



Green Practices Guideline for Livestock Sector

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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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Acknowledgement

The team wishes to express our appreciation to all stakeholders who have provided feedback and comments to the draft versions of this document.

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Abbreviation

AI – Artificial Intelligent

DAN 2.0 - Dasar Agromakanan Negara

EM – Effective Microorganism

ENE – Energy Efficiency

FDI – Foreign Direct Investment

GAHP - Good Animal Husbandry Practices

GDP – Gross Domestic Product

GHGs – Green House Gases

GPS - Global Positioning Systems

INN – Innovation

SSL – Self-Sufficiency Level

KK – Kedah-Kelantan

LCA – Life Cycle Analysis

MAN – Management

MBIS – Market-Based Instruments

MyGAP – Malaysian Good Agricultural Practices

NGO – Non-Government Organization

OECD - Organization for Economic Co-operation and Development

RE –Renewable Energy

RWH – Rainwater Harvesting

R&D – Research and Development

UNEP - United Nations Environment Program



Terminology

Livestock Industry – Comprise of domesticated ruminants and non-ruminants.

Ruminants – Sectors that consist of beef and dairy cattle, sheep and goats.

Non-ruminant – Sub-sector such as poultry (broilers and eggs) and swine productions.





PREFACE

Demand for animal-source foods in low- and middle-income countries more than quadrupled from 1970 to 2012 and population growth, urbanisation, income gains and globalisation continue to fuel this “livestock revolution”. Though growth has slowed, demand is still predicted to increase by 35 percent from 2012 levels by 2030, and 50 percent by 2050.

While livestock systems support the livelihoods of millions of people and contribute to healthy diets and resilience, the rapid growth in production and trade has increased risks as well as opportunities. Of particular concern are threats to human and animal health, animal welfare and the environment.

Strong policies and guidelines are needed in the livestock sector to optimise its contribution to achieving many sustainable development objectives.

This guideline works towards sustainable livestock by strengthening the knowledge and evidence base of producers and others; developing tools, methodologies, and protocols; piloting and assessing policy options and facilitating intergovernmental and multi stakeholder dialogue.

To promote sustainable livestock, teamwork from governments, the private sector, research organisations, civil society, community groups, other intergovernmental organisations, and donors.



- Livestock provides valuable nutritional benefits as well as supporting livelihoods and the resilience of families and communities. Demand for animal products continues to grow in response to rising population and increasing wealth, especially in low- and middle-income countries. In spite of productivity gains, greenhouse gas emissions from livestock are also increasing.
- Successful action on climate crisis through practical action in livestock agriculture food systems is an urgent priority, but must not come at the expense of other sustainability objectives, particularly those relating to hunger and poverty. Hence there is a need to balance the benefits of animal-source foods and livestock keeping for nutrition, health and livelihoods, with the urgent need to reduce greenhouse gas emissions to tackle the climate crisis, which also threatens food security.
- The following five practical actions can be widely implemented for measurable and rapid impacts on livestock emissions:

01**Boosting efficiency of livestock production and resource use****02****Intensifying recycling efforts and minimizing losses for a circular bio-economy****03****Capitalizing on nature-based solutions to ramp-up carbon offsets****04****Striving for healthy and sustainable diets****05****Developing policy measures to drive change**

This brief describes how these can be implemented in integrative and sustainable ways, taking into account the diversity of livestock systems and enhancing synergies and managing trade-offs with other sustainable development objectives.

PART I: INTRODUCTION OF LIVESTOCK INDUSTRY





1.1 Background

- Malaysia's livestock industry is an important and one of the fundamental industries in the country's agricultural development. It provides sustainable and lucrative employment, supplying the domestic requirements of meat, milk, and dairy products to the population.
- The important role of livestock in developing the economies was shown by the increase in rural households' food security and the establishment of large-scale agricultural development activities targeted at the poor.
- The livestock productivity has soared due to new technologies, mechanization, specialization, and government intervention that favored maximizing output and reducing input cost. These changes have allowed livestock farmers to produce more food and output at lower prices. The development of the industry will ensure food security in the country and reduce dependency on meat imports.
- In 2020, the livestock sector accounts for about 16.1% of the total agricultural gross domestic product (GDP). The poultry sub-sector is a major contributor to livestock GDP with a rate at 98.9% whereas the ruminant sub-sector contributes the least at 0.40%. Figure 1.1 shows the contribution.
- Looking at the livestock sub-sector, the number of livestock particularly cattle, goats and chicken has been increasing except for buffaloes, sheep, and swine. Although the livestock population showed an increase, the production has decreased except for poultry meat, chicken/ duck egg as well as fresh milk. The decline in some commodities was also attributed to the lack of demand by restaurants, eateries and hotels that were not operating or having restrictions in operations due to COVID-19 pandemic.



