9. Management of ADZs	The proclamation of ADZs will have significant management implications for the aquaculture authority. The responsibilities start with the development of zone management plans. This includes, for example, an allocation of the number of production units allowed for each zone based on carrying capacity, the maximum biomass of production units, minimum distances between production units, the implementation of an environmental monitoring programme and database that captures production, environmental and economic data for each production unit.

Component 8.4. Providing Public Financing and Investment Incentives

To attract and promote sustainable local and foreign investment, the public sector should consider providing investment incentives, particularly in the early stages of sector development (these may not remain applicable in mature industries). These may be tax incentives (e.g., exemption/reduction of corporate income tax, import duties on equipment and other production materials), or non-tax incentives (e.g., permits for foreign nationals to own land). These incentives are usually dependent on certain conditions (such as a certain percentage of local ownership, and certification under BMP standards to promote responsible sector development). Moreover, the public sector can also provide funding to support R&D programmes and product development to grow the industry.

Responsibilities of the Public Sector (and where support can be provided):

- Review your country's investment incentive policy towards aquaculture.
- In consultation with other government departments (e.g., Ministry of Finance, propose and agree on a set of rational fiscal incentives).
- Publicly make available the conditions that are required for an aquabusiness to qualify for an incentive.
- Partner with research institutions to establish R&D programs aimed at developing products and production technologies.
- Explore ways of providing sources of public financing for private sector aquabusiness operators and ensure that access to this funding is conditional upon aquabusinesses meeting necessary environmental sustainability and social responsibility criteria. Also, ensure that business plans are suitably assessed to promote viable investments – Principles 1-7 can be used in assessing private sector business plans. Provide support for business planning and, where necessary, work with the private sector to improve and develop business plans.
- Assist the private sector in sensitising financial institutions (e.g., banks) to the business opportunities in aquaculture, and in assessing aquabusiness plans, to promote investment in aquaculture.

Component 8.5. Strategic and Supporting Infrastructure and Services

Functional, well-equipped state-run or -supported aquaculture facilities, such as hatcheries, broodstock facilities feed mills or feed production facilities, and research laboratories can be valuable for supporting aquabusinesses. The provision of support services, such as disease diagnosis and treatment, environmental monitoring, and general extension services can also assist the private sector. The need for such facilities and services is strongly dependent on the maturity of the sector; for example, an emerging sector will have vastly different needs to those of an established aquaculture industry.

Such infrastructure and services do not necessarily need to be state run and are often more suitable as PPPs between relevant Government authorities and business-focused, technically equipped entrepreneurs.

In addition to aquaculture-specific infrastructure and services, reliable supporting infrastructure (e.g., roads, cold chain facilities) and services (e.g., water and electricity supply, waste management systems) are often critical for doing business. For many commercial aquaculture cases, most notably those with a high degree of vertical integration, effective supporting infrastructure and services may be more important than the presence of state-run aquaculture facilities.

Responsibilities of the Public Sector (and where support can be provided):

- Assess the status of public sector facilities and identify and implement interventions to improve their capacity.
- Make support facilities and services available to the private sector.
- Engage the private sector (potentially through private sector representatives e.g., industry associations) to understand industry needs in terms of state-run services and facilities, for example, hatchery facilities, cold chain infrastructure, and veterinary diagnosis and treatment services.
- Ensure that the provision of product from aquaculture facilities is of a high quality and does not impede the sector's growth.
- Assess the presence and state of supporting public services and infrastructure.
- Improve/upgrade services based on requirements. This can be achieved through prioritising infrastructure and services to ensure the reallocation of resources.
- Assess opportunities for the establishment of PPPs to effectively manage supporting infrastructure and services.

