

Green Practice Guideline for Fisheries Sector (Aquaculture)

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FOREWORD

The development of green practice guidelines is a continuation of the implementation of the MyHIJAU Program under the Ministry of Environment and Water (KASA) and the Malaysian Green Technology and Climate Change Corporation (MGTC) which is a coordinating agency and secretariat for the program. This program has been approved by the National Council for Green Technology and Climate Change (MTHPI) which was held on 23 October 2012. This is one of the Government's initiatives in the development of Green Technology in Malaysia. It is in line with the implementation of the National Green Technology Policy as well as the direction of Sustainable Consumption & Production (SCP) to encourage local manufacturers, producers and suppliers, especially to companies and Small and Medium Enterprises (SMEs). In addition, it will also focus on the Government's initiatives and direction in the development of the country's SMEs.

The development of Green Practice Guidelines is to provide guidance to the green industry in implementing green practices at the preliminary stage, during and after construction is implemented. These guidelines also have an implementation direction to ensure that these Guidelines will continue to be referred to and used by all parties, especially industry players to help achieve the government's goal of implementing green development in Malaysia. This green practice can help the industrial sector to have the potential to venture into the field of green technology, especially in the production of green products and services, as well as increase the encouragement of producers, manufacturers and suppliers to apply green technology in the premises, production process and operation.

These Guidelines are more towards the requirements that need to be put into practice so that industries, companies and organizations have green practice guidelines that can be referred to as well as help companies achieve the government's goal of using green practices in line with SDG 12.6, which is to encourage the industry to use sustainable practices and integrate information sustainability into the reporting cycle.

Referring to the twelfth Malaysia plan under the eighth main focus which is to accelerate green growth, where this green practice development program is able to play a very important role in being a catalyst to ensure that these green practices are more practical and applicable to all parties in the green industry whether directly or indirectly for local companies and businesses to gain exposure to this green industry practice guide.

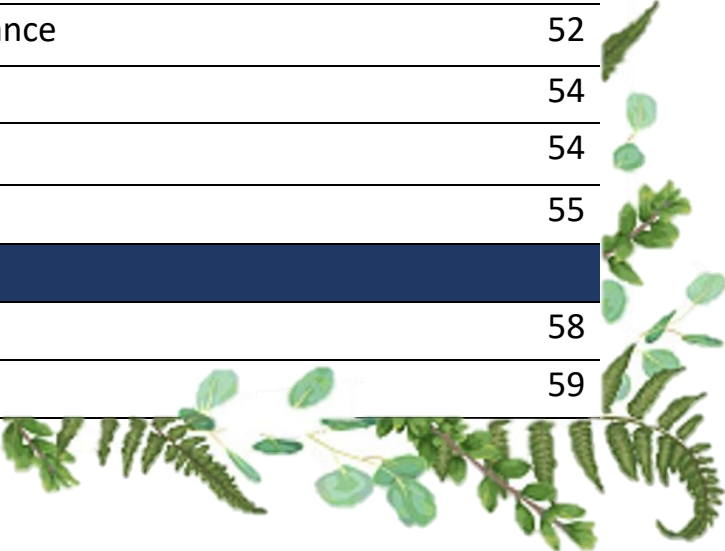
Therefore, increasing productivity and long-term profits through environmental, social and governance (ESG) elements should be applied in decision-making by ensuring that companies focus on reducing the negative impact on the environment. Although Malaysia only contributes 0.7 percent to greenhouse gas emissions, the Government will continue to fulfil its commitment to reduce GHG emission intensity up to 45 percent to GDP in 2030, based on emission intensity in 2005, in line with the aspiration to become a low carbon country.

It is hoped that this goal can be achieved by focusing on the industry to understand the importance of green practices in business by applying knowledge about the benefits and applications of green technology as well as the implementation strategy of the green practice monitoring mechanism in business management to obtain the recognition of the green industry.



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ABBREVIATION

GDP	Gross Domestic Product
OECD	Economic Co-operation and Development
KDNK	‘Keluaran Dalam Negara Kasar’
PCC	Per Capita Consumption
SSL	Self Sufficiency Level
BOT	Balance of Trade
COP	Code of Practice
UNEP	United Nations Environment Programme
UNIDO	United Nations Development Organization
ICT	Information and Communication Technology
AI	Artificial Intelligence
NAP3	Third National Agricultural Policy
NGO	Non-Governmental Organization
SME	Small and Medium Enterprise
FDI	Foreign Direct Investment
LCA	Life Cycle Analysis
R&D	Research & Development



TERMINOLOGIES

Gross Domestic Product	the standard measure of the value added created through the production of goods and services in a country during a certain period. As such, it also measures the income earned from that production, or the total amount spent on final goods and services (less imports).
Per Capita Consumption	the yearly use of goods and services by each person, derived by dividing the quantity of goods and services used by the total population. This variable serves as a direct measure of personal economic well-being.
Self Sufficiency Level	calculates the percentage of food consumed and produced domestically. It defines whether the production of agricultural commodities for a country is sufficient to meet domestic needs. The higher the ratio, the greater the self-sufficiency.
Balance of Trade	the difference between the value of a country's exports and the value of a country's imports for a given period.
Code of Practice	a set of written rules which explains how people working in a particular profession should behave.
Overexploitation	Also known as overfishing, is the removal of marine living resources to levels that are too low for sustaining viable populations
Policy maker	a broad term that covers all the people responsible for formulating or amending policy.
Sociocultural	used to describe the differences between groups of people relating to the social class and culture in which they live
Stakeholders	is either an individual, group or organization that's impacted by the outcome of a project or a business venture. Stakeholders have an interest in the success of the project and can be within or outside the organization that's sponsoring the project.
Fisheries	refers to the enterprise of raising or harvesting fish and other aquatic life, or more commonly, the site where such enterprise takes place
Green Practices	Environmentally friendly actions, which promote environment protection and sustainable development
Green Fisheries	Activities involving the fisheries sector which are environmentally friendly.



INTRODUCTION

1.1 Background

- The fisheries sector is managed in a sustainable, dynamic, and competitive manner based on scientific information and quality services. This is to ensure that food security, income of fishermen, fish breeders and fishery entrepreneurs, as well as the sector's sustainable growth will continue to be the primary objective of the fishing industry's development.
- Fisheries productivity has soared due to new technologies, mechanization, increased chemical use, specialization and government intervention that favoured maximizing output and reducing input costs. These changes have allowed farmers to produce more food and output at lower prices.



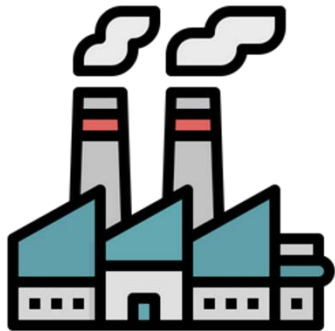
01 According to data from the Department of Statistics Malaysia, our population reached 32.7 million in 2021

02 The fisheries sector remains an important instrument to produce food and nutrition, generate incomes, and indirectly improves the welfare of its communities.



03 The fisheries sector also plays an important role in the economy's country through its contribution to national income and turnover exports and job creation.





This sector is a supplier of main food as well as raw materials for resource-based industries.

- In 2020, the fisheries sector recorded a production of 1.79 million metric tonnes of food fish, 227.9 million pieces of ornamental fish, and 41.9 million bundles of aquatic plant with a value of RM11.56 billion, a decrease of 4.5% in terms of production and 24.3% in terms of value as compared to 2019. Fisheries as a sub-sector of agriculture has contributed approximately 11%, or to 0.8% of national Gross Domestic Product (GDP) and with a growth rate of 0.04% during the 11th Malaysia Plan.
- In 2020, the Per Capita Consumption (PCC) was recorded at 42.6 kg/person/year with Self Sufficiency Level (SSL) of 95%. Whereas the Balance of Trade (BOT) has declined from RM1.07 billion in 2019 to RM1.37 billion in 2020 at a difference of 28%

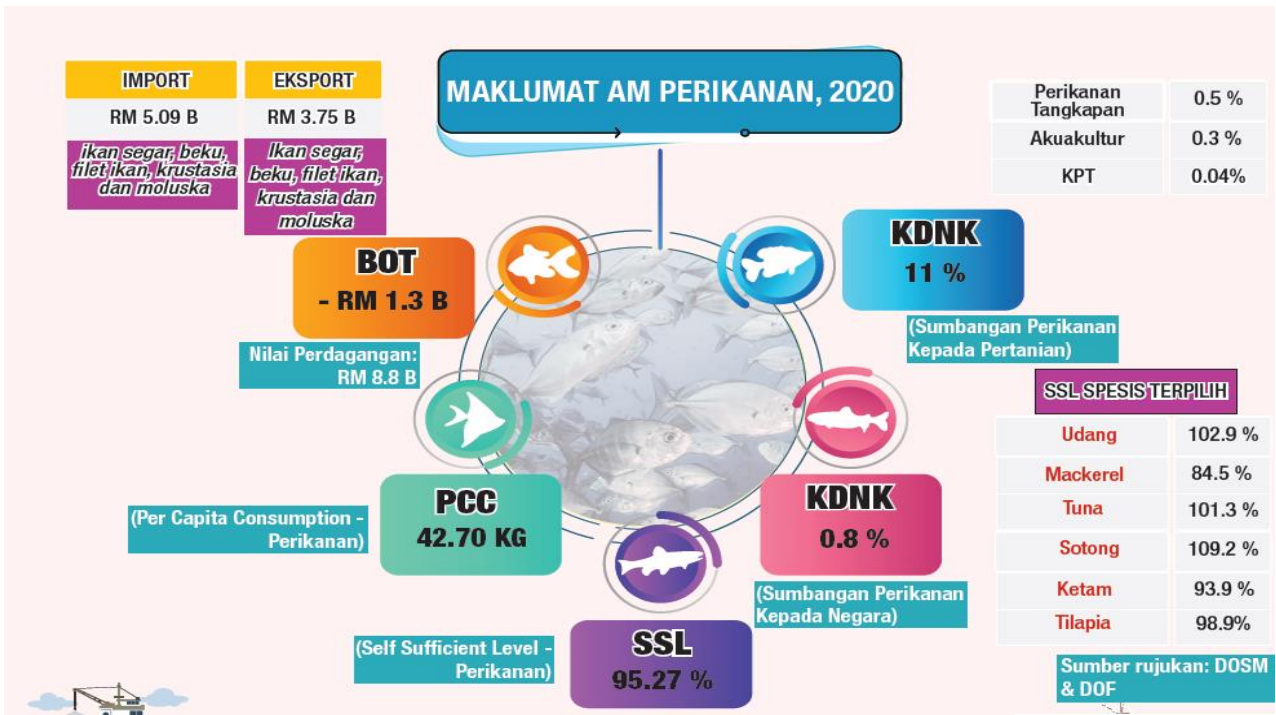


Figure 1.1. Information regarding Malaysia's fisheries sector in 2020

The fisheries sector in Malaysia is mainly divided into three categories: capture fisheries, aquaculture, and inland fisheries.

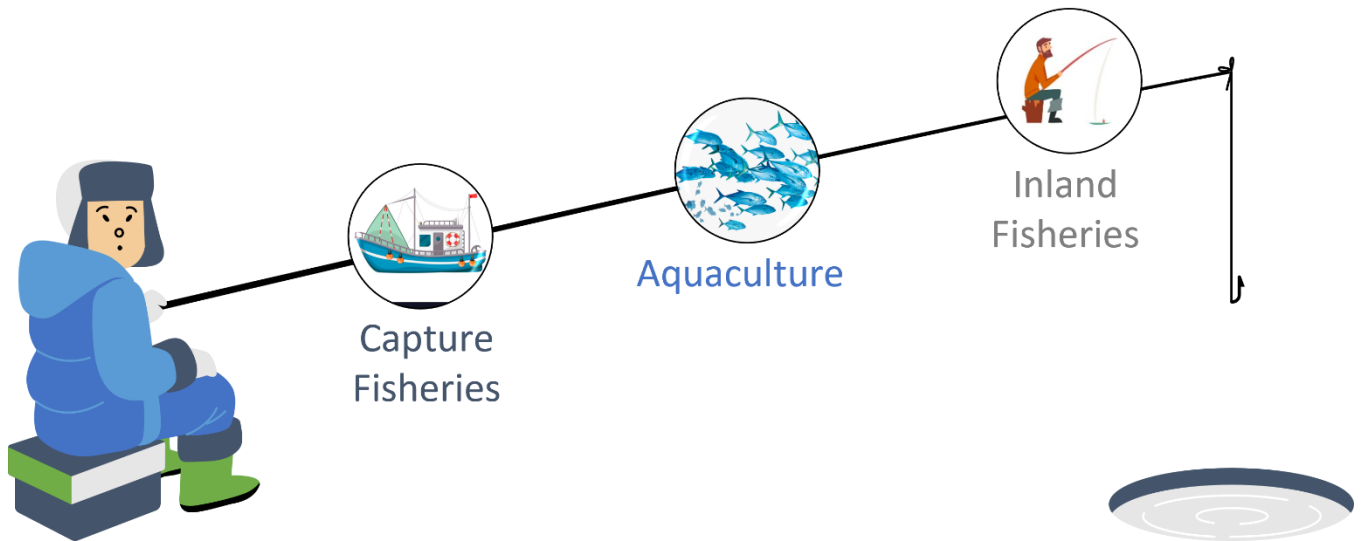
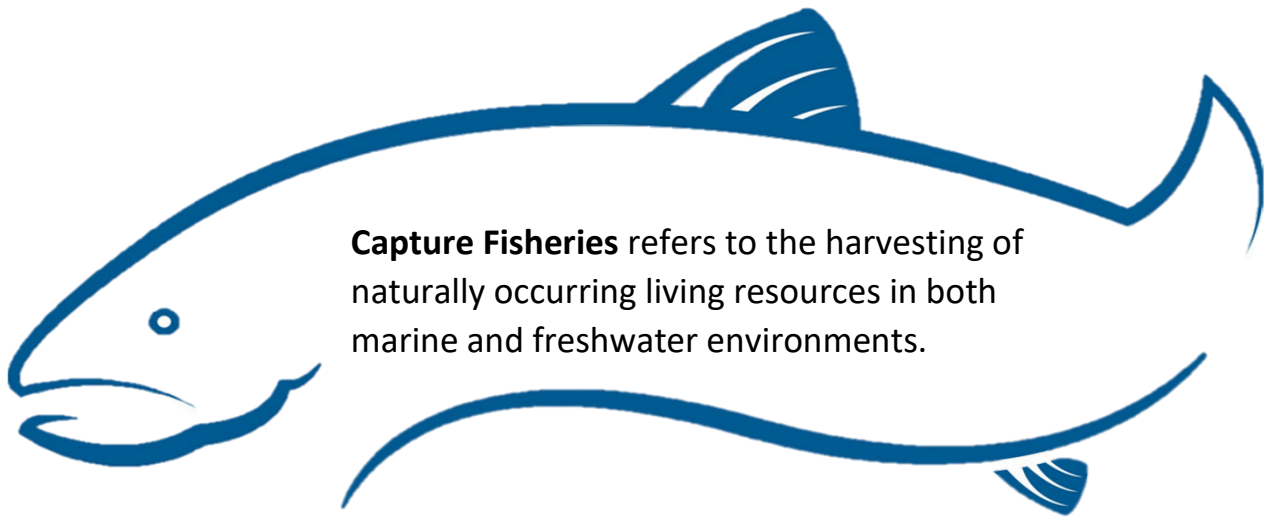
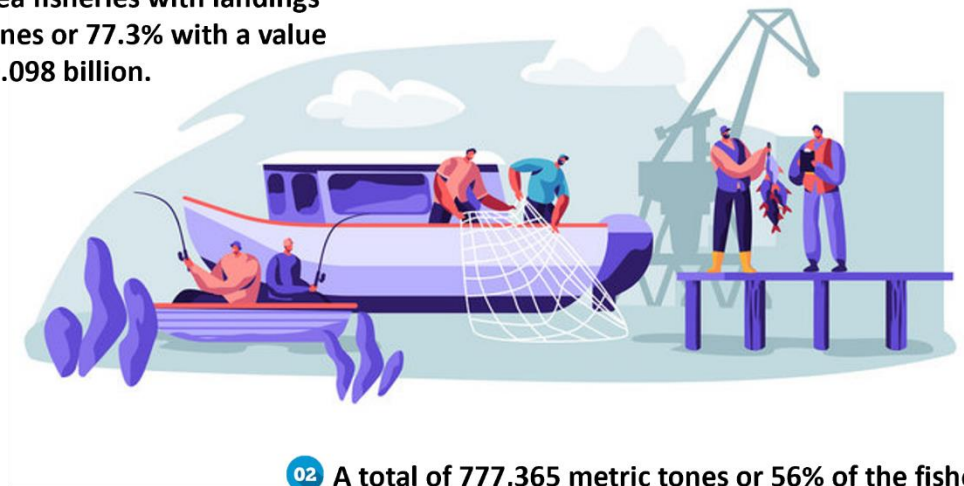


Figure 1.2. Information regarding Malaysia's fisheries sector in 2020



Capture Fisheries refers to the harvesting of naturally occurring living resources in both marine and freshwater environments.