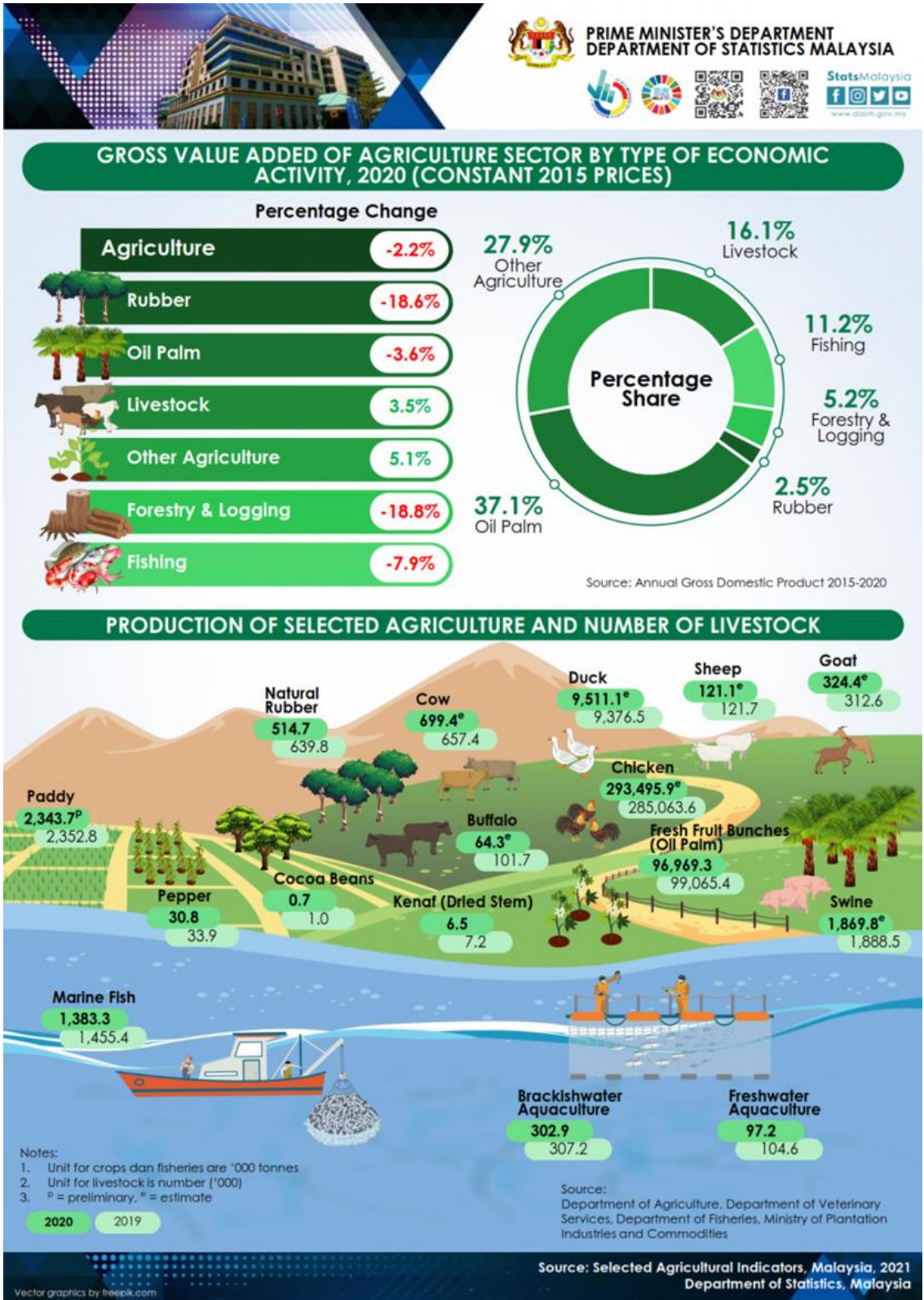
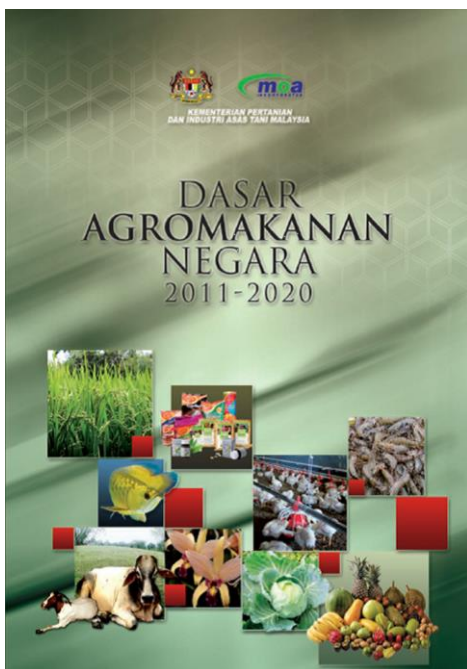


Figure 1.1. Malaysia GDP for 2020 shows the percentage share by kind of economic activity.



- The government has announced the new National Agrofood Policy 2.0 (Dasar Agromakanan Negara DAN 2.0) 2021-2030 to continue the DAN 1.0 which has been placed and implemented from 2011-2020.
- DAN 2.0, has listed 5 policy objectives and 5 policy thrusts in order to improve the national food security agenda. The 5 objectives are;
 - i. higher income and good quality of life for food producers,
 - ii. higher production with quality harvest through increased productivity,
 - iii. agile and resilient value chains with high value-added activities,
 - iv. economic, social and spatial inclusiveness for food producers,
 - v. sustainable consumption and production fully embraced.
- The 5 policy thrusts to accomplish the objectives are;
 - i. embrace modernization and smart agriculture,
 - ii. strengthen the domestic market and create/produce demand-driven and exports oriented products,
 - iii. build talents that meet the demand of the industry,
 - iv. advance towards sustainable agriculture practices and inclusivity, and
 - v. create a conducive business ecosystem and robust institutional framework.