Component 8.6. Promoting Technology and Knowledge Transfer, Innovation, Training and R&D

The public sector as well as supporting actors can support the development of commercial aquaculture by facilitating the transfer of advanced aquaculture technologies, knowledge, and skills through partnerships with international research institutions and industry experts. The public sector and supporting actors can also support the industry by offering training programs (e.g., through public learning institutions and practical demonstration facilities) to enhance the skills of the local workforce in aquaculture practices.

Additionally, R&D facilities and programmes (e.g., genetic improvement) offer valuable support to the private sector. These may be government-led or -supported, and may also involve collaboration with NGOs, industry actors, and public/private research institutions, or the formation of PPPs. The roles of each of the stakeholders involved in such arrangements must be clearly defined for maximum impact and efficiency. In many cases (e.g., genetic improvement programmes), research institutions, NGOs and/or private sector actors are best placed to provide technical expertise, while the public sector is best placed to provide infrastructure (e.g., laboratory facilities) funding and other strategic support.

Responsibilities of the Public Sector (and where support can be provided):

- Establish practical learning centres and promote their use among the youth.
- Train a skilled aquaculture workforce.
- Collaborate with international experts and establish knowledge-sharing programmes.
- Implement a knowledge transfer programme whereby an expert/s provides early management and implements a training and capacity building programme for local resources (e.g., train the trainer programmes).
- Promote continuous skills development, including funding of formalised programmes for the transfer of knowledge from foreign experts to the local sector (e.g., exchange programmes).
- Promote PPPs for initiating and maintaining essential R&D to support sustainable industry development; for example, genetic improvement programmes, development of vaccines, and aquafeed production using alternative protein sources.

Component 8.7. Market Access and Promotion

By developing marketing strategies, or promoting brand awareness, the public sector can support aquabusinesses in accessing both domestic and export markets and improve public perception towards aquaculture products (see Box 14). Moreover, access to international markets is dependent on a competent authority (CA; government agency or regulatory body with the legal authority and expertise to ensure and enforce food safety regulations and standards). Finally, access to export markets can also be enhanced by preferential trade agreements with other countries.

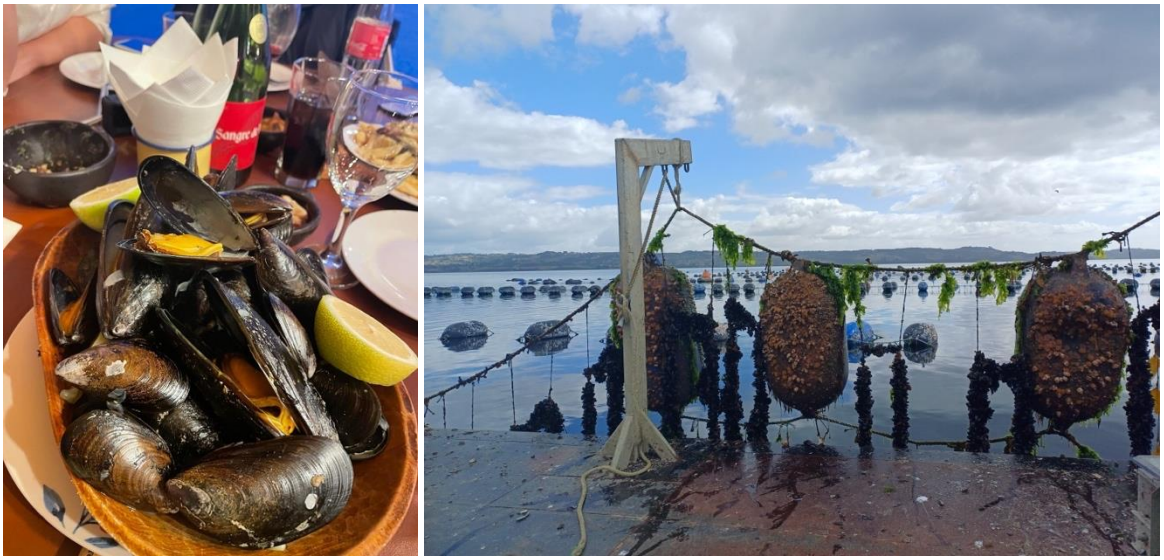
Responsibilities of the Public Sector (and where support can be provided):