01 The total production of fish is mainly contributed by capture fisheries which consists of coastal and deep-sea fisheries with landings of 1,383,299 metric tones or 77.3% with a value of RM10.098 billion.



02 A total of 777,365 metric tones or 56% of the fishery are landed on the West Coast of Peninsular Malaysia. Meanwhile, East Malaysia (Sabah, Sarawak, and Labuan waters) and East Coast of Peninsular Malaysia contributed 348,652 metric tones (25%) and 257,281 metric tones (19%) to the total landings, respectively.



03 In 2020, a total of 119,828 fishermen were working on the licensed fishing vessels, involving 90,443 local fishermen and 29,385 foreign fishermen (non-Malaysian) comprising Thai, Indonesia, and Vietnam Nationals.

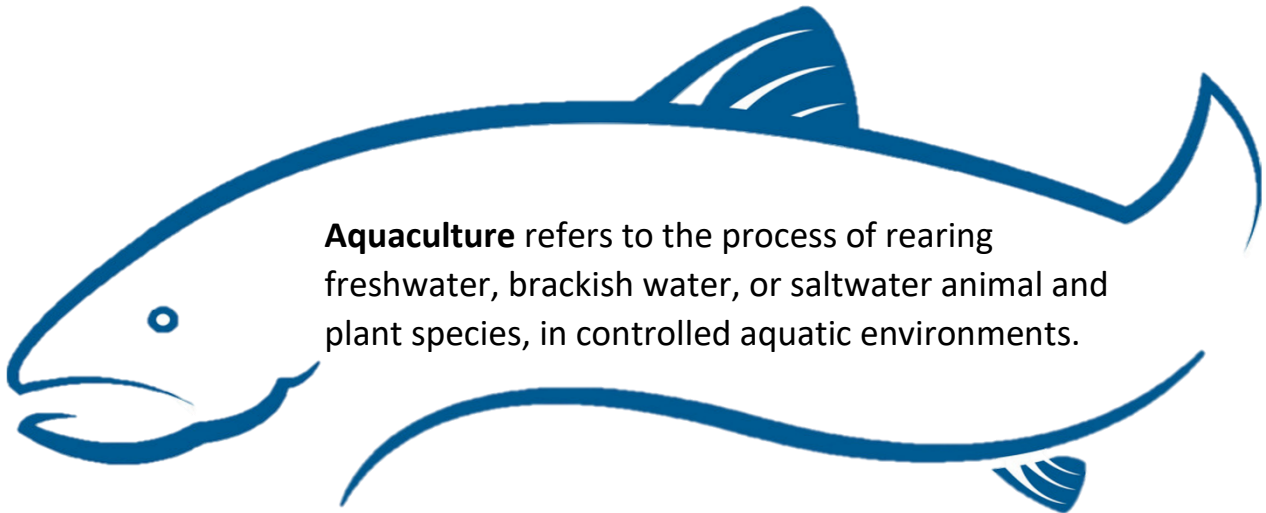
04 The overexploitation of marine resources will devastatingly reduce the fisheries landing. Therefore, a sustainable fisheries management is essential to ensure continuous fish supply for years to come.



05 Thus, empowering fisheries management by focusing on licensing regulations and habitat restoration are indispensable for a long-lasting preservation of marine lives and aquatic ecosystems.



06 These efforts contribute to the long-term security of the fisheries resources for the development of the fishing industry and the fisher's economic live hood which are highly dependent on these resources



Aquaculture refers to the process of rearing freshwater, brackish water, or saltwater animal and plant species, in controlled aquatic environments.

- 01 Aquaculture has recorded a production of 400,017 metric tones, which is valued at RM3.6 billion, equal to 22% of the national fisheries production.



- 02 This sector has shown a declining performance compared to 2019 where the production has shown a decrease of 2.9% in quantity and 5.7% in value.

03 A total of 20,262 fish farmers have been involved in the aquaculture industry, where a large number are involved in the freshwater aquaculture, which includes a total of 15,719 people or 77.5% of the total national aquaculture farmers. Meanwhile, a total of 4,539 farmers or 22.5% are involved in the brackish water aquaculture industry.



04 A total number of 35,206 hectares were utilized for aquaculture production using various culture systems, namely pond, cages, tanks, pens, mollusk system, estates, ex-mining pools and seaweed system. Almost 80% or 27,347 hectares were used for brackish water culture system and around 6,987 hectares (20%) were utilized for freshwater culture system.



05 As capture fishery has reached the maximum level of exploitation, aquaculture development is seen to have great potential for commercial development to increase the production and supply of fish in the country.



Inland fisheries refer to any activity carried out to catch fish and other aquatic organisms from water that are 'locked' on land.

- 01 Although the reported production of inland fishery is relatively small, this subsector contributes about 5,625 metric tones or 0.3% from the total national fish production worth RM83 million.



- 02 Systematic fisheries management will undoubtedly contribute to sustainable inland fishery stock, directly benefiting local communities. The inland fisheries stock has vast potential to be developed as a new source of economy

1.2 The Green Industry



- It is increasingly clear that climate change will have a profound influence on the agro-ecological conditions under which policy makers need to develop strategies and manage the natural resources to achieve food security and other ends.
- Therefore, this green practices guidelines for the fisheries sector were developed and refined through a participatory and iterative process, in preparation for national policies that support green industry.
- The amount of land is likely to remain constant while our population would continue to grow. Therefore, producing more resources is going to become a necessity within the conceptions of green and sustainable fisheries strategies for sustaining both food security and the need to conserve natural resources.
- The mechanization of fisheries production with application of innovative technologies and modern practices has transformed fisheries production into an industrial-type system. However, transitioning to a greener and sustainable fisheries economy will require change at many levels.
- There will be need for more equitable access to funding, a development in the social structure of fisheries sectors' players, efficient resources utilisation, market shifts and others.
- The barriers to the implementation of a green and sustainable fisheries are many, including financial and social resistances which prefers to maintain the current state of policy and practices.



SOCIAL

- Farmers with more social relationships across different socio-cultural groups are more inclined to experiment with sustainable practices.
- Social dynamics play a role in how farmers adopt new sustainability practices:



FINANCIAL

- Finance professionals can encourage more sustainable farming practices on the farms within their portfolios.
- The long-term benefits of sustainable fisheries practices do not always benefit the farmer.



POLICY

- Policies and regulations that incentivize conventional practices, or at least incentivize the status quo.
- Programs have economically favored conventional systems through subsidies.

Figure 1.3. Major barriers in fisheries sector

- There is also broad consensus that it is an essential goal for fisheries, and sustainable fisheries is seen as essential for global sustainable development.
- Since these concept and strategies can be met in several different ways, green and sustainable fisheries is unlikely to be linked to any particular management practice. Rather, green, and sustainable fisheries is thought of in terms of its adaptability and flexibility over time to respond to the demands for increased production and its ability to protect the natural resources such as soil and water.
- The shift to green and sustainable methods, however, often involve higher up-front costs. Green and sustainable fisheries is a necessary response to environmental risk and water quality. Yet social and financial pressures coupled with existing policies present a barrier to its adoption. By develop guidelines and pathways to green sustainable practices, stakeholders can play a key role in driving an industry-wide shift.



- Malaysia's national green economy framework reflects the global economic frameworks, such as that of the United Nations Environment Programme (UNEP) and the Organisation for Economic Co-operation and Development (OECD). The goals of these frameworks are to strengthen the economy via incentives, the tax system, pricing, regulatory frameworks, and prioritized investments.

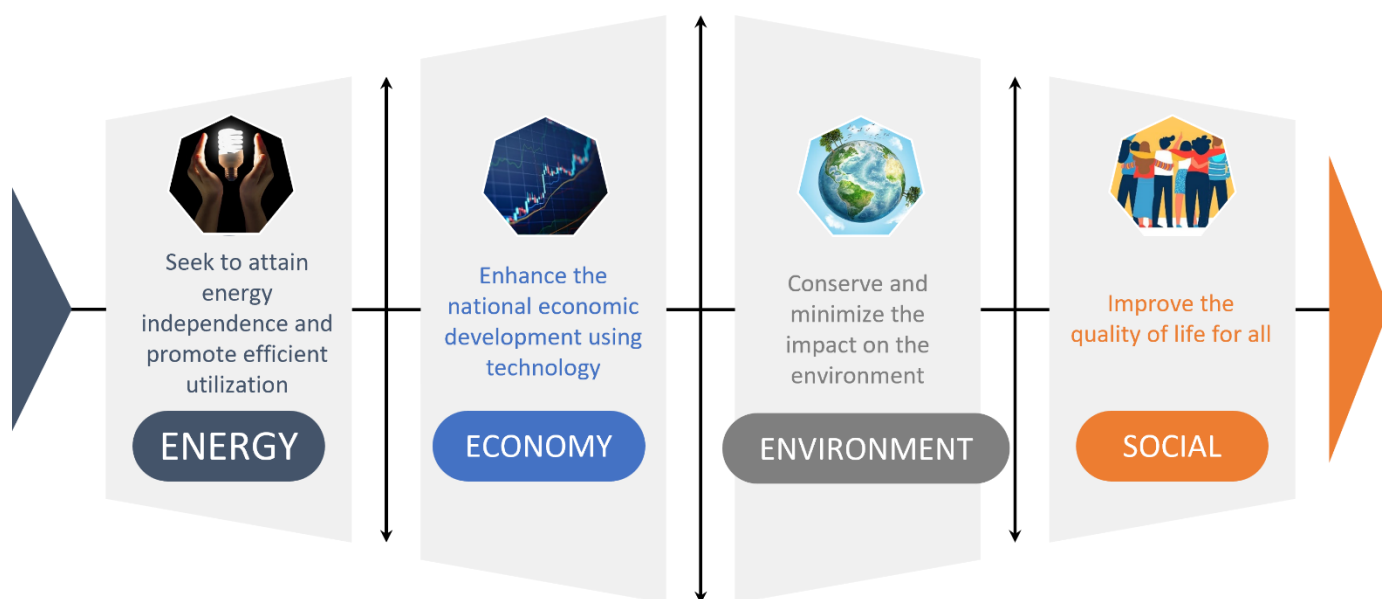


Figure 1.4 The Malaysia National Green Technology Policy with its four pillars

1.3 Purpose of Green Practices Guideline in Fisheries Sector

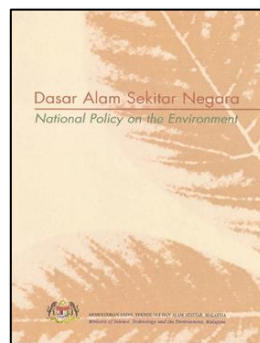
- This guideline was prepared through reviewing the role of the fisheries sector, mainly the aquaculture sector and other sources in agriculture ecosystems towards a greener growth in the fisheries sector. The early section briefly introduces the fisheries sector and outlines the challenges in this sector followed by offering innovation guidelines for a more sustainable and greener aquaculture ecosystem. It also draws conclusions on how the selected indicators could contribute towards greener growth in aquaculture.



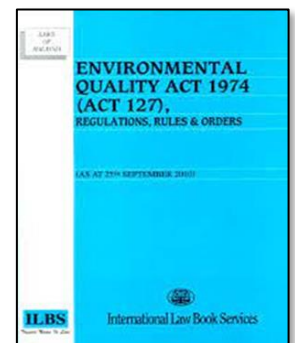
MALAYSIA GOOD AGRICULTURE PRACTICES (MyGAP)



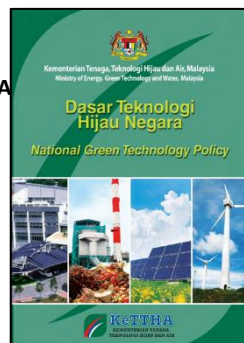
FISHERIES ACT 1985



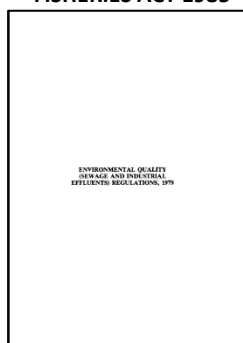
NATIONAL POLICY ON THE ENVIRONMENT



THE ENVIRONMENTAL QUALITY ACT 1974



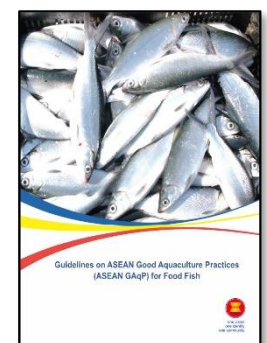
NATIONAL GREEN TECHNOLOGY POLICY



ENVIRONMENTAL QUALITY (SEWAGE AND INDUSTRIAL EFFLUENTS) REGULATIONS 1979



FISHERIES (INLAND FISHERIES AQUACULTURE) RULES 2017



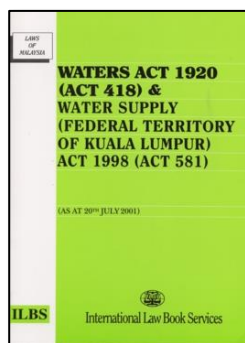
ASEAN GOOD AQUACULTURE PRACTICES (ASEAN GAqP)

NATIONAL GREEN TECHNOLOGY POLICY

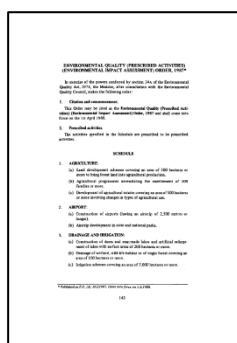
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FISHERIES (INLAND FISHERIES AQUACULTURE) RULES 2017

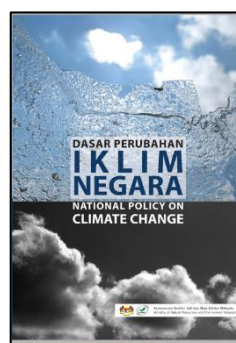
ASEAN GOOD AQUACULTURE PRACTICES (ASEAN GAqP)



WATERS ACT 1920 (NO. 418)



ENVIRONMENTAL QUALITY (ENVIRONMENTAL IMPACT ASSESSMENT) ORDER 1987



NATIONAL POLICY ON CLIMATE CHANGE



GREEN TECHNOLOGY MASTER PLAN MALAYSIA 2017 - 2030

WATERS ACT 1920 (NO. 418)