DAN 1.0



DAN 2.0

MALAYSIAN LIVESTOCK INDUSTRY 2020

				SSL
	763,674 NO. OF CATTLE /BUFFALOES	41,378.8 MT BEEF PRODUCTION	199,478.1 MT BEEF CONSUMPTION	20.74%
	449,029 NO. OF SHEEP/ GOATS	3,916.8 MT MUTTON PRODUCTION	41,693.3 MT MUTTON CONSUMPTION	9.39%
	30,581 NO. OF DAIRY CATTLE	41.8 M Litre MILK PRODUCTION	65.1 M litre MILK CONSUMPTION	64.19%
	303,006,946 NO. OF POULTRY	1,702.8 ('000 MT) POULTRY MEAT PRODUCTION	1,638.3 ('000 MT) POULTRY MEAT CONSUMPTION	103.94%
	1,869,772 NO. OF SWINE	220,586.4 MT PORK PRODUCTION	234,204.3 MT PORK CONSUMPTION	94.19%

DVS,2021

- The self-sufficiency level for beef production in 2020 is 20.74%. Total beef production recorded 41,378.8 million metric tons (mt) in 2020 which brings a value of RM 1,489.14 million (ex-farm value) and the consumption of beef/buffalo meat by the population of Malaysia is 199,478.1 metric tons.
- In the small ruminant industry (sheep and goats), the SSL is much lower than the large ruminant industry which are 9.39%. With 449, 029 number of heads, total mutton can be produced is around 3916.8 mt.
- For dairy industry, the production of milk generated around 41.8 million liter which brings a value of RM 104.44 million. The SSL for dairy production is currently around 64.19%.
- Unlike ruminant industry, the non-ruminant industry (poultry and swine) is more productive and established. In poultry, it has achieved the SSL% (103.94%) and has brings a value of RM 11,841.91 million to this industry.
- In swine industry, the pork production is around 220,586.4 mt and the consumption by the non-Muslim population of Malaysia (40% non-Muslim) is 234,204.3 mt. The swine production has generated a value of RM 4091.02 million to the country.



Basically, there are many issues and challenges faced by the livestock industry such as diseases, supply chains, environmental and policies; to name a few. These three factors below are considered as the main issue;

1) Lack of quality breeds



- In general, the size of local cattle and goats are small and produce low meat. The major breeds of beef cattle in Malaysia are Kedah-Kelantan (KK), and Brahman Crosses. The KK cattle are the most important indigenous cattle in Malaysia. A small-sized breeds ranging between 300 - 312 kg for adult male, and from 219 - 240 kg for female. In comparison, the mature weight of Brahman cattle from India is between 800 and 1100 kg. In goats, Katjang breed is a local indigenous goat. The mature weight of this breed are 25-32 kg for female and male goats. Besides Katjang, there are also several large breed goats in Malaysia such as Boer crosses, and Jamnapari.

2) High feed raw materials prices



- The cost of animal feeds accounts for more than 25% of the total cost of production. The cost of animal feeds that contribute to the total cost of production is between 5.4% and 19.3% for cattle, 22.9% - 31.6% for goats and 58.9% - 71.2% for poultry. The main factor that contributed to the higher cost of animal feed is the raw materials, which are imported from other countries. The main ingredient of animal feed is corn which is imported from China, Thailand, Argentina, and Brazil.