- Undertake an in-depth market assessment (online and/or by visiting relevant markets) to understand the position that similar products hold in export markets (collaborate with the private sector on this).
- Establish a market intelligence unit for disseminating market information to prospective investors.
- Enquire with the export countries to understand which markets the country's aquaculture products have access to. Alternatively, enquire in the target markets what certifications or standards are required to obtain access.
- Invest in these certifications or standards as part of promoting aquabusiness and trade.
- Establish trade agreements with export market countries.
- Based on all the above factors, it is highly recommended that national fish marketing strategies are developed, and their objections implemented.

Box 14: Brand promotion by a Chilean industry association to boost market access.

Mussel production supports Chile's second most important aquaculture value chain (after salmonids) and is based on the production of Chilean mussels (*Mytilus chilensis*), with smaller volumes of cholga mussel (*Aulacomya ater*) and choro mussel (*Choromytilus chorus*). In 2021, farmed mussel production reached a record high of almost 426 000 tonnes (>99% Chilean mussels) (FAO, 2023a). However, one of the major challenges to the industry's continued growth is the need for diversification of markets. While cholga and choro mussel production is consumed locally, Chilean mussel production is almost entirely exported. The local market therefore represents a major opportunity for growth of the mussel value chain.

To address market challenges and opportunities, the industry association AmiChile is working with mussel farmers and government organisations – including CORFO and PROCHILE – on marketing campaigns for both local and export markets. One of these is a campaign to promote local consumption of homegrown Chilean mussels, through a campaign called "Hay Choritos". This translates to "They are Mussels", as *chorito* is the local name for the Chilean mussel.



A mixture of farmed mussel species at a local Chilean restaurant (left), and a mussel grow-out operation in Chiloe Island, Chile (right).

Component 8.8. Promoting and Regulating Socially Responsible Practices

The public sector is responsible for putting in place, promoting and enforcing the necessary social safeguards to ensure the socially responsible development of aquaculture. Aside from being a social and ethical necessity, a robust framework for socially responsible aquaculture can enhance a country's attractiveness of responsible aquabusiness investment and development and is an important component for market access and certifications. In many cases, social safeguards are cross-cutting and do not apply only to the aquaculture sector.

Efforts to create a socially responsible aquaculture sector typically require a combination of regulatory measures, awareness campaigns, and initiatives to improve social and economic conditions in communities. The aquaculture industry, governments, and international organisations must work together to promote responsible practices, enforce labour standards, and ensure that the rights and well-being of women, youth and children are protected. International organisations such as the ILO provide guidelines and recommendations to address labour issues globally, and many countries have national laws and regulations in place to prevent and eliminate child labour. Collaboration among stakeholders, including governments, industry associations, and NGOs, is essential to create a sustainable and socially responsible aquaculture sector that prioritises the well-being of all individuals involved, through the implementation and enforcement of robust labour standards, promotion of ethical and sustainable practices, and fostering social responsibility.

Responsibilities of the Public Sector (and where support can be provided):