ENVIRONMENTAL QUALITY (ENVIRONMENTAL IMPACT ASSESSMENT) ORDER 1987

NATIONAL POLICY ON CLIMATE CHANGE

GREEN TECHNOLOGY MASTER PLAN MALAYSIA 2017 - 2030

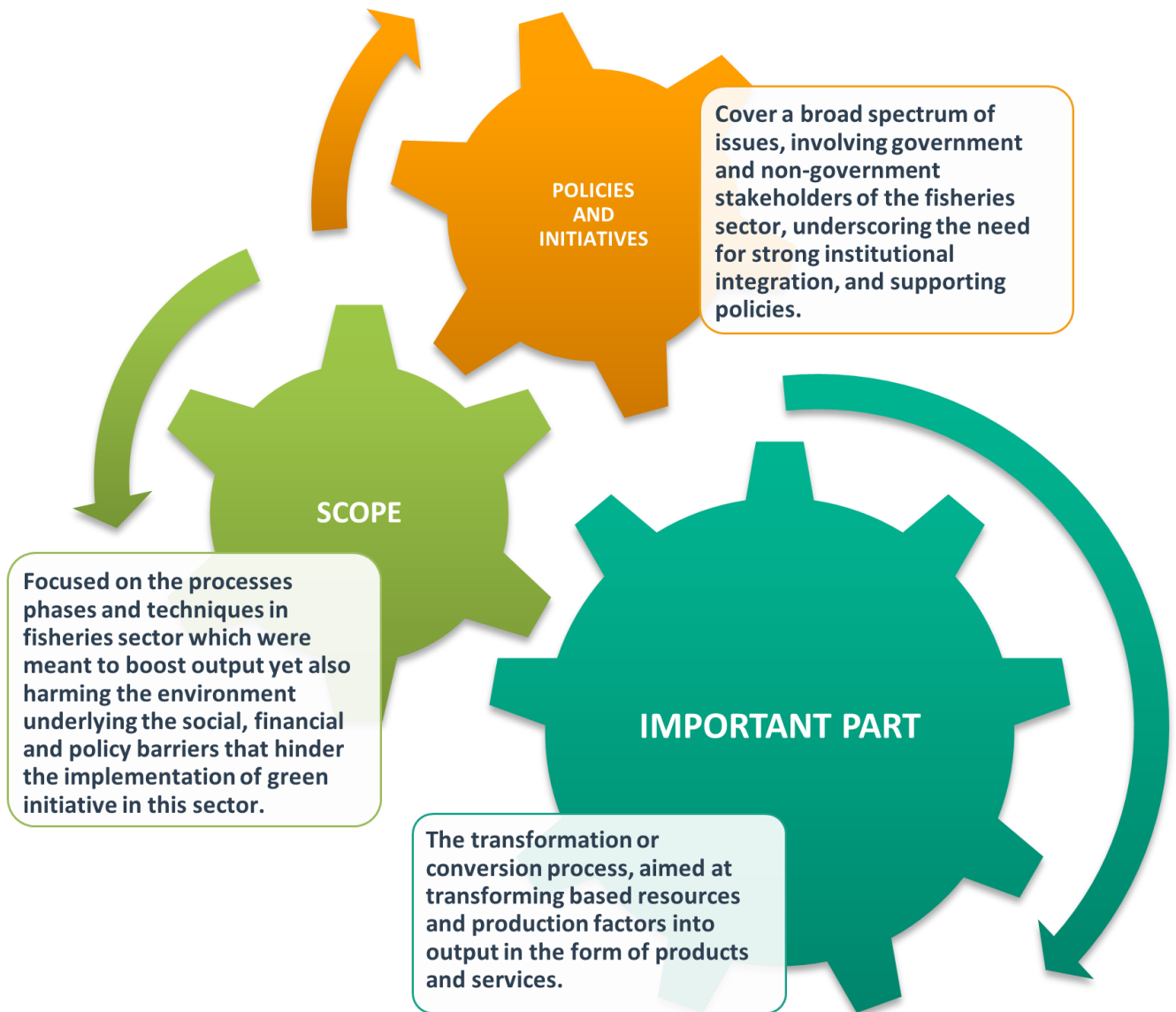
Figure 1.5 Current Green Standard and Guidelines

- This guideline also identifies the broad range of policy measures by governments to promote and facilitate the greening of fisheries industries.
- There are advantages of committing towards a green agricultural practice and these guidelines aim to help fisheries stakeholders in making better decisions towards the goal of green fisheries.



Figure 1.6 The Objectives of the Green Fisheries Industry Guidelines

1.4 Scope and Applicability/Application



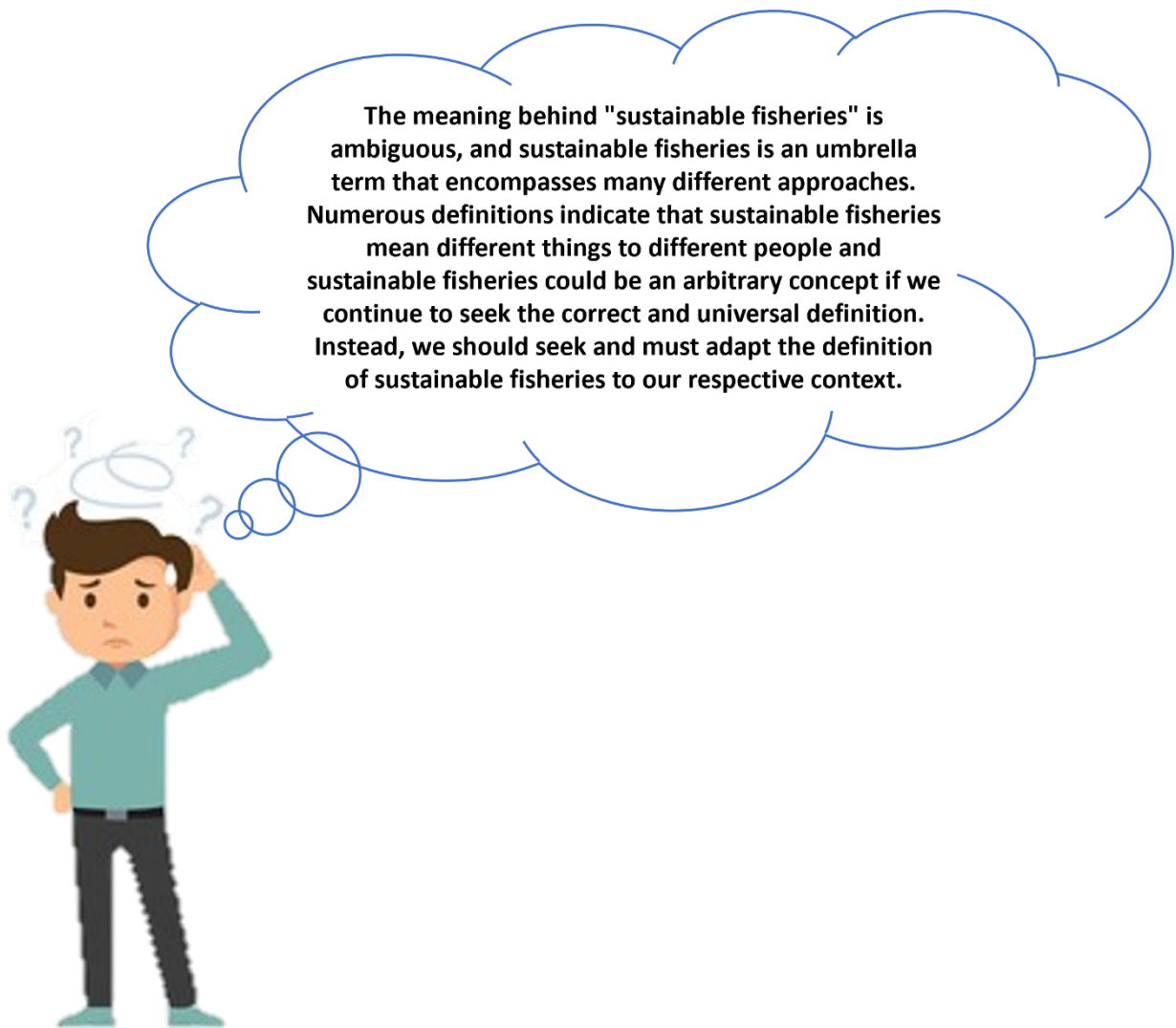
During this transformation, the input factors are subjected to a change of conditions. For initiating and maintaining the transformation process, some means of production must be available. Production resources include but are not limited to labour and machinery, for example. Often these resources will only be available on a limited scale, imposing restrictions on the capacity of the transformation process.



OPERATIONAL DEFINITION AND TERMINOLOGIES

2.1 Definition of Green Fisheries

Intensive modernizations are among the major challenges that any sector, including fisheries must identify, meet, and balance, beyond which unsustainable trends caused by fisheries technologies would lead to tipping-point phenomena. Only those activities that meet the established threshold criteria while advancing the nation towards food security would be considered viable forms of Green Fisheries.



Definitions of green and sustainable resource management in fisheries are generally concerned with the need for fisheries practices to be economically viable, to meet human needs for food, to be environmentally benign or positive and to be concerned with quality of life. A green fisheries system that can overcome the barriers of a rapidly changing world require attributes that constitute the defining elements of a sustainable fisheries.

The 'green revolution' is a well-known term for the period between the 1930s and the 1960s and refers to the high number of technology transfers to agricultural production, including high yielding varieties of cereals, artificial fertilisers, agrochemicals, and various new cultivation practices (Bochtis, 2019).

According to UNEP (2011), a green economy is one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. Green practices promote sustainable patterns of production and consumption i.e., patterns that are resource and energy efficient, low-carbon and low waste, non-polluting and safe and which produce products that are responsibly managed throughout their lifecycle (UNIDO, 2011).

The Green practices agenda covers the greening of industries, under which all industries continuously improve their resource productivity and environmental performance. It also aims to create green industries that deliver environmental goods and services in an industrial manner, including, for example, waste management and recycling services, renewable energy technologies, and environmental analytical and advisory services.

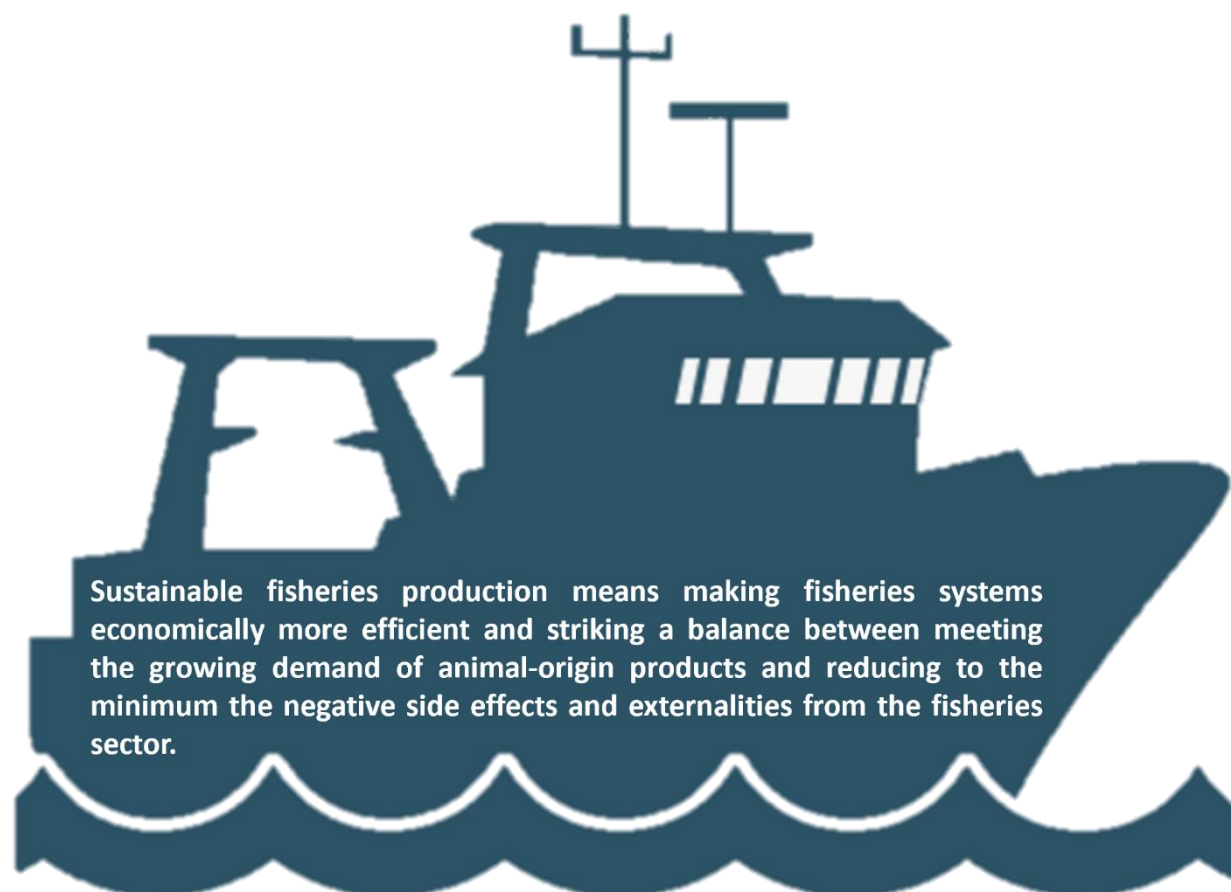


Figure 2.1 The Definition of Sustainable Fisheries

In order to be optimal, fisheries systems need to promote advancements in the technological and infrastructural aspects of the sector and, at the same time, institutions and experts should support the progression of knowledge with policies that define and shape sustainable fisheries development from a social, economic, and environmental perspective.

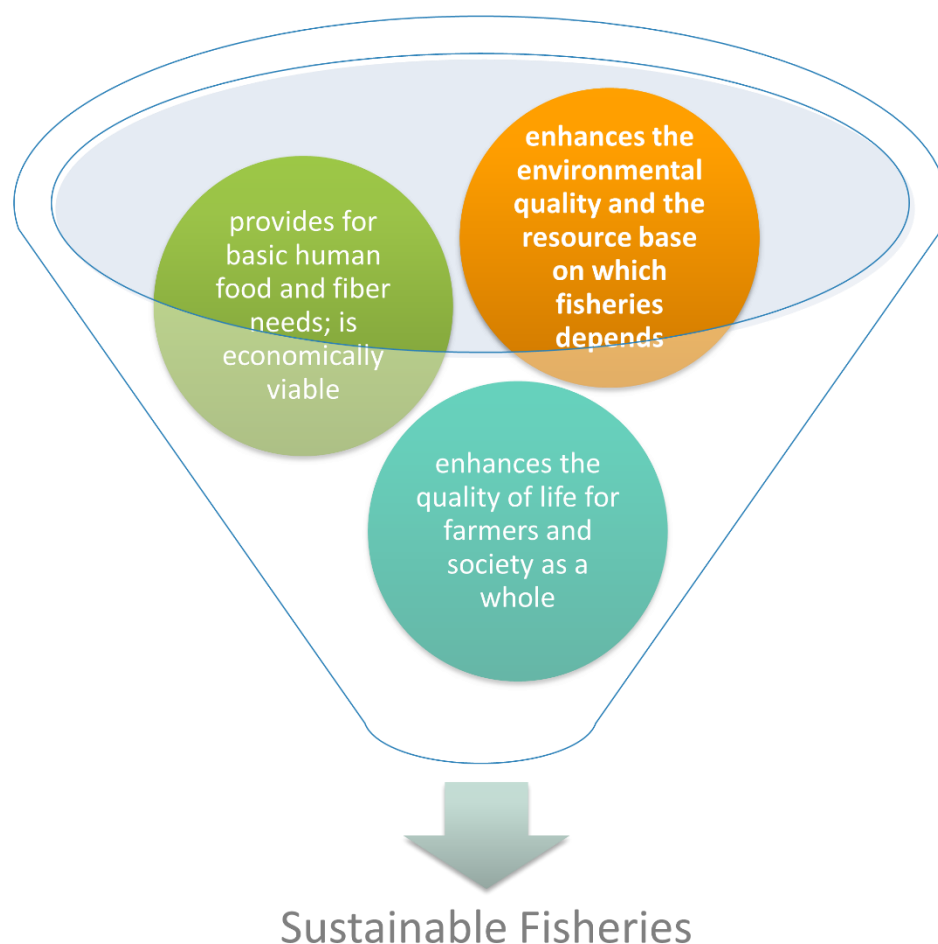
Sustainable agriculture as defined by United States Food, Agriculture, Conservation and Trade Act is an integrated system of plant and animal production practices having a site-specific application that will, over the long term produce the following:



The American Society of Agronomy has developed the following definition of sustainable agriculture, according to Francis and Youngberg (1990):

*"A **sustainable agriculture** is one that, over the long term, enhances the environmental quality and the resource base on which agriculture depends; provides for basic human food and fibre needs; is economically viable; and enhances the quality of life for farmers and society as a whole"*

Another definition of sustainable agriculture is "the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the natural resources-based and avoiding environmental degradation as proposed Consultative Group of International Agricultural Research (1988).