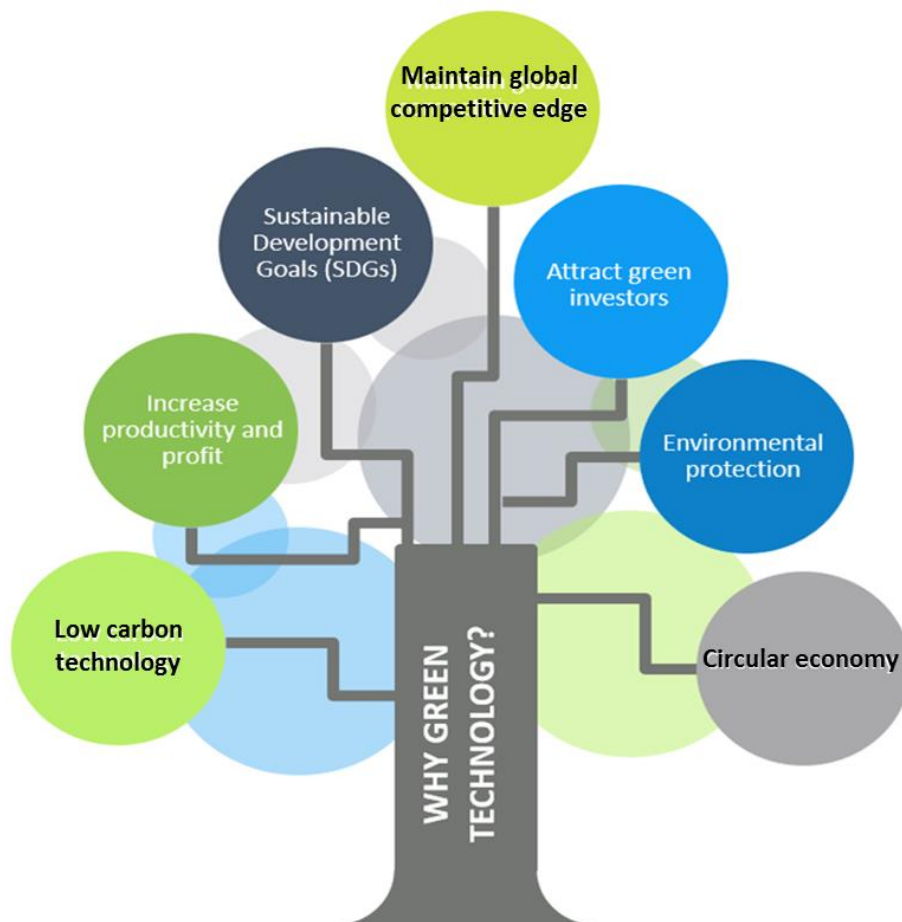
3) Lack of arable land



- Grazing reserves are land officially allocated by the government to be used by farmers to rear ruminants, such as cattle, buffalo, and goats. Natural grassland in Malaysia has generally low productivity resulting in very poor carrying capacity. The competition in using land with other industries and this has resulted in a lack of land area for the livestock industry. At the same time, farmers prefer to use their land for more productive agricultural activities such as palm oil, fruits, and vegetable cultivation.

1.2 The Green Industry

- It is increasingly clear that climate crisis will have a profound influence on the agro- ecological conditions under which policy makers need to develop strategies and manage the natural resources in order to achieve food security and other ends.
- Therefore, these green industry guidelines for the livestock sector were developed and refined through a participatory and iterative process, in preparation for national policies that support green industry.
- The amount of arable land is likely to remain constant while our population would continue to grow. Therefore, increasing livestock production from existing resources is going to become a necessity within the conceptions of green and sustainable livestock strategies for sustaining both food security and the need to conserve natural resources.



It is the process of change in ideologies and practices into the environmental concerns. It includes non-polluting practices, reducing non-chemical inputs in production systems and relying on ecological farming techniques (Burch et al., 2006)



- The barriers to green and sustainable livestock are many, including financial and social pressures to keep doing things the way that they are currently done or business as usual. The high cost of getting into farming is a major obstacle for new operators. Farm equipment, quota, property, and livestock are all expensive, and once a farm operator goes out of production, few can afford to get back in.
- The average age of farmers continues to increase. Many members of the next generation are not entering the livestock industry. The livestock farming is a tremendously sophisticated and complicated industry and successful farmers are largely related to knowledge that comes with experience. When a farm is handed on to the next generation, it is not just the land that is handed on. The knowledge gained from working with the previous generation is also handed on. There is no point in protecting the land base if there is no younger generation of skilled operators to continue farming.
- For livestock to evolve, adaptation to new technology is essential. This requires a public debate over issues such as genetically modified food. New technology is being implemented globally, with far-reaching consequences. Malaysia must decide where it stands with respect to evolving technology and then support the agricultural community in providing accessible, accurate information upon which reasonable, healthy food choices can be based.
- There is also broad consensus that it is an essential goal for livestock, and sustainable livestock is seen as essential for global sustainable development. Since these concepts and strategies can be met in several different ways, green and sustainable livestock is unlikely to be linked to any particular management practice. Rather, green and sustainable livestock 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 natural resources such as soil and water.



- The shift to green and sustainable methods, however, often involve higher up-front costs. The need for green and sustainable livestock will only increase as climate crisis disrupts weather patterns and worsens drought, as is already being seen. Green and sustainable livestock is a necessary response to climate risk and water scarcity. Yet social and financial pressures coupled with existing policies present a barrier to its adoption. By developing 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 a mainstream economics framework, such as that of the United Nations Environment Program (UNEP) and the Organization for Economic Co-operation and Development (OECD). That framework attempts to strengthen the economy via incentives, the tax system, pricing, regulatory frameworks and prioritized investments.
- This aspiration is in line with the Malaysian government's commitment towards climate action and green technology





- The Malaysia National Green Technology Policy is built on pillars namely energy which seek to attain energy independence and promote efficient utilization; environment intended to conserve and minimize the impact on the environment; economy which is to enhance the national economic development through the use of technology; and social via improve the quality of life for all.