- If your country has not ratified the ILO Minimum Age Convention, 1973 (towards eliminating child labour), put pressure on the relevant Government authorities to ratify this Convention, and to adapt relevant legislation and policies accordingly.
- Labour laws should contain clause/s that ban child labour practices. If this is not the case in your country, put pressure on the relevant Government authorities to incorporate such a clause, and ensure that the primary aquaculture legislation contains such a clause. The authority responsible for aquaculture must monitor the sector to ensure that this is enforced.
- Labour legislation should be aligned with global standards for equitable labour, for example, the ILO Declaration on Fundamental Principles and Rights at Work. If this is not the case in your country, put pressure on the relevant Government authorities to improve labour legislation in line with these standards. The primary aquaculture legislation should also include sections on labour, in line with these standards. The authority responsible for aquaculture must monitor the sector to ensure that this is enforced.
- Incorporate gender equality and mainstreaming into aquaculture policies and sector planning documents, based on the four ILO Conventions on gender equality: the Equal Remuneration Convention, 1951, the Discrimination (Employment and Occupation) Convention, 1958, the Workers with Family Responsibilities Convention, 1981, and the Maternity Protection Convention, 2000. Promote gender mainstreaming through public campaigns.
- Promote wage scales and/or a minimum wage for the aquaculture sector; and monitor the private sector to ensure that these are being complied with.
- Promote policy development and coordination between regulatory bodies to address GBV in aquabusiness.

- It is important to uphold any relevant customary tenure rights (land ownership and land-use rights based on traditional or customary practices of indigenous communities). The primary aquaculture legislation should recognise and incorporate any relevant customary rights, and the allocation of land/water rights for aquaculture must not infringe on these rights. It may be necessary to engage experts in indigenous communities in your country, in developing the regulations for customary rights.
- For all the above, auditing and mandatory reporting requirements for aquaculture licence holders are important tools for ensuring compliance with social safeguards.

Component 8.9. Promoting and Regulating Environmentally Sustainable Practices

While the private sector is largely responsible for implementing environmentally sustainable aquaculture practices, the public sector is responsible for its promotion and enforcement. Governments and regulatory bodies can promote environmentally sustainable aquaculture through regulatory frameworks and strategic planning, as well as by formulating policies that establish standards for responsible practices. Through licensing and permitting procedures, they ensure compliance with stringent environmental criteria before operations commence. Governments can also allocate funds for research, collaborating with diverse stakeholders to promote innovation and knowledge exchange. Their oversight includes data collection, aiding assessments of environmental impact and identifying areas necessitating improvement. By fostering collaborations, capacity-building efforts, and educational programs, they enhance awareness and competence among aquaculture operators. Engaging in international partnerships and adopting global standards further strengthens their commitment to sustainable aquaculture. Financial incentives and support initiatives also incentivise the adoption of eco-friendly technologies, collectively forming a robust framework for the development and promotion of sustainable aquaculture practices.

Responsibilities of the Public Sector (and where support can be provided):

- Ensure that the aquaculture sector is underpinned by a robust regulatory framework (including primary laws, regulations and production standards) that is based on environmental best practices; for example, the World Bank Environmental and Social Standards (ESS), the FAO Ecosystem Approach to Aquaculture, and the FAO Guidelines for Sustainable Aquaculture (GSA).
- This framework should include, amongst others:
    - Regulations pertaining to the production of non-native species, genotypes, and strains – including which species are or are not permitted, and any specific conditions related to the production of non-native species (e.g., use of closed systems);
    - Water quality parameters for effluent water and waste management standards for solid waste;
    - Environmental monitoring (e.g., benthos, discharge site) and reporting requirements; and
    - Fallowing requirements.
- Work closely with the environmental authority to ensure all aquaculture legislation, regulations and standards are aligned with the environmental regulatory framework; for example, the need for varying levels of impact assessments with different types of aquabusiness developments.
- Ensure effective enforcement of the regulatory framework for aquaculture, through a well-capacitated authority.

Component 8.10. Promoting Aquatic Biosecurity and Health

The public and support sectors have important roles to play in biosecurity and health governance and regulation, provision of veterinary support services, industry-driven R&D, and support to public sector initiatives, for example through the formation of PPPs (see Box 15). As biosecurity is one of the major risk factors in aquabusiness, the role of the public sector (and support sector) is a critical factor that the private sector will consider when assessing if a country presents a suitable enabling environment for investment and development.