2.2 Categories

This guideline focuses on operational aspects of the fisheries sector. However, the challenges raised might be relevant for other agricultural and cutting across different ministry level administration in Malaysia. Emphasis is placed on practices which impact green and sustainable production rather than consumption, although we acknowledged that the two concepts are inextricably linked.

Fisheries sector is classified as a sub-sector under the agriculture sector, where the other sub-sectors include livestock, forestry, and crops.

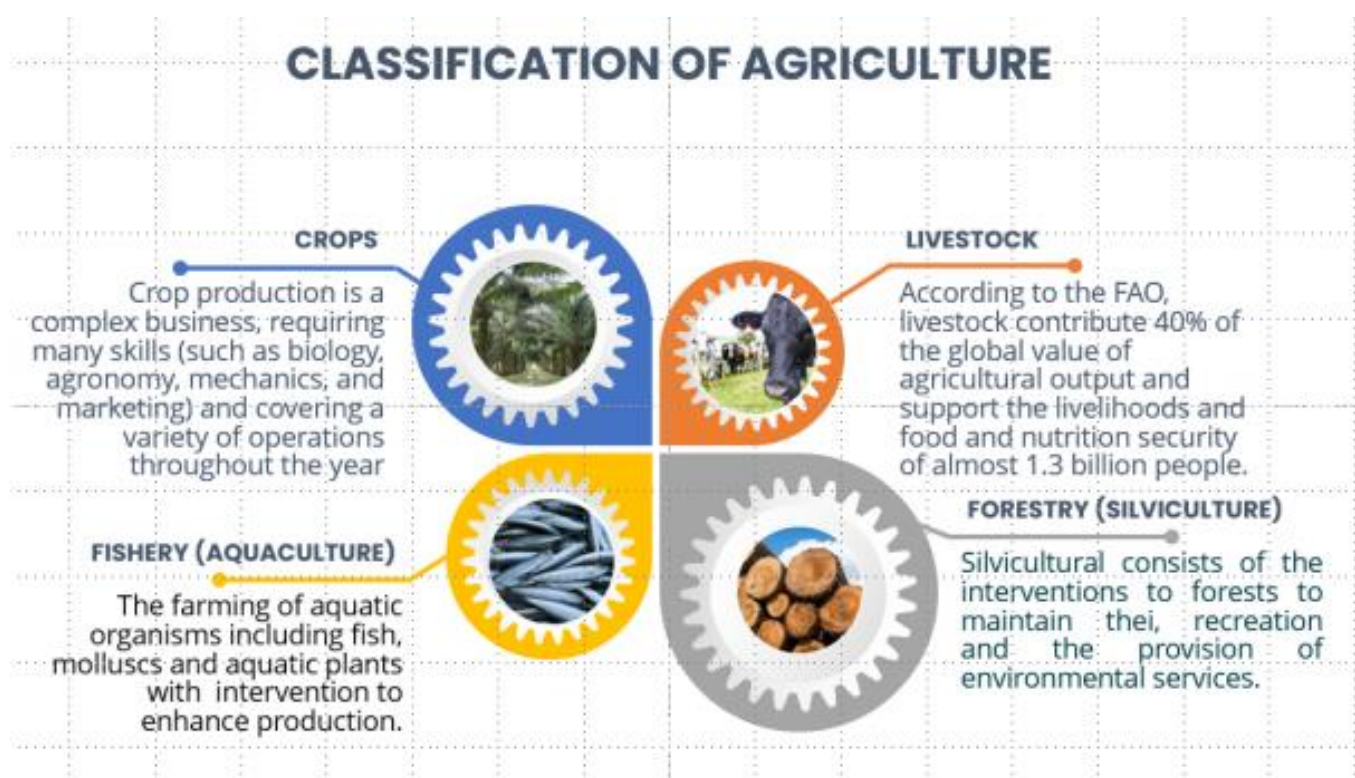


Figure 2.2. Classification of Agriculture showing Crops, Livestock, Fishery and Forestry

- Fisheries sector can be divided into three categories: inland fisheries, capture fisheries and aquaculture. **Inland fisheries** refer to activities carried out to catch fish and other aquatic organisms from 'inland waters' (creeks, dams, canals, river). **Capture fisheries** refers to harvesting of naturally occurring living resources in both marine and freshwater environment. **Aquaculture** refers to the process of nurturing freshwater, brackish water, or saltwater organisms in a controlled aquatic environment.
- Total fisheries production of Southeast Asia region in 2017 indicates that the largest portion of the production volume was derived from aquaculture accounts approximately 54.8% followed by marine capture fisheries at about 38.1% and inland capture fisheries at 7.1% (Figure 2.3).
- Malaysia's National Agrofood Policy, 2021-2030 (NAP2.0) targets aquaculture production (excluding seaweeds) to increase two-folds, from 217,957 to 486,610 metric tonnes by 2030, representing 40% of the total fisheries production from only 22% in 2020.
- Green Practice Guidelines for the fisheries sector will therefore focus exclusively on aquaculture, because of the greater prominence given to it in comparison to capture fisheries.



Figure 2.3. Percentage of the sub-sectors' contribution to Southeast Asia's fishery production in 2017

2.3 Basic Principle of Green Aquaculture Farm

Aquaculture is projected to be the prime source of seafood by 2030, as demand grows from the global middle class and wild capture fisheries approach their maximum yield. The aquaculture sector is under renewed pressure to embrace more sustainable practices to safeguard an increasingly fragile environment. Benefits of aquaculture farms can be grouped within three categories:



Environmental

Green aquaculture farms have a positive impacts on the environment (both small- and large-scale farms) by using renewable energy or supporting biodiversity, eliminating negative environmental consequences by using less water, energy, or natural resources.



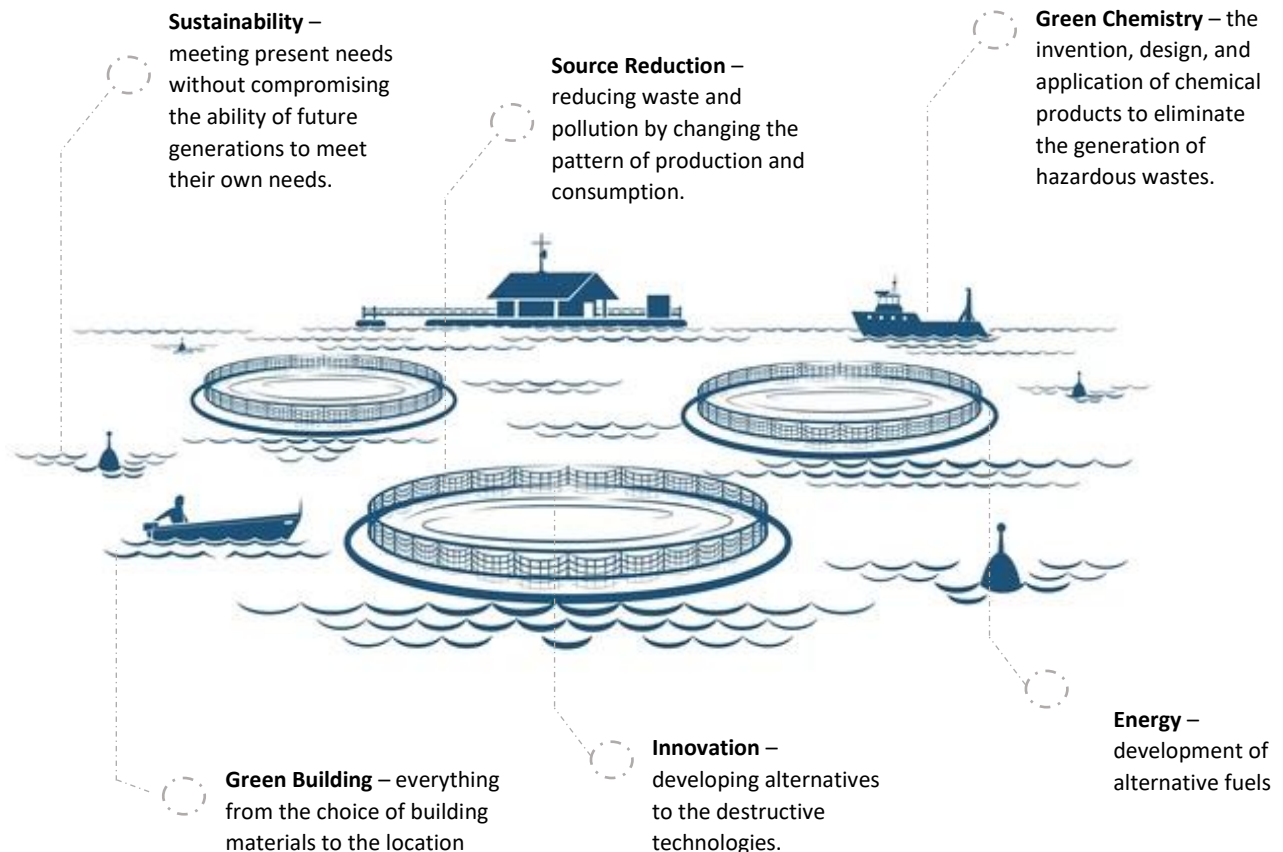
Economic

Green aquaculture farms offer several economic or financial benefits relevant to a range of different groups of people. These include cost savings on utility bills (through energy & water efficiency); lower production costs & higher productivity.



Social

Green aquaculture farms bring positive social impacts around the health and wellbeing of people who work in green farms, people who live nearby, or consume products from green farms.





GREEN PRACTICES GUIDELINE FOR FISHERIES SECTOR

Green Practice Guideline for Fisheries Sector (Aquaculture)

3.1 Introduction

- Among the key essentials of this are greater understanding and collaboration between policymakers and industry player in fisheries, greater collaboration among researchers and fisheries communities and consideration of interdependencies across whole climate-agri-food nexus.
- Fisheries management focuses on the design, planning, and operation of machine and human operations in aquaculture. Operators generally seek to reduce the risk of adopting a new practice. Green practices in fisheries sector which provide economic and other advantages will be adopted more rapidly. For this to happen, guidelines should be tailored so that green practices benefit communities while safeguarding economic returns, fish health, water quality, energy efficiency and conservation.
- Operations in aquaculture include fish stocking, feeding, water quality analysis, fish health analysis, harvesting and farm maintenance. These activities require proper planning and resource allocation to optimize returns while minimizing impact to the environment.

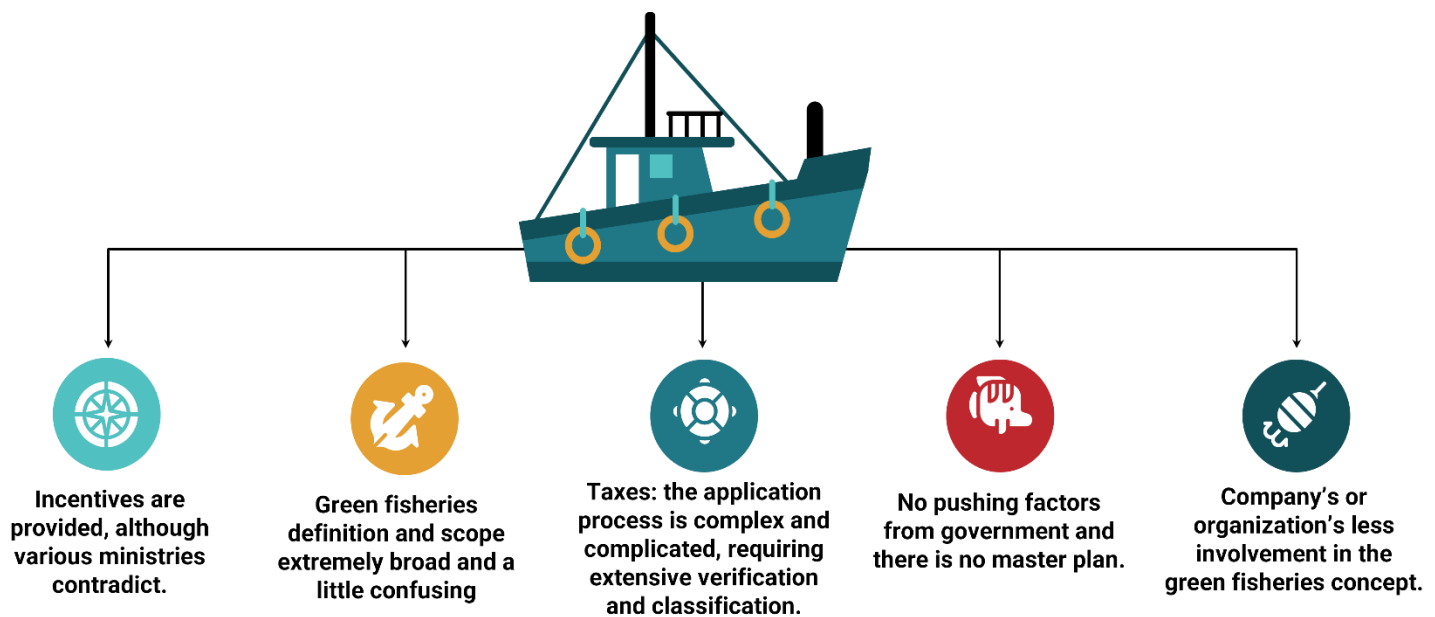


Figure 3.1. Technical Barriers

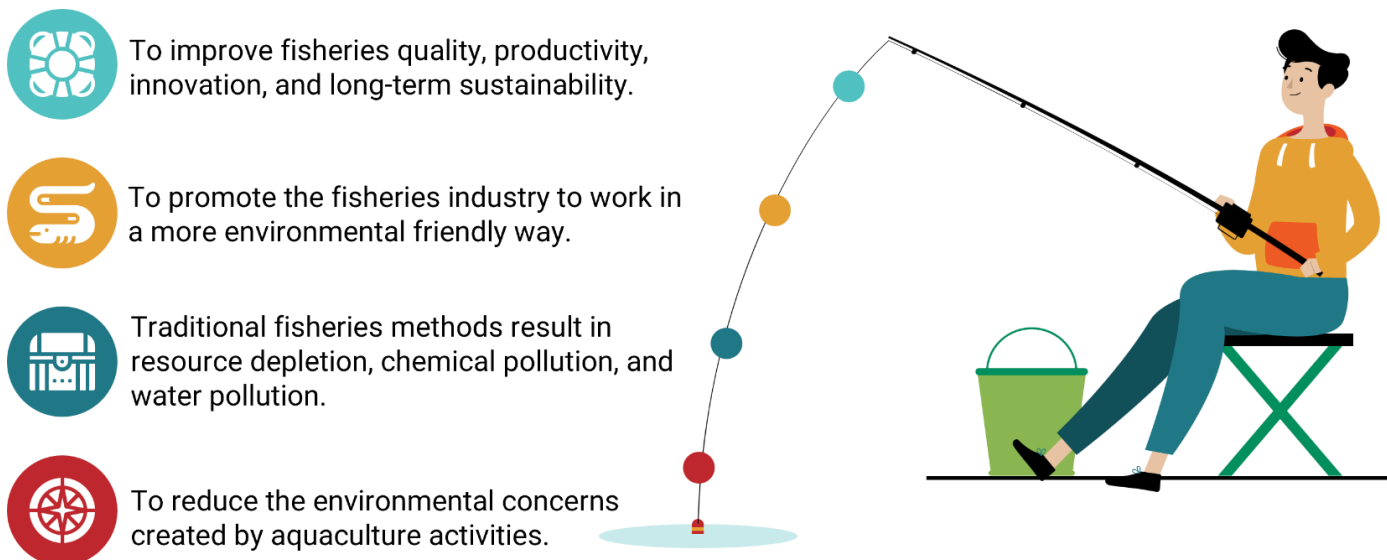
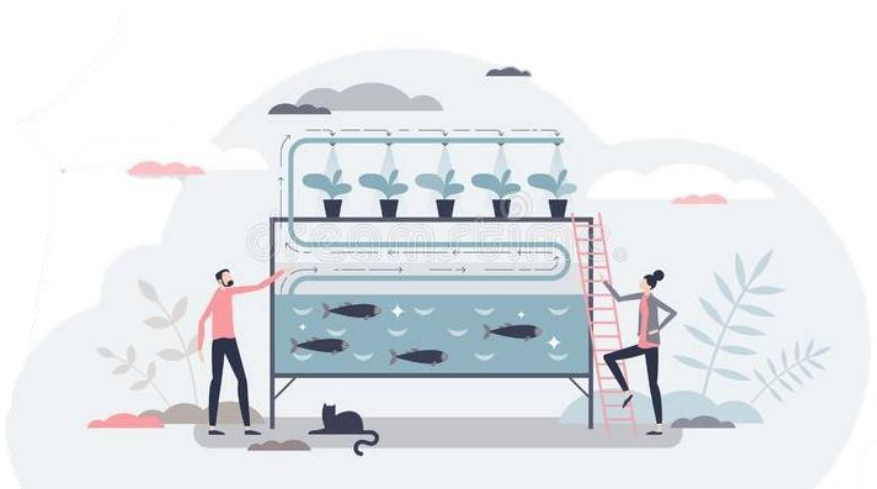


Figure 3.2. Reason for Green Fisheries Guideline

- This guideline, which focuses on the aquaculture sector, highlights the gap in knowledge on recent advances in management and operations of fisheries in Malaysia by exploring aspects on a specific topic with advanced technical approaches that have been applied in fisheries operation.
- Consultation with government officers, researchers, farmers, and other stakeholders is imperative during guideline development processes. Under normal circumstances, governments can establish multistakeholder consultative bodies or taskforces which may include representatives from the community, nongovernmental organizations (NGOs), industry and trade union.
- Indicators are instrumental to guideline development as a means of tracking progress against policy targets and to assess the effectiveness of implementation programmes.