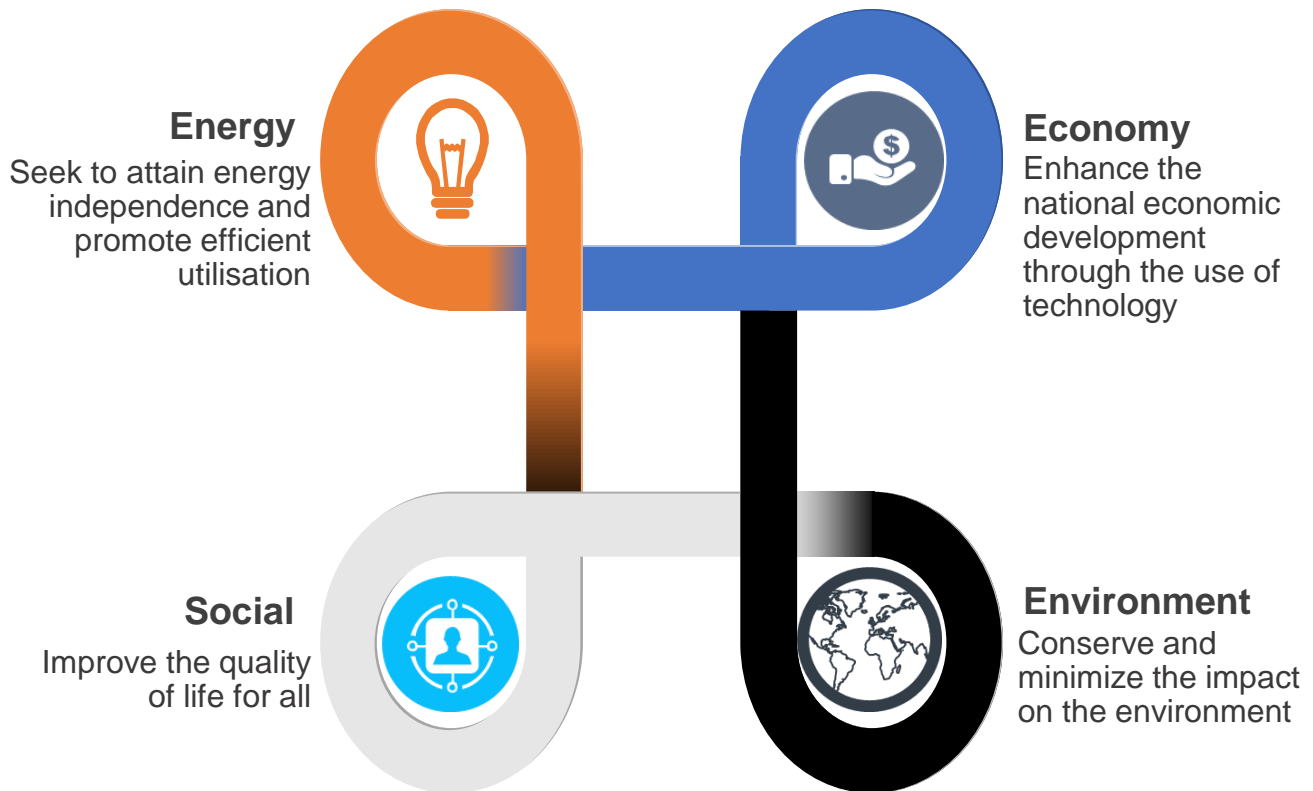



Figure 1.2. The Malaysia National Green Technology Policy with its four pillars



1.3 Green Practices Livestock Management Guideline Purpose

This guideline was prepared by reviewing the role of the livestock sector mainly and other related sources of knowledge in livestock ecosystems toward greener growth in livestock. The early section briefly introduces the livestock sector and outlines the challenges in this sector followed by offering a guide of innovation for a more sustainable and greener livestock ecosystem.

It also draws the conclusions about how selected indicators could contribute towards greener growth in livestock.

This guideline also identifies the broad range of policy measures by governments such as MyGAP to promote and facilitate the greening of livestock industries. Thus, the objectives of existing initiatives are to provide guidance in implementing green practices and to offer direction on green practices implementation in supporting the national strategies, policies, and governance structures.

OBJECTIVES

To provide guidance in implementing green practices in livestock sector



To offer direction on green practices implementation pertinent to green livestock industry

Figure 1.3. The Objectives of Green Livestock Industry Guidelines

•There are advantages to committing to the greening of livestock practices and these guidelines aim to help livestock farmers make better decisions towards the goal of green livestock.



1.4 Scope and Applicability/Application

- The green policies and initiatives identified in this guideline cover a broad spectrum of issues, involving government and non-government stakeholders of the livestock sector, underscoring the need for strong institutional integration, and supporting policies.
- Meanwhile, the scope of this guideline is focused on the processes, phases and techniques in the livestock sector which were meant to boost output yet also harming the environment underlying the social, financial and policy barriers that prevent the green initiation implementation in this sector.
- The most important part of a green livestock production process is the transformation or conversion process, aimed at transforming livestock-based resources and production factors into output in the form of products and services.
- 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. These means (or 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.



1.4.1 Existing National Policies and Guidelines

There are several existing policies, regulations and guidelines used by Malaysian livestock industries whereby different aspects of green practices can be found.



Figure 1.4. Some of the existing policies, regulations and standards pertaining to the livestock sector

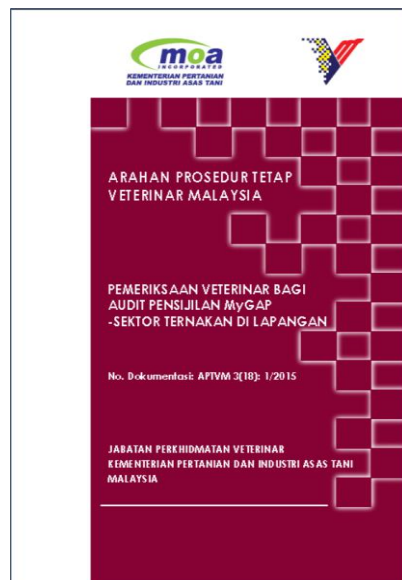
- Malaysia Good Agricultural Practices (MyGAP) launched in 2013, is a scheme that recognizes farms that follow best practices in agriculture (crop, fishery, and veterinary) to not only produce good quality products but also protect their workers' welfare and the environment.
- National Policy on the Environment (Dasar Alam Sekitar Negara) is a national policy that aims for continuous economic, social, and cultural progress and enhancement of the quality of life of Malaysians, through environmentally sound and sustainable development.