Responsibilities of the Public Sector (and where support can be provided):

- Ensure that the regulatory framework for aquaculture is aligned with the World Organisation for Animal Health (WOAH) Aquatic Animal Health Code, and complimented by effective communication, monitoring, support and enforcement by the public sector (see Box 15). This framework must include:
    - Notification of listed diseases; e.g., ensuring operators are aware of the list of notifiable diseases, methods to detect them, and the process involved in reporting outbreaks.
    - Aquatic animal surveillance: Implement regular monitoring and surveillance programs to detect and respond to disease outbreaks promptly (including reporting of notifiable disease outbreaks to the WOAH), and invest in advanced technologies for early detection of diseases, such as surveillance through molecular tools and remote sensing.
    - Import risk analysis; e.g. establish and enforce standards for the import and export of animals for aquaculture (e.g., ova, broodstock, fingerlings) to prevent the introduction and spread of diseases.
    - Quality of animal health services and communication
    - Disease prevention and control; e.g., biosecurity requirements for aquaculture establishments, zoning and compartmentalisation; contingency planning, fallowing, handling, disposal and treatment of waste, and control of feed.
    - Trade measures, import and export procedures and health certification; e.g., Certification obligations and procedures; and health measures (e.g., quarantine) and assessments required for import and export.
    - Welfare of farmed animals.
    - Guidelines for use of antimicrobial agents.
    - Guidelines for treatment of specific diseases.
- Invest in the infrastructure (e.g., laboratories, quarantine facilities) necessary for alignment with the WOAH requirements above.
- Promote and provide support to research initiatives focused on biosecurity and animal health; e.g., the development of vaccines or specific pathogen-resistant (SPR) strains of aquaculture species.
- Provide training programs for both the public and private sectors on best management practices with regards to biosecurity measures, animal health management and monitoring, and disease prevention and treatment.
- Collaborate with international organisations and neighbouring countries to share information on disease control, exchange best practices, and prevent the spread of diseases across borders (particularly in the case of transboundary water bodies).

- Develop and regularly update emergency response plans to address disease outbreaks promptly, including protocols for culling infected stocks, disinfection procedures, and communication strategies.
- Foster collaboration between the public sector, private industry, and research institutions to collectively address challenges related to aquatic biosecurity and health (see Box 16).
- Facilitate the exchange of information between government agencies, research institutions, and aquaculture stakeholders to keep all stakeholders informed about emerging threats and best practices.

Box 15: Benefit of Public-Private Sector Collaboration for Animal Health Aquabusiness - Examples from Vietnam.

An example of a private sector innovation in aquatic health management that can benefit from public sector support is the VMC Mobile Lab, which aims to overcome the inefficiency of diagnostic services available to smallholder aquaculture farmers in Vietnam. Timely and accurate diagnosis is critical for mitigating the spread of pathogens at a farm-level and amongst farms, and to discourage indiscriminate use of therapeutants and incorrect treatments. The VCM Mobile Lab – which is a collaborative effort between VMC Vietnam and academics from Vietnam National University of Agriculture – provides smallholder farmers with free diagnosis. Thereafter, farmers can purchase the correct therapeutants from VMC. However, the service, which operates across a large area of northern Vietnam, currently consists of only one vehicle. The Mobile Lab partners have emphasised how important government support will be to assist in scaling up this valuable and successful innovation.

The VMC Mobile Lab team responds to a request to diagnose common carp mortalities at a smallholder pond farm in Ha Nam Province, Vietnam.

On the other hand, the public sector Biotechnology Centre of Ho Chi Minh City works closely with private sector shrimp farmers to develop treatments for the pathogens that affect the industry. This includes research and development into new vaccines. However, without private sector partners, the vaccines cannot be commercialised and, at present, Vietnam imports the majority of commercial vaccines used in shrimp farming.

These examples emphasise the importance of collaboration between the public and private sectors, for example through the establishment of PPPs, to benefit from each party's expertise and contributions.

Box 16: The Industry Impact of Poor Biosecurity Regulations – Examples from Taiwan and Belize.