3.2 Advantages of Green Practice Guidelines for Fisheries Sector (Aquaculture)



Generate Jobs

The creation of wealth and high-quality employment. Generate possibilities for more employment.



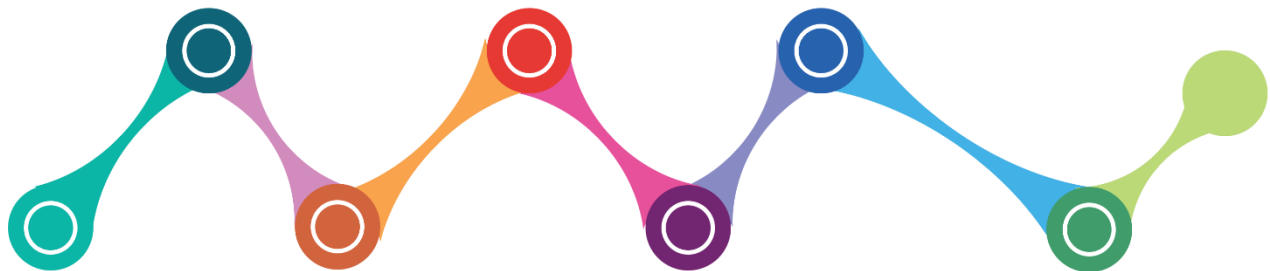
Reduce Pollution

generates less waste, minimizes energy consumption and reduces the use of chemicals that damage the ozone layer.



Cost Efficient

In the long term, using sustainable and green energy sources will lower the operational cost.



Sustainable growth and the proper organization of authorities and industry.

Sustainable Growth



Sustainable small-scale fisheries account for 66% of all catches destined directly for human consumption.

Food Security



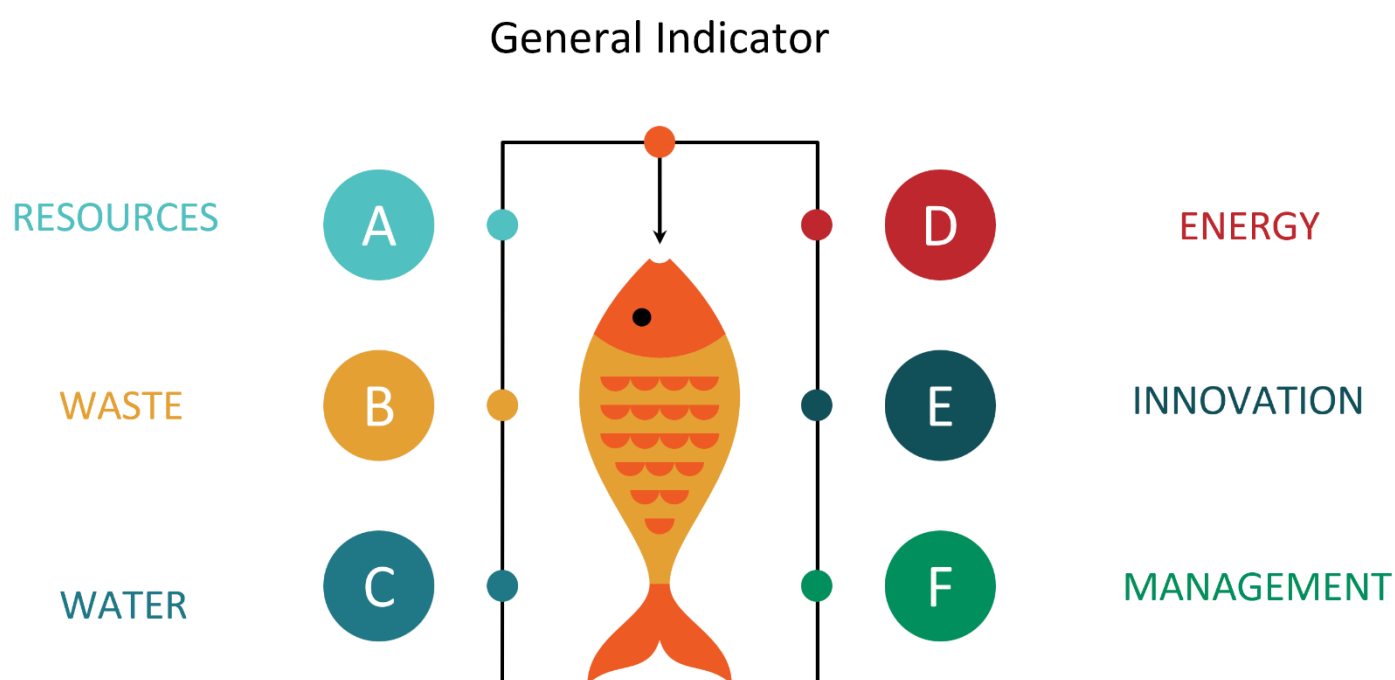
In sustainable fisheries, the bycatch is used, for example, to make fishmeal to minimize food waste.

Avoids Waste

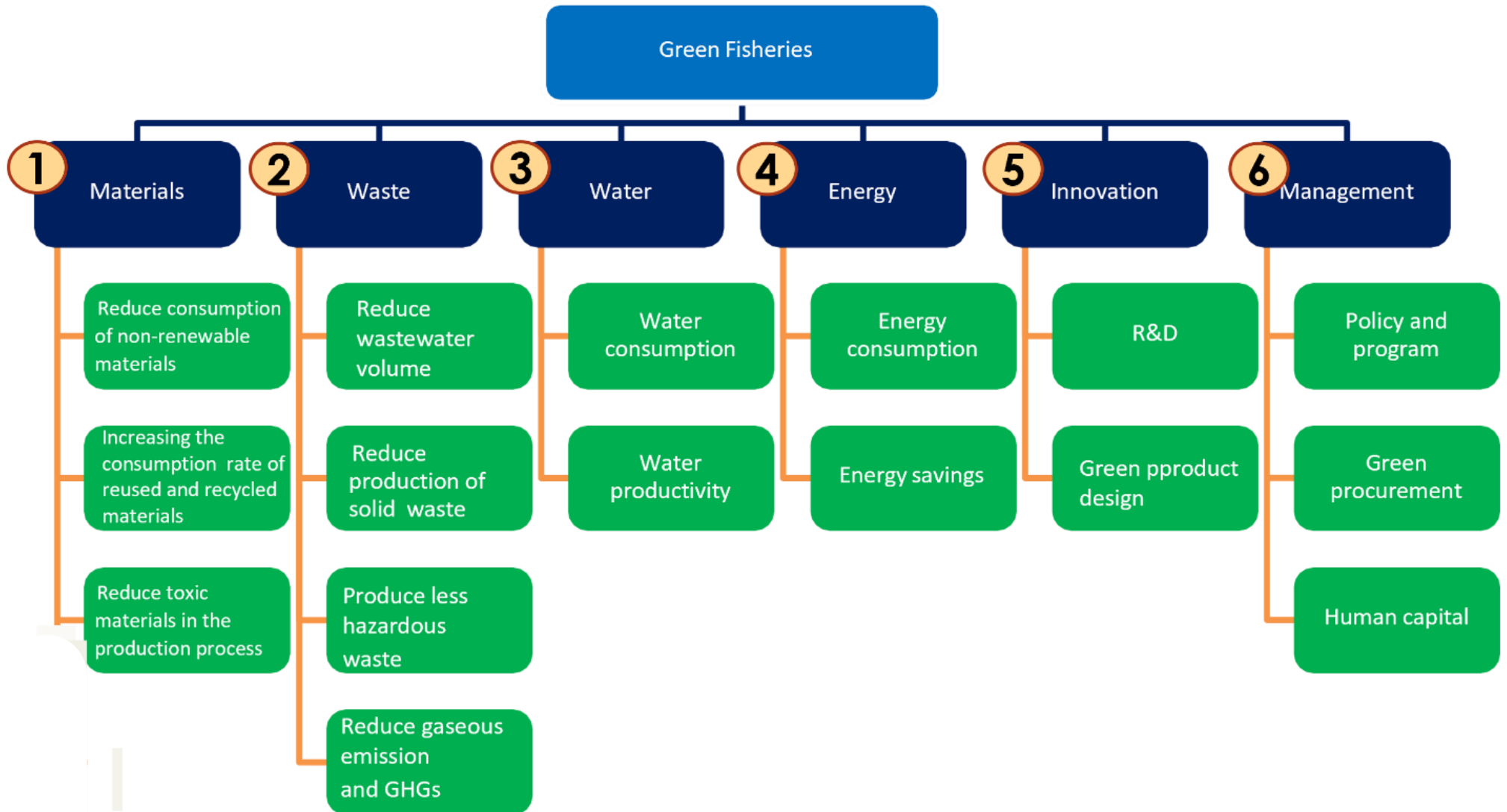


3.3 General Indicators

The indicators of green fisheries have an important influence on the greening of fisheries, providing the environment through which fisheries process changes can take place. Indicators should form part of monitoring and as a tool to simplify, quantify data and achievement. Indicators could be categorized based on the following:



Indicators and Sub-Indicators for Green Fisheries



3.2.1 Resources



Introduction

General

- Natural resources, especially those of water, wide variety of animal and plants, renewable energy sources, climate and ecosystem services are fundamental for the structure and function of aquaculture systems.
- Nature is the single largest source of subsidies for fisheries.
- Worldwide, agriculture accounts for 70 percent of human freshwater consumption. Pond aquaculture is more water intensive than most other methods of production.
- A huge amount of this water is redirected into ponds for culture purposes, and this may increase an additional 15 percent or more by 2050.
- Aquaculture is also a large polluter (water, as well as solid [uneaten food, scales, mucus] and soluble waste [dissolved nutrients]), which has negative impacts on the environment.
- Some of the negative environmental impacts of aquaculture includes nutrient build-up, and transmission of diseases.
- As aquaculture systems become more intensive, the energy efficiency of these systems decreases.

Target

- To ensure the utilized materials can generate less waste per aquaculture production cycle and the materials can be recycle so that the number of natural resources needed to produce aquaculture products through more energy and material-efficient farming processes can be reduced by 50% by 2030.

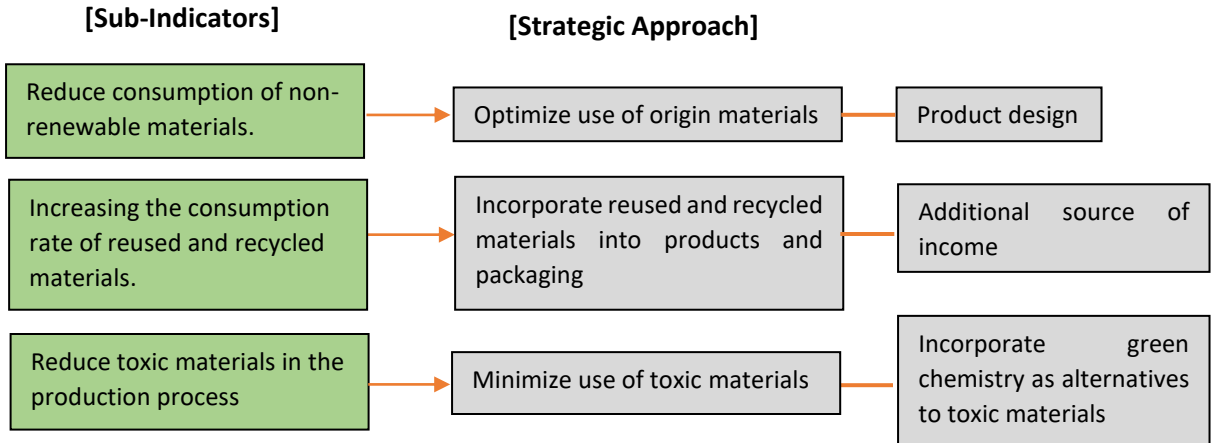
Aim and Scope

The scope is on facilitating the stakeholders to implement the sustainable initiatives and promote a shift towards sustainable aquaculture in an ecological and resource-efficient manner.

The aim is to protect and preserve the natural resources which consumed in aquaculture activities, as well as to conserve natural resources for present and future generation.

Subindicator	Area of Assessment for Resources
MRF	Materials & Resources
MRF1	Materials Reuse and Selection
	<ul style="list-style-type: none"> • Reuse resources such as water, as it is the main pillar of aquaculture system. • Reduce the consumption of natural resources and generalization of excess waste from entering natural water bodies to reduce environmental impact. • Need to account for environmental externalities in costs and prices to send the right signals to producers and consumers. • Undergoes treatments such as probiotic treatment before releasing excess used water to natural water bodies.
MRF2	Sustainable Resources
	<ul style="list-style-type: none"> • To secure fund for supporting the changing into new business processes and the research, development, and dissemination of new green technologies. • To adopt environmental financing as an instrument for promoting resource efficiency measures through financial institutions or independent funds.
	<ul style="list-style-type: none"> • Use local resources and materials that are available within the region, there by supporting the use of local resources and reducing the environmental impacts resulting from transportation.
MRF3	Green Product
	<ul style="list-style-type: none"> • Governments are using green public procurement to pursue social and environmental goals and as a means of creating demand for green products and services especially in public sector. By replicating this in aquaculture, government can shape demand for green product and services, allowing green public procurement to continue playing an important role in stimulating new market opportunities thus improving environmental practices amongst firms. • In aquaculture sector, myGAP certification acts as benchmark to indicate whether a product is considered as 'green product' or not, as myGAP certification covers every aspect in aquaculture sector, from feed production, up to exports.

OVERVIEW



EXAMPLES

Current-Flow-Powered Waterwheel to Sort Cockles



Re-purposing Feed Bags



Compliance to SOPs



3.2.2 Waste



Introduction

General

- Aquaculture industries produce a huge number of wastes every year. This waste includes sludge, nutrients run offs, excess feeds, and fish carcase.
- If these residues are released directly to the environment without proper management that may cause environmental pollution and eventually harmful effects on human health.
- Most of the aquaculture wastes are untreated, therefore in maximum reports it is disposed by discharging back into natural water bodies such as river/ocean.
- Almost 90% of aquaculture establishments in Malaysia are small and medium enterprises (SMES).