- Livestock waste management in Malaysia is regulated by statutes and subsidiary legislations introduced by the Department of Environment including:



- For the livestock industry, the Department of Veterinary Service is leading in overseeing the supply-chain of livestock commodities. The livestock commodities good animal husbandry practice (GAHP) is coded with MS 2027:2018 Good Animal Husbandry Practice.



GAHP GUIDELINES

1.4.2 Benefits of Green Practices towards the Livestock Sector

- The major benefits of applying the options suggested by this guideline include increased efficiency and reduced consumption of materials, energy, and water. In essence, it will produce less waste with a lower intensity of environmental pollution such as toxic or hazardous materials, as well as supporting green innovations of the technology. It should also lead to better human resource utilization for the livestock industry.
- Green practices may also increase the livestock productivity and revenue, while inculcating a green working culture that is beneficial not only to the economy but also to the environment.

	FINANCIAL RESOURCES	HUMAN RESOURCES	TIME RESOURCES			
Challenges	<ul style="list-style-type: none"> • High initial capital investment • Longer rate of return • Cost of operation may increase 	<ul style="list-style-type: none"> • Requires specific expertise • New 'green' occupation • New SOP to be implemented 	<ul style="list-style-type: none"> • Requires additional time to implement options that involves, procurement of new equipment, infrastructure and system modification 			
Assessment	<ul style="list-style-type: none"> • Payback period • Return on initial investment 	<ul style="list-style-type: none"> • Staff competency, training <ul style="list-style-type: none"> • Labor cost • Green tech expert 	<ul style="list-style-type: none"> • Maximum downtime 			
Implementation of Green Practices						
Benefits	<ul style="list-style-type: none"> • Increase productivity and quality of the product 	<ul style="list-style-type: none"> • Reduce health and occupational safety risk 	<ul style="list-style-type: none"> • Minimizing environmental impacts 	<ul style="list-style-type: none"> • Farm reputation and product branding 	<ul style="list-style-type: none"> • Cost reduction on energy, water and material usage 	<ul style="list-style-type: none"> • Staff competency increase

Figure 1.5. An overview of direct benefits for livestock farm when green options are implemented despite the initial challenges of financials, human resource, and time.

PART II: OPERATIONAL DEFINITION AND TERMINOLOGY



2.1 Definition of Green Practices in Livestock Production

- Livestock farmers are facing a number of challenges today. Demands for a lower impact on the environment, especially reducing greenhouse gas emissions, for more animal welfare and for less intensive production need to be balanced with a stable production and a good income. While there are challenges for livestock farmers, there are also many opportunities to increase the resilience and profitability of their farms.
- Increased facility size and regional concentration of livestock and poultry operations have, in turn, given rise to concerns over the management of animal wastes from these facilities and potential impacts on environmental quality, public health and welfare.
- Intensive modernizations are among the major challenges that any agricultural sector particularly livestock must identify, meet and balance, beyond which unsustainable trends caused by farming technologies would lead to tipping-point phenomena. Only those livestock activities that meet the established threshold criteria while advancing the nation towards food security would be considered viable forms of Green Livestock.
- Similarly to sustainable agriculture, the meaning behind "sustainable livestock" is ambiguous, and sustainable livestock is an umbrella term that encompasses many different approaches. Numerous definitions indicate that sustainable livestock means different things to different people and sustainable livestock could be an arbitrary concept if we continue to seek the correct and universal definition.
- Definitions of green and sustainable resource management in livestock are generally concerned with the need for livestock practices to be economically viable, to meet human needs for food, to be environmentally benign or positive and to be concerned with the quality of life. A green livestock system that is able to overcome the barriers of a rapidly changing world requires attributes that constitute the defining elements of sustainable livestock.



- The Green Industry 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.