In Taiwan, grouper fingerling production has faced significant challenges due to outbreaks of severe nervous necrosis virus (NNV) and other pathogens. Careless farming practices, characterized by a lack of biosecurity regulations and protocols facilitated the transmission of NNV, Irido virus, bacterial pathogens, Aeromonas, Streptococcus, and parasites among grouper populations. Consequently, bans from major imports such as China were imposed on grouper from Taiwan, citing the presence of banned chemicals and high levels of antibiotics.

Similarly, in Belize, the shrimp farming industry encountered a devastating disease outbreak, resulting in a drastic decline in production by over 95% in 2015. This outbreak led to a sharp reduction in employment within the industry. The spread of disease was facilitated by inadequate biosecurity measures, allowing pathogens to infiltrate farms, spread between them, and contaminate water sources.

The ramifications of poor biosecurity regulations are multifaceted. Economically, both the grouper and shrimp industries suffered immense losses, with decreased production and employment opportunities. Moreover, the reputational damage incurred by the bans on imports further exacerbated the economic strain on affected regions. Environmentally, the spread of diseases compromised the ecological balance of aquatic ecosystems, posing risks to wild populations and biodiversity. Socially, the livelihoods of individuals dependent on aquaculture were severely impacted, leading to financial instability and decreased standards of living.

Recognizing the urgent need for improved biosecurity measures in Belize, a biosecurity project was implemented following ASC Certification standards, aiming to bolster defences against disease outbreaks. Measures encompassed the prevention of pathogen entry, inter-farm disease transmission, and internal cross-contamination through water management strategies and improved farm infrastructure.

These examples underscore the importance of robust biosecurity regulations in safeguarding aquaculture industries from disease outbreaks and economic downturns. By addressing the systemic weaknesses in biosecurity practices, stakeholders can mitigate the risks posed by pathogens and uphold the sustainability and resilience of aquaculture operations.

Conclusion

The Global Aquabusiness Investment Guide serves as a practical, operational and user-friendly reference document for sustainable aquaculture investment, expansion, and development. The Guide does not duplicate the existing body of frameworks, guiding documents and literature, but builds on relevant synergies within these. Moreover, the Guide, and its Guiding Principles for Sustainable Aquabusiness, expand on existing documents and reports, transitioning from theoretical concepts to practical recommendations and implementation.

It is a comprehensive, accessible reference point for navigating sustainable aquaculture investment, expansion, and overall development, catering to diverse user needs; and serves as a compass for both private and public sector stakeholders, aiding them in making responsible investments, stimulating investment practices, nurturing aquabusiness growth, and expanding the sector. Users are encouraged to review each Guiding Principle contained within the Guide and adapt the content to their specific context, thereby maximising the value of this Global Guide. This adaptable approach ensures the optimisation of these Guiding Principles to suit individual needs and circumstances, enhancing their effectiveness in driving sustainable practices and fostering growth within the aquabusiness domain.

The Global Aquabusiness Investment Guide will be accessible to the public through the AquaInvest Platform, allowing for regular updates to align with the evolving and expanding aquabusiness landscape. This ensures that the Guide remains current, reflecting the dynamic changes within the aquabusiness environment, and staying abreast of the industry's growth and transformation.

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Appendix A: Stakeholder Engagement Registry

The following stakeholders have been engaged to date, to inform the development of the Global Principles for Sustainable Aquabusiness:

Date	Stakeholder	Meeting mode
24 February and 3 March 2023	• Seychelles Ministry of Investment, Entrepreneurship and Industry (MIEI) including PS of Investment • Seychelles Investment Bureau (SIB) • Seychelles Fishing Authority (SFA) • Prospective investors in Seychelles' aquaculture industry	In-person
14-17 March 2023	Various East African aquaculture stakeholders including: • Conservation International • Gatsby Africa • Private sector farms (e.g., Victory Farms) • Lake Victoria Fisheries Organisation • World Aquaculture Society, African Chapter (WAS) • TRUE-FISH (EU-Funded)	In-person
20 and 22 March 2023	• FAO Fisheries and Aquaculture Division (NFI)	Virtual
28 March 2023	• Sanlei Trout and Katse Fish Farm, Lesotho	In-person
5 April 2023	• Gatsby Africa	Virtual
11 and 22 April 2023	• Seychelles Fishing Authority	In-person
13 April 2023	• FAO Inclusive Rural Transformation and Gender Equality Division (ESP)	Virtual
24 April 2023	• Buffelsjags Abalone Farm (Viking Aquaculture (Pty) Ltd), South Africa	In-person
4 May, 7 June, and 5 July 2023	• Aquaculture Stewardship Council (ASC)	Virtual
30 May 2023	• WWF-USA	Virtual
31 May 2023	• Global Seafood Alliance (GSA) / The Center for Responsible Seafood (TCRS)	Virtual
6 June 2023	• GlobalG.A.P.	Virtual
7 June 2023	• Meridian Institute	Virtual

12-23 June 2023	• Thailand:
	  ○ Asian Institute of Technology (AIT) - Aquaculture and Aquatic Resources Management Unit
	  ○ Thailand Board of Investment (BOI) - Investment Promotion Division 1 (Bio and Medical Industries)
	  ○ FAO NFI
	  ○ FutureFish
		In-person

Date	Stakeholder	Meeting mode
	○ FAO ESP / FAO Regional Office for Asia and the Pacific (RAP) ○ Network for Aquaculture Centres in Asia-Pacific (NACA) ○ Centex Shrimp at Mahidol University ○ Aqquua (ASC-certified grouper farm) ○ Thai Union Feedmill, Bangkok • Malaysia: ○ Inno Resource Development ○ Seadling ○ Seaweed farmers and middlemen, Semporna ○ WorldFish Centre (Penang) ○ Penang State Fisheries Office ○ Fisheries Research Institute (FRI) ○ investPenang • Vietnam: ○ Van Lang University ○ Biotechnology Centre of Ho Chi Minh City ○ Minh Phu ○ Forte Biotechnology ○ Vietnam Association of Seafood Exporters and Producers (VASEP) ○ Vietnam Seaculture Association (VSA) ○ Vietnam National University of Agriculture, Faculty of Fisheries ○ VMC Animal Health ○ Cage and pond farm owners and workers	
27 June 2023	• Charoen Pokphand (CP) Group	Virtual
28 June 2023	• Blue Archipelago Berhad, Malaysia • International Finance Corporation (IFC)	Virtual
3 July 2023	• Longline Environment	Virtual
4 July 2023	• WWF-Vietnam	Virtual
7 July 2023	• Shrimp Welfare Project • Cargill Vietnam	Virtual
12 July 2023	• De Heus Vietnam	Virtual
13 July 2023	• Marine and Mining Resources Department (DRMM) of French Polynesia, Aquaculture Section • Secretariat of the Pacific Community (SPC), Fisheries Aquaculture and Marine Ecosystems (FAME) Division	Virtual
14 July 2023	• Zambian Ministry of Small and Medium Enterprise Development • WWF-USA / WWF Global	Virtual
17 July 2023	• World Bank Vietnam	Virtual
18 July 2023	• World Bank ENB Middle East and North Africa	Virtual