Target

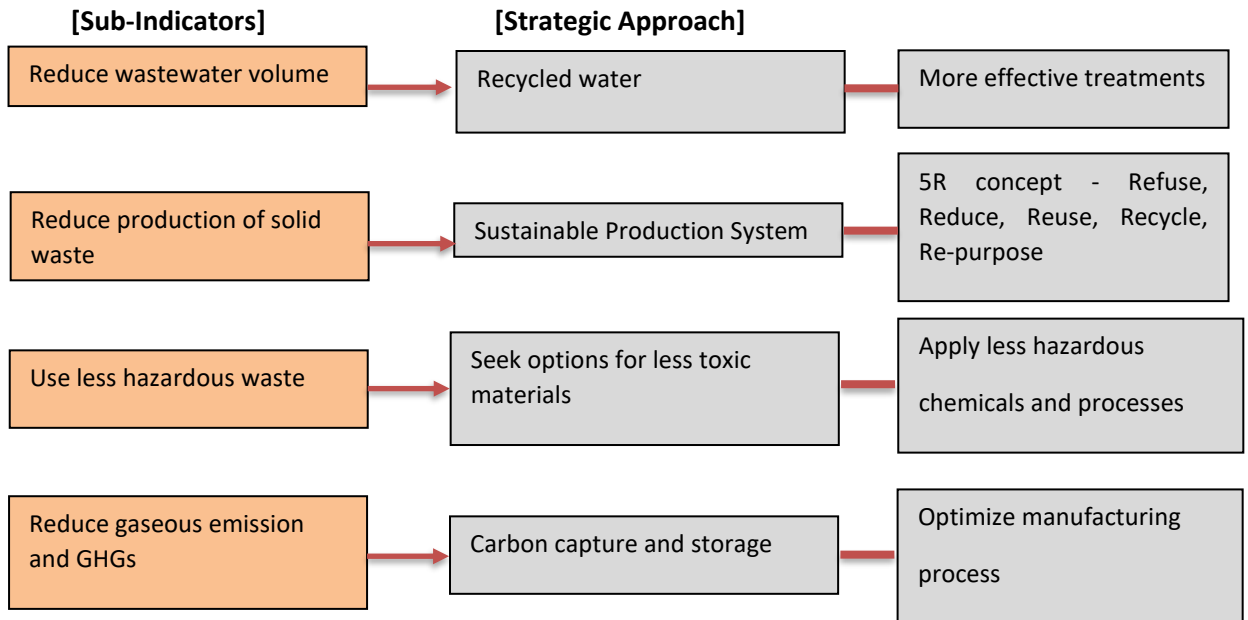
- To ensure aquaculture waste not only can be reduce, but also can minimise the environmental impacts and decrease hazardous emissions from aquaculture farming activities such as generation of gaseous emissions including greenhouse gases methane (CH₄), ammonia (NH₃) and hydrogen sulphide (H₂S), odours or any other undesirable emissions.
- The target for Waste Treatment and Disposal by 2030 is 28% of recycling rate. Apart from that, Wastewater Treatment is 100% (sludges to be recycled) and 33% treated effluent to be recycled as stated by Green Technology Master Plan Malaysia 2017-2030.

Aim and Scope

The scope is on waste generation with the aim to encourage a circular economy approach in aquaculture waste management, and to establish proper waste management practice in Malaysia.

Subindicator	Area of Assessment for Waste
WMF	Waste Management
WMF1	Waste Management Plan
	<ul style="list-style-type: none"> • Reuse: The most efficient ways to increase food availability is to reduce waste. • To adopt zero waste approach and attain circularity of economy in managing the waste. • Improperly treated wastewater discharged into water bodies has short and long terms consequences for the ecosystem and human health. • Aquaculture farms need to establish a more systematic plan on how to manage wastes before releasing into water bodies. • Check the quality of the treated waste to verify it meets the prescribed standard before being discharged.
WMF2	Circular Economy for Aquaculture Waste
	<ul style="list-style-type: none"> • Prioritise the waste management and wastewater treatment for example should be a priority for governments. • The provision of infrastructure to support the greening of industries through • Mobilising resources for waste and wastewater management remains a considerable challenge for governments, and therefore, efforts should be made to leverage financing from public-private sector partnerships, Foreign Direct Investment (FDI), and regional cooperation such as ASEAN network. • To promote responsible Life Cycle Analysis (LCA) through initiatives such as Extended Producer Responsibility. • LCA is considered as a tool used to assess the environmental impacts of products and processes in aquaculture systems. • To assess the LCA for green supply chain networks

OVERVIEW



EXAMPLES

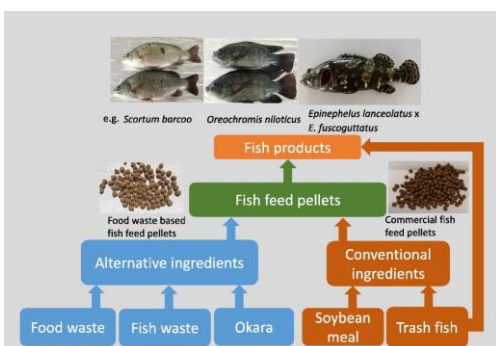
Sludge as Fertilizers



Using of cockle shells to buffer pH in biofilters



Replacing Mineral Fertilizers with Organic Fertilizers from Fermented Food Waste



SOP for Chlorination



3.2.3 Water



Introduction

General

- All types of agriculture demand water, but water is especially important for aquaculture because it is the medium in which aquatic food organisms are produced.
- Pond aquaculture usually has a greater effect on local hydrology than other types of aquacultures because water may be removed or diverted from natural water bodies for filling ponds and maintaining water levels.
- Aquaculture is a water-intensive endeavour because large amounts of water are needed to fill ponds, and water levels must be maintained throughout the grow-out period.
- Pollution from aquaculture farms negatively affects the natural environment, with iconic problems such as algal blooms and massive fish kills while the rising human population has a great demand for food and puts pressure on water resources.
- This tension between sufficient food production and environmental pressure from aquaculture activities asks for a different way of thinking: that of sustainable green fisheries to reach blue water in our lakes, rivers, and oceans.

Target

- To ensure that the water use efficiency at the farm can be improve so that the rate or re-circulation of the consumed water can be increase reuse within the and between the farms.
- The target for Water Harvesting Technology is around 60% of farm building installed with Rainwater Harvesting System as stated by Green Technology Master Plan Malaysia 2017-2030.

Aim and Scope

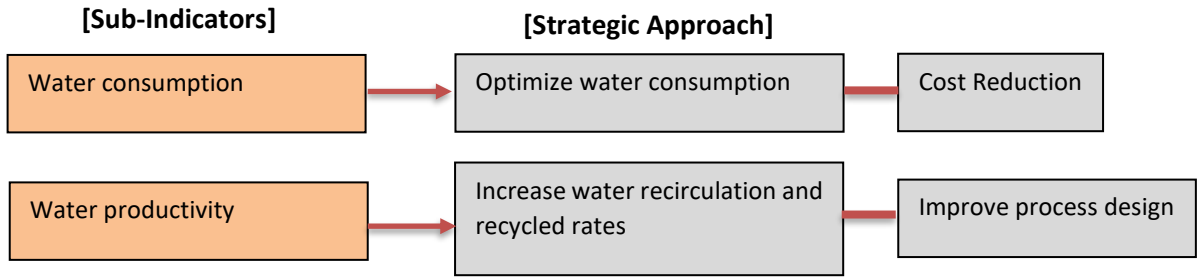
The scope is on water usage and wastage in aquaculture sites which have been identified as critical.

There is a high potential for improving water efficiency at aquaculture farms by adopting various approaches and measures.

This guideline would help developing a framework for sustainable water use at aquaculture farms.

Subindicator	Area of Assessment for Water
WEF	Water Efficiency
WEF1	Rainwater Harvesting (RWH)
	<ul style="list-style-type: none"> • Rainwater harvesting is a technique of collecting rainfall as a supplementary source of water supply. • There is a scope for improvement in optimising the RWH system making it efficient and effective. Current approaches towards water management in Malaysia are supply driven, where a new resource will be developed to manage a water shortage. • As there will be an ever-increasing demand, there is a possibility that the aquaculture industry will face a water crisis. Hence, water demand management that focuses on conservation measures utilising demand driven approaches will make better use of our limited potential water. • The government should provide support by subsidising the system and providing a 2500 L capacity storage tank. • Government initiatives to extend support by way of providing technical expertise to develop draft guidelines for adoption. • RWH can be beneficial to ecological systems and assist environmental conservation. • Encourage the design of system that does not require the use of drinking water supply from the local water authority.
WEF2	Water Reuse and Recycling
	<ul style="list-style-type: none"> • Prioritise Government initiatives that promote capability and capacity development in areas related to water such as water efficiency, water reuse, water pollution control and water recycling are very beneficial for the greening of the aquaculture sector. • Training and demonstration programs could be explored for creating the skills required to implement water-efficiency initiatives. • This is to be paired with industry partners or associations as means of promoting guidelines on water-efficient practices specific for the aquaculture sector.

OVERVIEW



EXAMPLES

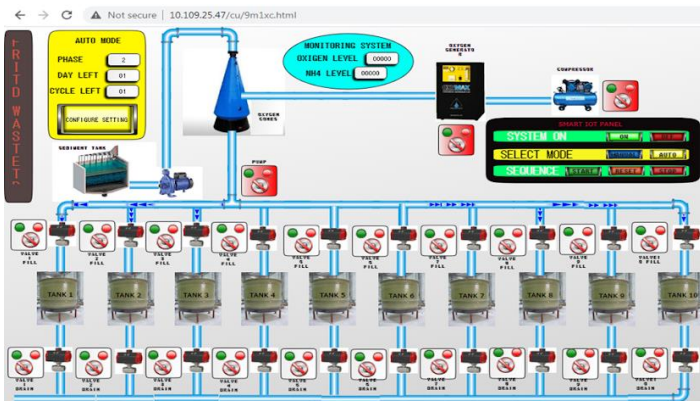
RAS (Recirculating Aquaculture System)



Biofloc



RAS Using IR 4.0



3.2.4 Energy



Introduction

General

- The input of fuels and machinery such as aeration pump, water pump, water filters, causes aquaculture to depend heavily on energy. Increasing energy costs have caused economic challenges for fisheries sectors.
- For this reason, more industry players are seeking alternative energy sources to improve their energy independent.
- This creates a continued effort to find ways to reduce inputs by applying new technologies and methods capable of reducing, for example, solar and wave energy consumption.

Target

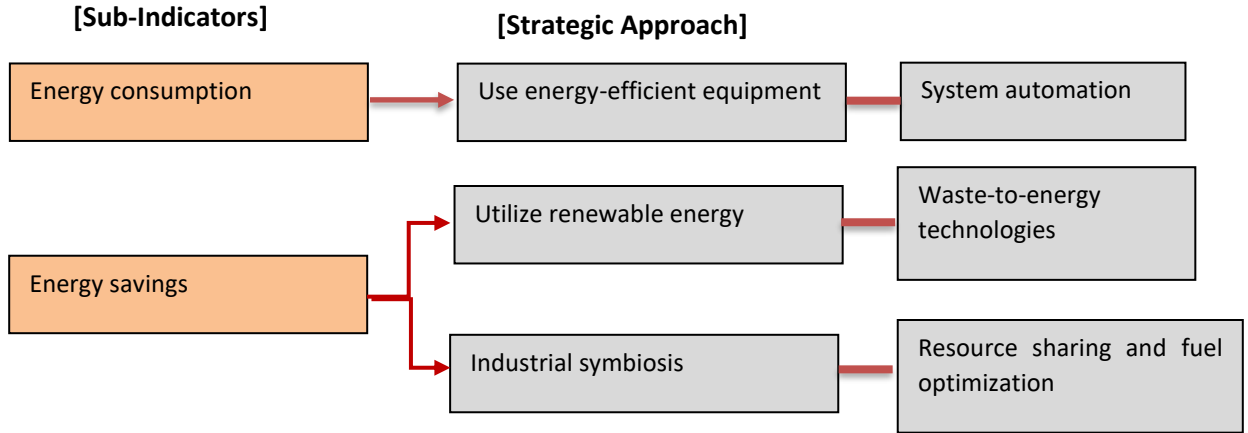
- To ensure that the intensity of energy consumption in the farm will decrease sufficiently so that even with increased production, the total energy consumption remains stable or decreases which eventually leads to sustained environmental protection and reduces the energy cost through the use of renewable energy such as solar and biogas.
- The target for the Renewable Energy by 2030 is 30% and 15% for Energy Efficiency usage as stated by Green Technology Master Plan Malaysia 2017-2030

Aim and Scope

The scope is on minimising the energy consumption, optimising energy demand as well as making aquaculture activity a low carbon sector. To reduce energy demand and enhance renewable energy capacity.

Subindicator	Area of Assessment for Energy
ENF	Energy Efficiency
ENF1	Energy Data
	<ul style="list-style-type: none"> • Compile data on the direct and indirect energy usage for measuring energy efficiency in aquaculture production systems. • Avoid sub-optimisation and incorrect recommendations on technology use in operations through data generated. • Use a dedicated tool of modelling approaches and methodologies, such as the life-cycle assessment (LCA) to assess potential environmental impacts.
ENF2	Energy Saving
	<ul style="list-style-type: none"> • Adopt energy saving measures and energy producing facilities that use renewable sources such as wind, solar, and others to reduce energy costs. • Use renewable energy for providing additional income for stakeholders.
ENF3	Renewable Energy
	<ul style="list-style-type: none"> • Non-renewable fossil fuels like oil and gas leave a carbon footprint on the world, and regulatory authorities are constantly tightening emission controls. • Adopt the usage of renewable energy such as solar and biomass energy. • Increase the usage of renewable energy to reduce dependence on fossil fuel energy sources. • Improve the energy mixture to include renewable energy sources

OVERVIEW

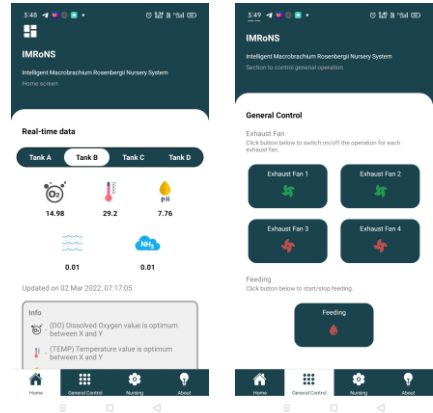


EXAMPLES

Solar Application in Aquaculture



Real-Time Water Quality Monitoring



RaFAS

Rain Fed Aquaponics System RaFAS
 Hanan bin Mohd Yusof & Tazri Amil bin Shafie
 Bahagian Pervelidikan Perikanan Air Tawar, FRI Glami Lemi, Jabatan Perikanan Malaysia

LATAR BELAKANG & MASALAH SEBELUM INOVASI

Kos operasi RAS & akuafonik konvensional mahal -termasuk air	Sumber air sistem konvensional perlu dirawat dahulu	RAS konvensional hanya hasilkan satu produk (ikan) sahaja	Akuafonik konvensional - tidak ekonomik & praktikal di kawasan pulau

OBJEKTIF : Mengurangkan kos operasi dan mempelbagaikan hasil dari sistem kitaran semula akuakultur (RAS) konvensional menggunakan sumber air hujan ke atas sistem RAS secara akuaponik.

Improving Cockle Breeding from Power Station Cooling Water



3.2.5 Innovation



Introduction

General

- Added to the problem of low productivity especially in smallholder aquaculture farming is the fact that the global population is estimated to reach almost ten billion people by 2050.
- The capacity of the aquaculture industry to provide adequate supplies for food, and non-food uses in an environmentally sound manner depends in large part on technology and innovation.
- More exposure to international fisheries markets will facilitate the sharing of technologies and innovations supportive of green fisheries.
- Technological innovation can improve the environmental performance of fisheries systems through innovations in engineering, information technology and biotechnology.
- Newer technologies can reduce the load of known toxins in fisheries production, substitute safer alternatives, protect ground, or surface waters, conserve natural habitats, reduce nutrient loads in soil/ water.
- These innovations imply changing current aquaculture farm practices and using different technologies to enhance resource productivity and ecoefficiency.