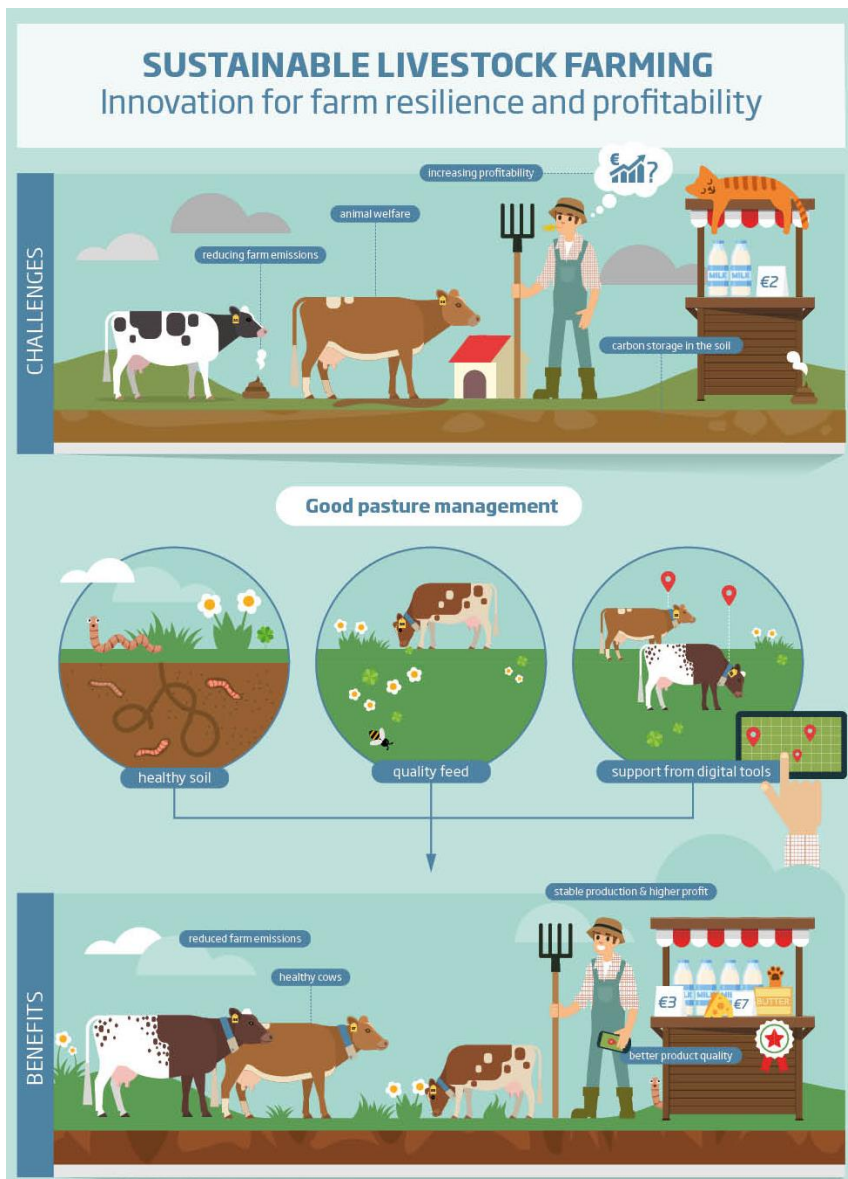


Figure 2.1. Sustainable Livestock Farming adopted from the EIP-ARGI network at www.eip-agri.u

- Sustainable livestock production means making livestock systems economically more efficient and striking a balance between meeting the growing demand of animal-origin products and reducing to the minimum the negative side effects and externalities from the livestock sector.
- In order to be optimal, livestock 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 livestock development from a social, economic and environmental perspective.





2.2 Regulation, Standards and Guidelines Related to Livestock

- Animal manure can be and frequently used beneficially on farms to fertilize crops and add or restore nutrients to soil. However, animal waste, if not properly managed, can adversely impact water quality through surface runoff and erosion, direct discharges to surface waters, spills and other dry-weather discharges, and leaching into soil and ground. It can also result in emission to the air of particles and gases such as ammonia, hydrogen sulfide, and volatile organic chemicals. Livestock waste management in Malaysia is regulated by statutes and subsidiary legislations introduced by the Department of Environment including: Environmental Quality Act 1974 and Environmental Quality Regulation 1979.
- Livestock industry as part of the agriculture industry is an important sector in Malaysia. For many years, this sector has been the backbone of Malaysian economy by producing livestock and agricultural products for domestic consumption, as the earner of foreign exchange.
- Together, livestock and agriculture sector has contributed to the national Gross Domestic Products (GDP). It provides major employment for the people, especially from the rural areas. In 2013, this sector employs more than 1.6 million people or 10.9% of the total employment, contributed more than 23% of the total export earnings and adds about 7.2% of Malaysia's GDP.
- However, majority of our farmers still live in rural area. Thus, green policies framed to support the livestock and the agriculture sector require modification to a rural thrust for uplifting sustainability and economic well-being of our people.
- Coupled with the fact that a large part of the agriculture including the livestock sector is in the rural segments, strong policy inputs is needed to lead to a multiplier impact in outputs, including growth, jobs, and social parameters. All of these parameters overseeing by the Department of Veterinary Service that responsible to supervise the supply-chain of livestock commodities.
- The livestock commodities good animal husbandry practice (GAHP) is coded with MS 2027:2018 Good Animal Husbandry Practice. The GAHP later were translated into Malaysia Good Agricultural Practices (MyGAP) which is a scheme that recognizes farms that follow best practices in agriculture.