Date	Stakeholder	Meeting mode
	• World Bank Liberia team • Ocean Era, Hawaii USA	
31 July 2023	• World Bank Bangladesh team • World Bank Cote d'Ivoire team	Virtual
1 August 2023	• World Bank Sri Lanka team	Virtual
3 August 2023	• World Bank Seychelles team • World Bank Argentina team	Virtual
15 August 2023	• ASC Improver Programme	Virtual
16 August 2023	• World Bank Peru team	Virtual
18 August 2023	• World Bank Cabo Verde team	Virtual
20 August-1 September 2023	• Norway o Lumarine – Land-based cod facility o ScaleAQ o GroAqua o AquaBioTech o AquaGen o Innovasion Norge o SINTEF Ocean AS o University of Stirling: Institute of Aquaculture o Akvaplan-Niva o Cargill o Lerøy o NOFIMA o Seafood Innovation Council	In-person
8 September 2023	• World Bank Pacific Islands team	Virtual
14 September 2023	• New Zealand King Salmon	Virtual
21 September 2023	• Seas the Opportunity • The Seaweed Alliance	Virtual
27 September 2023	• Ministry of Primary Industries, New Zealand	Virtual
13-17 November 2023	• AQUACULTURE AFRICA 2023 (WAS), Lusaka, Zambia o World Bank o GIZ o FAO o SADC o AUDA-NEPAD o ECOWAS o Zambian Ministry of Fisheries and Livestock o Malawi Department of Fisheries o World Aquaculture Society o Gatsby Africa o Aquaculture Consulting and Management Services o Longline o FutureFish o Aquaculture Association of South Africa	In-person

Date	Stakeholder	Meeting mode
	○ Blue Aqua	
14 November 2023	• Meridian Institute: authors preparing case studies on global aquaculture industries for the ASA: ○ Chile – Salmon ○ Ecuador – Shrimp ○ Egypt – Tilapia ○ Thailand – Giant freshwater prawn ○ Indonesia – Pangasius ○ Bangladesh – Black tiger prawn ○ China – Carp	Virtual
20-24 November 2023	• Mauritius and Rodrigues ○ Ministry of Blue Economy, Marine Resources, Fisheries and Shipping ○ Department for Continental Shelf, Maritime Zones Administration and Exploration, Prime Minister's Office ○ University of Mauritius ○ Ministry of Environment, Solid Waste Management and Climate Change ○ Integrated Coastal Zone Management Division, Ministry of Environment, Solid Waste Management and Climate Change ○ Sustainable Development Division, Ministry of Environment, Solid Waste Management and Climate Change ○ Ministry of Tourism ○ Commission for Fisheries, Rodrigues ○ Mauritius Research and Innovation Council	In-person
11 December 2023	• FAO Regional Office for Europe and Central Asia	Virtual
13 December 2023	• FAO Caribbean subregion	Virtual
14 December 2023	• FutureFish	Virtual
9 January 2024	• Zambian Ministry of Fisheries and Livestock	Virtual
15 January 2024	• Liberian National Aquaculture and Fisheries Authority (NaFAA)	In-person
17-25 January 2024	• Chile: ○ Control Union Chile ○ SERNAPESCA ○ SalmonChile ○ AMI Chile and mussel farmers ○ CORFO ○ MultiX ○ DNB Group ○ Private individual investors • Ecuador:	In-person

Date	Stakeholder	Meeting mode
	○ Ministry of Production, Foreign Trade, Investments and Fisheries (Ministerio de Producción, Comercio Exterior, Inversiones y Pesca ○ Chamber of Aquaculture (Cámara Nacional de Acuacultura; CNA) ○ OMARSA Shrimp Farm and Processing Plant ○ Biogemar Shrimp Hatchery ○ Centro de Investigación Marina y Acuícola Construido (CENAIM), Escuela Superior Politécnica del Litoral (ESPOL) (National Mariculture Research Centre) ○ LANEC Shrimp and Oyster Farm ○ Federación Ecuatoriana de Acuicultores (FEDAC) (represents SME aquaculture producers) ○ La Bodega del Mar (oyster producer)	
29 February 2024	• Board of Directors of the Council for Sustainable Management for aquaculture and adaptation to climate change in Tongoy Bay, Chile • Guild Association of divers, fishermen and similar independent artisanal branches of Tongoy • Cultivos Ostimar • Nanaku Cultivos • MásMar	Virtual