Target

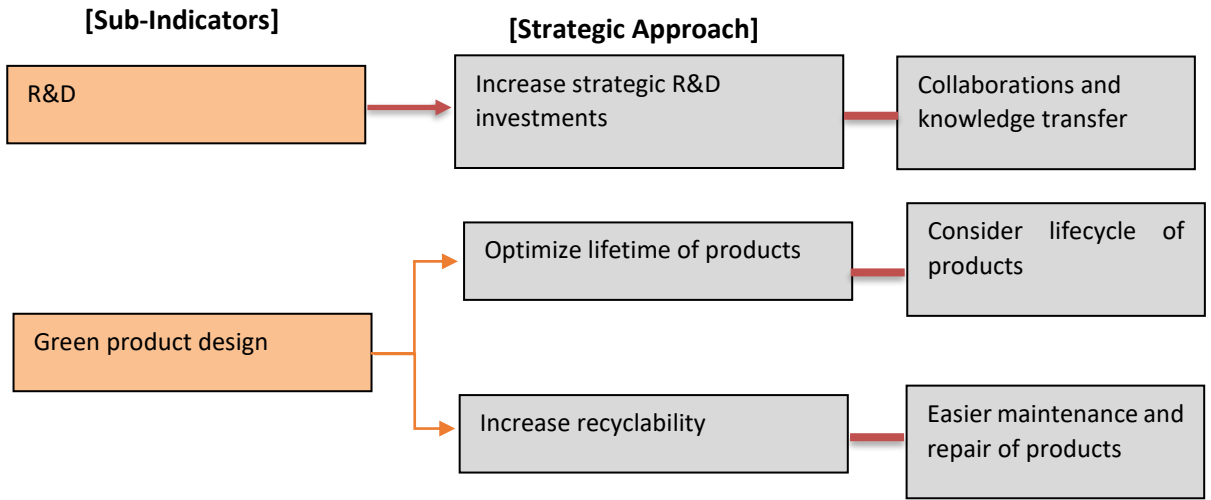
- To ensure the support, recognize and advocate green innovations and sustainable practices within the conventional aquaculture production processes and operations. This includes efforts and financial commitments in research and development (R&D) and product design that supports green practices and products by more than 50% by 2030.

Aim and Scope

The scope is to supports and fiscal incentives to green innovation, activities, businesses, and jobs. Innovations in the aquaculture sector have increased the incomes of small farming enterprises, boosted employment, and improved the regional food supply especially in the rural regions.

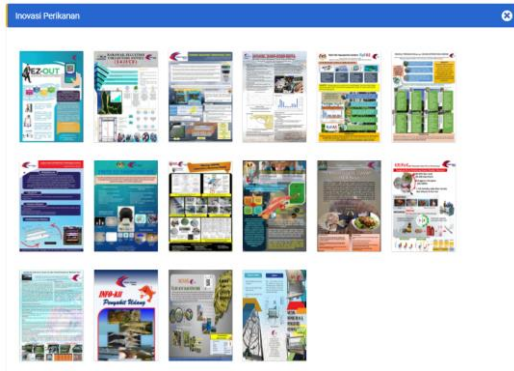
Subindicator	Area of Assessment for Innovation
INF	Innovation Cross-compliance
INF1	Innovation on Cross-Compliance Mechanism
	<ul style="list-style-type: none"> • Implement environmental cross-compliance mechanisms. • Require aquaculture farmers to adopt good environmental practices or resource management programs to receive government support.
INF2	Support for Innovation
	<ul style="list-style-type: none"> • Supports or incentives aquaculture farmers to manage their supply of commodities, influence their cost, supplement the income of producers, and achieve other social and environmental aims. • Measure the level of innovation along the product value chain. • Adopt Good Agricultural Practices (GAP) and to include cost-effective and optimized water, nutrient, waste & disease management. • Set up a model or demonstration farm for organic and healthy animals. • Improve processing, storage, and distribution for optimized post-harvest handling.
INF3	Extension of Innovation
	<ul style="list-style-type: none"> • Setting up aquaculture farmers organizations. • Adopt Smart Aquaculture Farming technology for real time monitoring of the operations.

OVERVIEW



EXAMPLES

DOF Innovation



Solar-powered Cockle Sorter



Hydro-powered Cockles Sorter and Using Cockle Shells as Biofilters



3.2.6 Fisheries Management



Introduction

General

- The management aspect of green fisheries produces an environmentally friendly economic growth by advancing a comprehensive strategy which is flexible enough to be tailored to differing sub sector circumstances and stages of development.
- A primary conceptual management paradigm is the need to transform production and consumption patterns from resource intensive processes to eco-efficient and low-carbon trajectories.
- In fisheries, the management policy for green fisheries consists primarily of a mix of policy, regulations, support and research and development (R&D) directed to enhancing environmentally friendly aquaculture farming.
- The option of a policy instrument depends on the economic, environmental, and social objectives to be achieved and the fisheries sector to be addressed taking into consideration the political economy in which the instrument will operate.
- In the longer-term, environmental regulations and standards raise fisheries improving productivity and eco-efficiency through cleaner production processes and enhanced resource management techniques.

Target

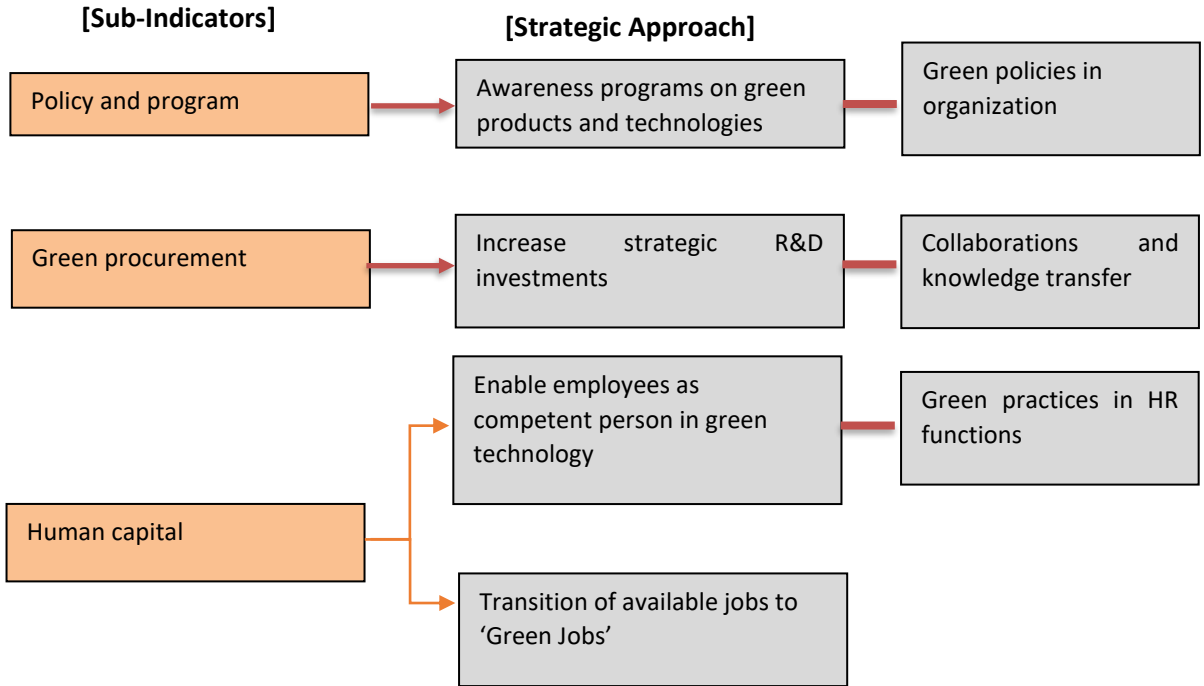
- To ensure the adoption and improve of good animal husbandry practices, sustainable and responsible resources consumption, strengthening the economy as well as promoting research and development at the farm management. For example, embedding green policies, practices, and systems that stimulate the creation and availability of green jobs within the organization to be achieved by more than 50% by 2030.

Aim and Scope

The scope for management is to encourage adoption of good aquaculture practices, sustainable and responsible consumption, strengthening the economy as well as promoting research and development.

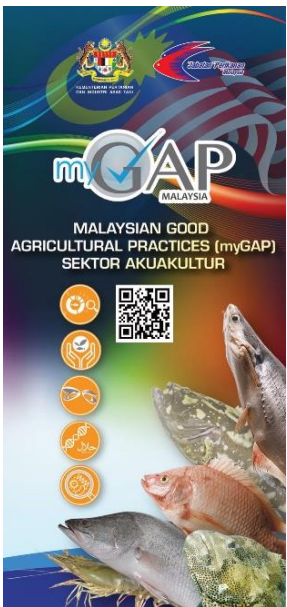
Subindicator	Area of Assessment for Management
MAF	Regulation and Standards
MAF1	Strengthen Rules and Standards for Natural Resources Management
	<ul style="list-style-type: none"> • Controls the excessive use of chemicals or probiotics in aquaculture farms. • Adapt regulations on specific farming systems with consideration on the nature of local environment as a one-size-fits-all requirement may be neither environmentally effective nor economically efficient.
MAF2	Improve Enforcement of Environmental Regulations
	<ul style="list-style-type: none"> • Increase the support for environmentally friendly practices. • Adopt different types of incentives namely, market and non-market, regulatory measures, and cross-compliance measures. • Adherence to basic environmental standards or maintaining land in good condition would be eligible for incentives.
MAF3	Economic Instruments and Trade Measures
	<ul style="list-style-type: none"> • Impose charges on excess use of environmentally damaging inputs. • Implement trading schemes for water rights. • Lower tariff and non-tariff barriers to fisheries trade. • Apply for reduced export subsidies to fisheries products. • Increase spending for green growth initiatives. • Raise profile of green aquaculture practices in national poverty reduction initiatives.
	Research and Development
	<ul style="list-style-type: none"> • Increase research and innovation initiatives on green aquaculture management and technologies. • Promote fisheries R&D through grants offering and resources (laboratories, human resource) collaboration. • Undertake public/private partnerships for green fisheries research

OVERVIEW



EXAMPLES

myGAP



Kaedah Perikanan Darat



MyHIJAU Label



Transition to Green Jobs





MALYSIAN GOOD AGRICULTURAL PRACTICES (myGAP) - SEKTOR AKUAKULTUR

Pengenalan

- 2004** Pengenalan Skim Pensijilan Ladang Akuakultur Malaysia (SPLAM).
- 2013** Penjenamaan semula SPLAM kepada Malaysian Good Agricultural Practice (myGAP) bagi Sektor Akuakultur.
- myGAP** myGAP Sektor Akuakultur merangkumi sistem:



Kolam



Sangkar



Tangki



Hatceri



Rumpai Laut



Ikan Hiasan

Objektif

Bermatlamatkan penghasilan produk akuakultur yang selamat dimakan dan berkualiti serta dikeluarkan tanpa memberi kesan memudaratkan terhadap persekitaran, kebajikan haiwan dan mematuhi keperluan keselamatan dan kesihatan pekerjaan.

Kriteria Pematuhan Pensijilan myGAP Sektor Akuakultur:

- | | | |
|---|---|---|
| Pemilihan Tapak | Pengurusan Air | Bekalan Bahan Mentah (Aditif, Benih) |
| Kawalan Air Buangan | Amalan Kebersihan Ladang | Pelabelan, Penyimpanan dan Penggunaan Sebatian Berbahaya |
| Pembinaan Ladang | Pembajaan Kolam | Pengurusan Kesihatan Ternakan |
| Kebersihan dan Keadaan Permukaan Bersentuh | Sosial dan Kebajikan Pekerja | Penyimpanan Rekod Ladang |
| Reka bentuk Kolam / Sangkar | Kawalan Pemangsa dan Makhhluk Perosak | Kawalan Biosekuriti Ladang |
| Kesihatan Pekerjaan | Penuaian dan Pengendalian Hasil Ladang | Halal |

Program Pemantauan Rasmi Ladang Dipersijilkan myGAP



Program Pemantauan Residu Akuakultur (Aquaculture Residue Monitoring Plan (ARMP))



Program Sanitari dan Fitosanitari Akuakultur (Sanitary and Phytosanitary (SPS) Programme for Aquaculture)



Program Sanitasi Kerang-kerangan Kebangsaan (National Shellfish Sanitation Programme (NSSP))



Pemantauan Kehadiran DNA Babi (DNA Porcine Monitoring)



Program Survalen Penyakit Ikan Kebangsaan (National Fish Disease Surveillance Programme (NFOSP))

Standard dan Garis Panduan Rujukan

- Code of Conduct for Responsible Fisheries- FAO (<http://www.fao.org/fishery/code/en>)
- ASEAN Good Aquaculture Practices (ASEAN GaaP)
- Malaysian Standard (MS 1998: 2017) Good Aquaculture Practice (GaaP)-Aquaculture Farm General Guidelines
- Malaysian Standard (MS 2467:2012) Code of Practice for Seaweed Cultivation



MyHIJAU Mark

‘MyHIJAU Mark’ is Malaysia’s official green recognition scheme endorsed by the Government of Malaysia, bringing together certified products and services that meet local and international environmental standards under one single mark.



MyGAP

A certification scheme designed by the Department of Agriculture in 2002 to give recognition to farms that practice APB with an environmentally friendly concept, taking care of the welfare and safety of workers to produce quality, safe and edible products.







Kaedah Perikanan Darat

This method must be applied to people who carry out aquaculture activities in relation to land fisheries in aquaculture premises for commercial purposes in the Federal Territory of Kuala Lumpur and the Federal Territory of Labuan.

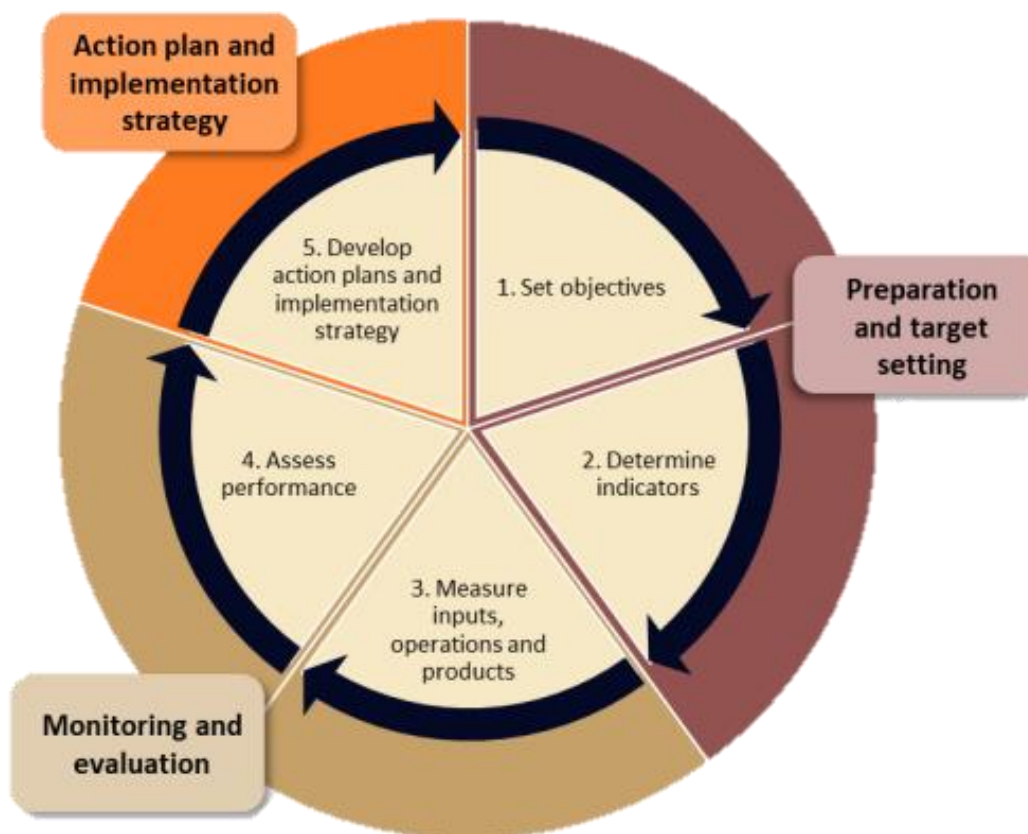


3.3 Sector-specific Indicators

Specific Indicators	Justification
<p>Resources</p> 	<ul style="list-style-type: none"> • Science and technology play a vital role in encouraging fisheries' sector transformation towards green or sustainable production and growth. • The use of autonomous machines and robotic technologies to further advance agricultural systems' productivity and increase efficiency due to the automation and information technologies. • Specific indicators for fisheries are the use of local and improved fish breed to enhance genetic diversity and enhance adaptation to changing environmental conditions • Avoidance of unnecessary use of chemical that adversely impact on the environment and on human health. • Government assistance programmes could be utilised to expediate both the absorption and diffusion of green technologies for sustaining technological advancements. • This could also be achieved through technology transfer, capacity development, demonstration projects, technical assistance programmes and the establishment of Centres of Excellence
<p>Energy</p> 	<ul style="list-style-type: none"> • Based on the survey, securing fisheries production methods with maximum net energy productivity, and minimized environmental impact is a key issue. • This could be achieved through automation and control technologies and information and communication technologies (ICTs) such as wireless networks, global positioning systems (GPS) and geographic information systems for improvements in productivity, and advance operation management via remote sensing, data mining, and analytics. • A renewable energy source may provide a cost-effective option for the electrification of remote rural communities.
<p>Water</p> 	<ul style="list-style-type: none"> • Enabling environment and capacities to manage movement of water both physical and virtual. Basin authorities with ability to enforce water allocations and to convene stakeholders. • Physical movement of water can occur through changes in initial allocations of surface and groundwater resources mainly from the agricultural to urban, environmental, and industrial users. • Water can also move virtually as the production of water intensive food, goods, and services is concentrated in water abundant localities and is traded to water scarce localities. • Improvement in the efficiency of water use. Improvements in the main system (off-farm) with appropriate incentives for on-farm investments aiming to improve water management. The use of advanced technologies to improve efficiency and productivity of water.
<p>Waste</p> 	<ul style="list-style-type: none"> • Specific for fisheries sector is the waste in the form of dissolved nutrients, scales, and leftover fish food. Water containing nutrients can be used in fertigation or aquaponic system as alternatives for fertilizers. This can maximise the production (ex, fish, and vegetables) while solving the waste issue.

3.4 Implementation and Action Plan

- The figure below illustrates five main steps that are highlighted in the green fisheries process. “Preparation and target setting”, as well as “Monitoring and Evaluation”, are the two key stages of these five activities. An Action plan and Implementation Strategy will precede for the final stages.



3.4.1 Preparation and Target Performance

- An integrated and strategic approach is needed to support the greening of fisheries, which includes compromise between environmental and economy. Targeted implementation of this guidelines using methods used in other type of industries and adopted to the unique working environment and domain is suggested while guideline targeting the greening of industry should comprise a mix of market-based, regulatory, voluntary, and information-based indicators.
- No single guideline can effectively promote the greening of industries. Thus, there is a need to ensure that we have an optimal mix of indicators in place, which are supported by national green strategies and policies.
- Guidelines designed need to be adopted and implemented by stages yet targeting across all relevant sectors in agriculture. Furthermore, guidelines mixes should be flexible and broad-based, and should not overlap in their application.
- Adoption of recommended green and sustainable practices depends largely on whether stakeholders think they are profitable. Reluctance to change is frequently mentioned by change agents in fisheries sector.

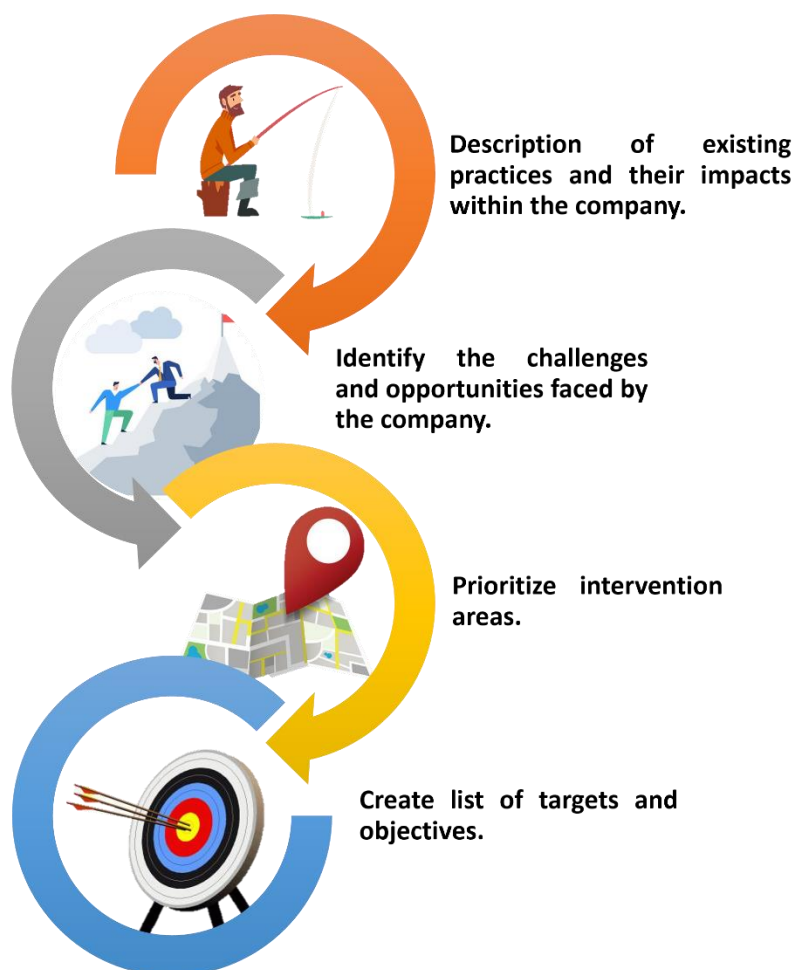


Figure 3.3. Recommended Procedure to Set Targets and Objectives

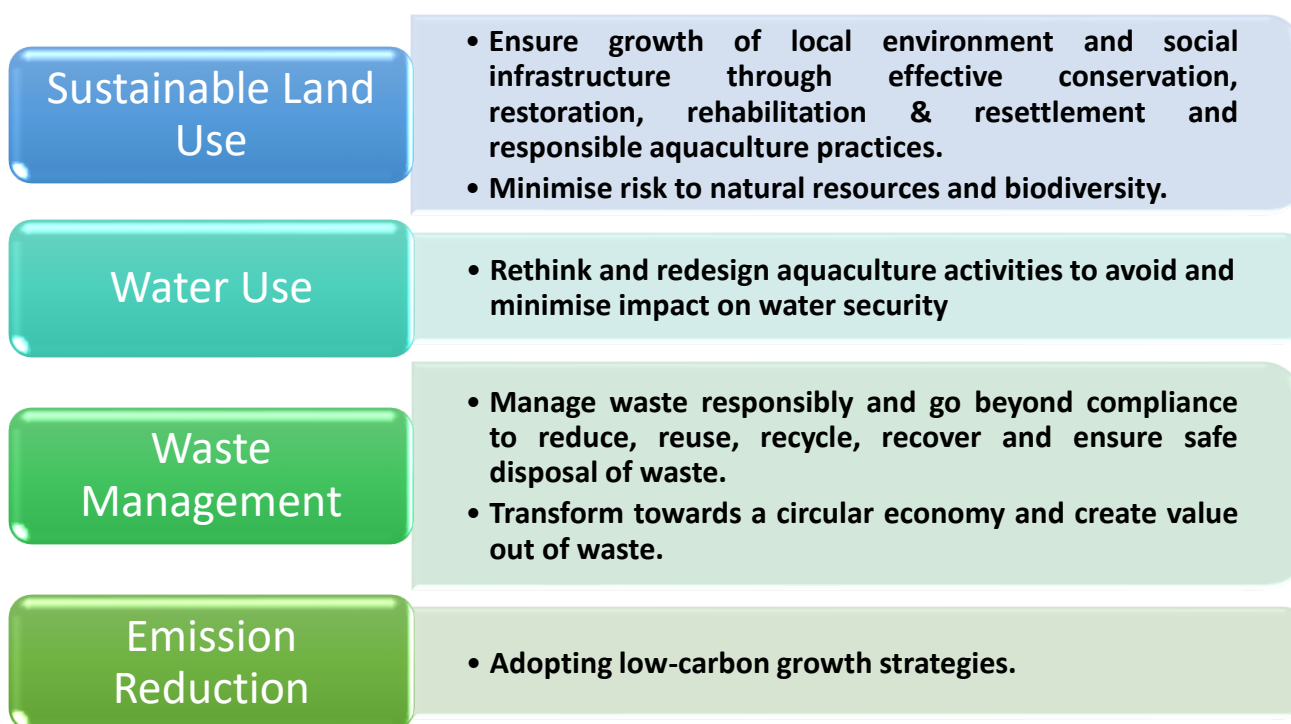
- However, this needs to be differentiated from just as a way of blaming farmers for non-adoption than explaining the often-tangible reasons for their attitude. Availability of support infrastructure is among the significant impediments to adoption of green initiatives.
- Thus, strategies such as improved management of the existing green information, fisheries specific economic support programs and fisheries extension efforts need to be addressed by change agents themselves to help overcome some of the barriers identified.
- Voluntary adoption of guidelines can be a useful tool for raising industry awareness while lowering administrative and enforcement costs on both sides. However, it is generally accepted that voluntary is most useful when used in combination with other instruments such as economy and policy. Information-based instruments (e.g., ecolabelling, public disclosure) can therefore strengthen the effectiveness of this guidelines.



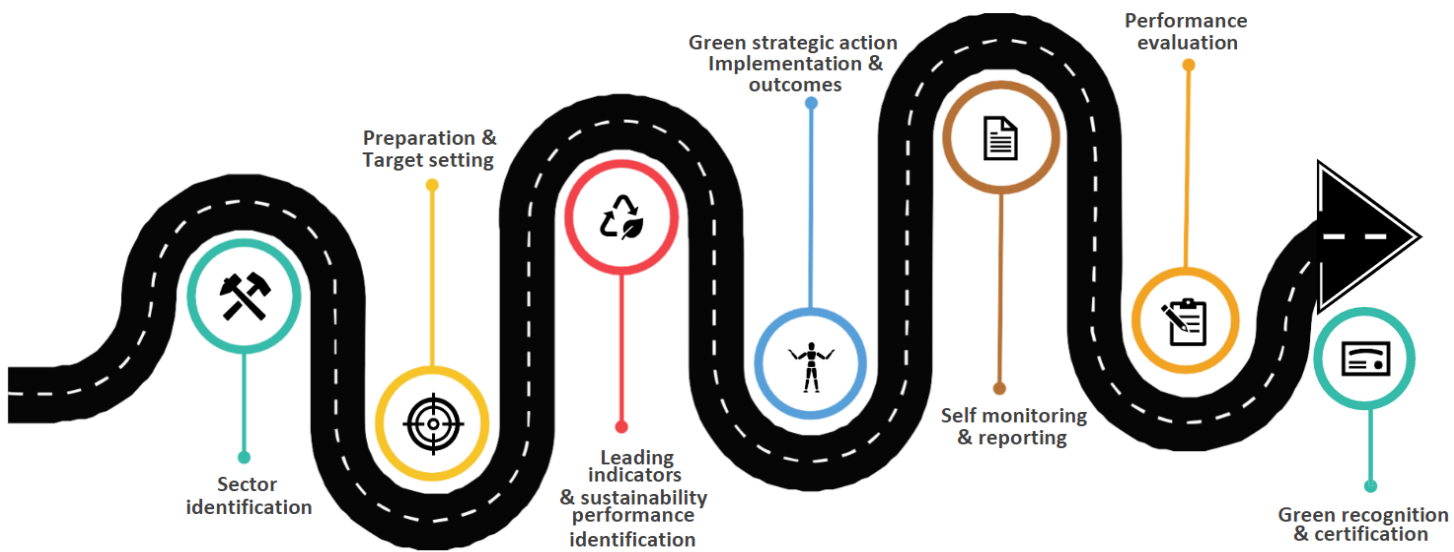
3.4.2 Monitoring and Evaluation

- Monitoring and reporting systems should be established to identify areas for improvement and to assess whether guidelines have been well received and effective over the long-term.
- Evidence shows that incentives that promote economic benefits are more likely to lead to the adoption of better practices in the short term, especially if they are voluntary. In the long term, however, positive outcomes for the farm or the environment are prime motivators.

3.5 Framework



3.6 Roadmap Towards Green Certification



- Despite having support in terms of government policies and technical assistance, aquaculture farmers rarely adopt green practices.
- Aquaculture farmers often struggle to obtain accurate information about the benefits of green practices.

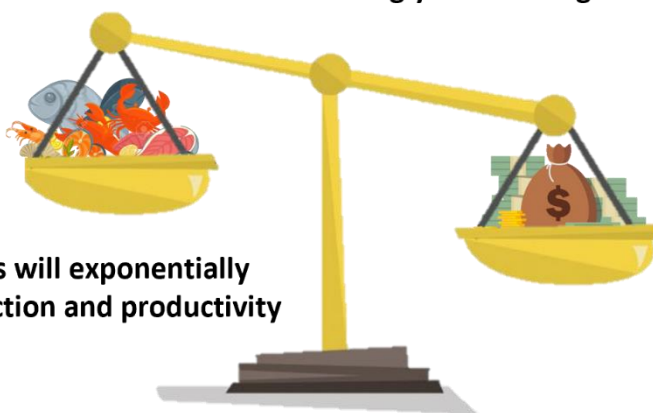


- Governments should consider Market-Based Instruments (MBIS) such as taxes, charges, tradable permits as least-cost guidelines, yet spur technological innovations.
- Successful implementation of guidelines requires a system of monitoring.
- Guidelines should be flexible and well-designed so as not to stifle technological innovations among fisheries industries.
- Government support programs need to encourage adoption despite the lack of funding, inappropriate design, and ineffective targeting of incentives



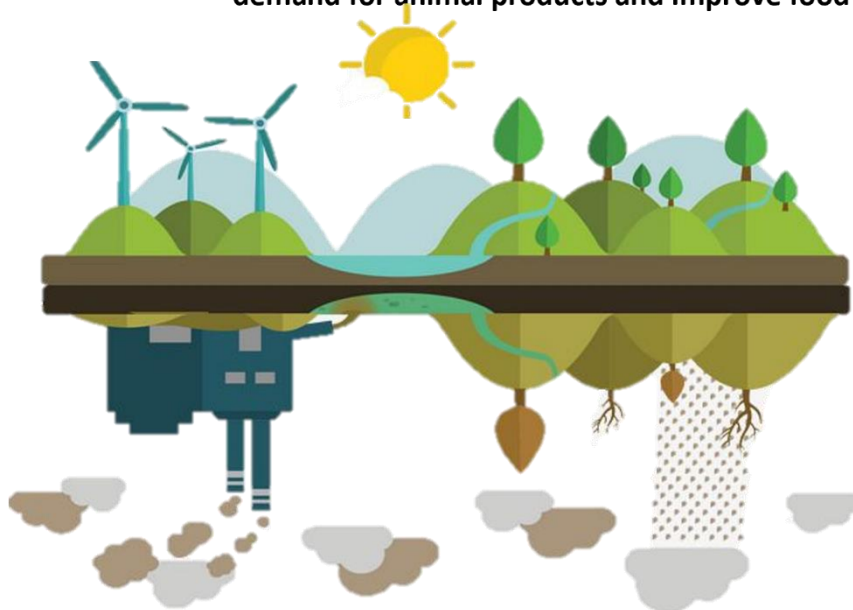
01 Malaysia will grow and transform tremendously in the next three decades. Its population will increase from 32.9 million today to over 40.7 million in 2050, and the continent will experience sustained development

02 A growing, progressively more affluent, and urbanized Malaysian population will increasingly demand high-value foods,



03 As a response, farmers will exponentially increase fisheries production and productivity

04 The future growth and transformation of the Malaysian fisheries sector will be unprecedented. It will contribute to meet the consumers' demand for animal products and improve food security and nutrition



05 However, it might also generate negative effects on society: outbreaks of zoonotic diseases, such as influenzas and animal food borne diseases, can be disruptive; inappropriate production practices can pollute and degrade water, and air; small farmers might be forced to exit the fisheries sector, with negative impacts on their livelihoods.



CONCLUSION

4.1 CONCLUSION

The Malaysian fisheries sector plays an essential role in ensuring food security, supplying food and resources in high demand. Aquaculture, in particular, is expected to become more important in the future. Currently, the industry is providing job opportunities to more than one million people. With the dedication of all stakeholders, continuous efforts to reinforce the achievement and assure the success of the green practices supported by sustainable development implementation can be realised. Therefore, it is hoped that this guideline serves as a beneficial approach to where the country could move into the future development of sustainable and green fisheries.



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