Example of existing regulations

Environmental Quality Act 1974

Environmental Quality Regulations 1979

Food Act 1983 and Food Regulations 1985

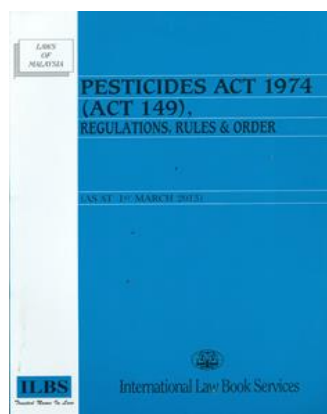
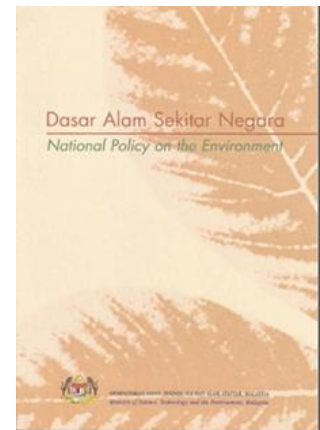
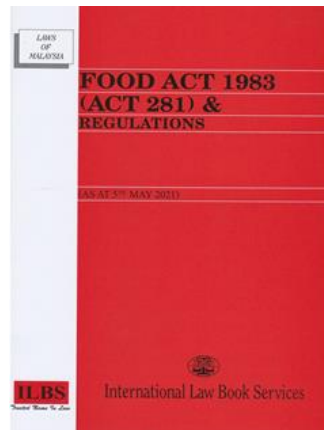
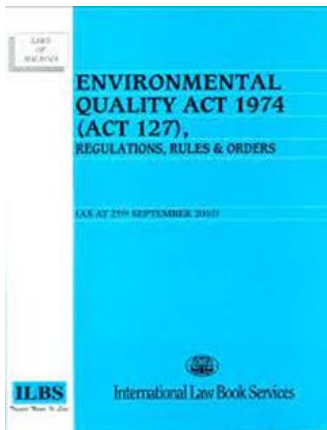
Occupational Safety and Health Act 1994

Pesticide Act 1974

National Policy on the Environment (Dasar Alam Sekitar Negara)

Dasar Agromakanan Negara 2.0

Skim Amalan Pertanian Baik Malaysia (MyGAP)





2.3 Categories for Livestock

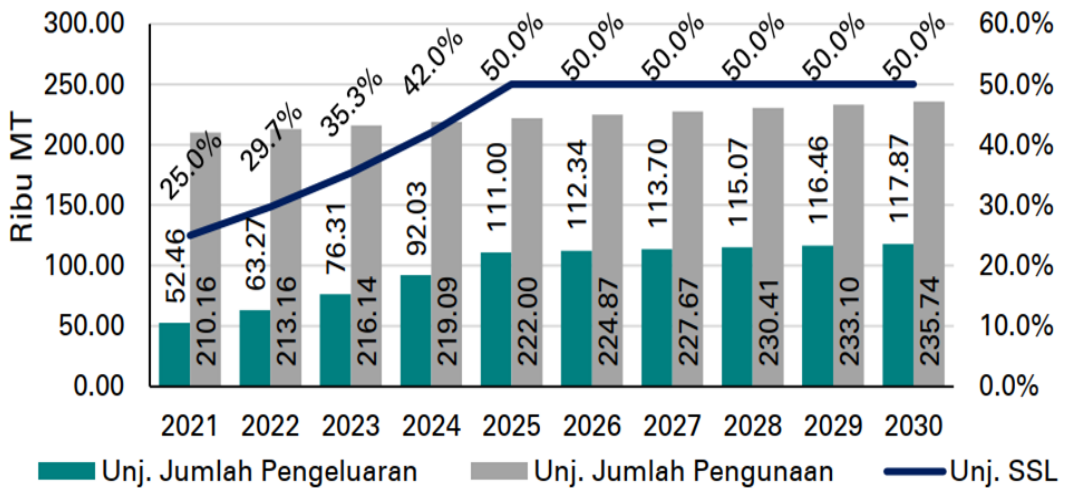
- This guideline focuses on operational aspects of the livestock sector. However, the challenges raised might be relevant for other agricultural and cutting across different ministry level administration in Malaysia. Emphasis is placed on practices which impact green and sustainable production rather than consumption, although we acknowledged that the two concepts are inextricably linked.
- Livestock production receives a lot of criticism, yet often there is a failure to differentiate between livestock that are part of problem (primarily intensively reared, grain-fed) and high welfare livestock systems that can be a vital part of the solution, restoring ecosystems, maintaining soil fertility, producing food from marginal land and providing important nutritional benefits.
- Three components are essential for a livestock operation to achieve sustainability. Most important is meeting the social acceptability component of sustainability.



Figure 2.2. Essential Components to achieve Livestock Sustainability

- The first component is a livestock operation, and the value chain that it is part of, to make every effort to ensure that consumers still want its products. Without a strong market for these products, the entire meat or milk value chain would cease to exist.
- The second component of sustainability is economic viability. Livestock are critical to building sustainability. To be sustainable, livestock sector growth needs to support the livelihoods of an estimated 1 billion people, contribute to enhancing economic and social well-being, protect public health through balanced diets and the reduction of health threats from livestock, and protect the natural resources. Every livestock enterprise must make a profit, or it will ultimately go out of business.
- The third component is environmental responsibility. The livestock industry is well aware that the care for the land, air, water, animals and environment is part and parcel of their daily routine . But they need to make the policymaker, processor, retailer and consumer realize that they do care.

Projection of production, consumption and SSL % of beef in Malaysia until 2030



DAN 2.0



Classification of Domesticated Livestock



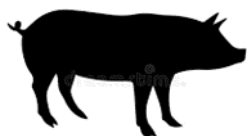
Large ruminant consists of beef and dairy cattle and buffalo;



Small ruminant consists of sheep and goats



Poultry consists of broiler and layer chicken and ducks.



Swine industry

Figure 2.3. Classification of Domesticated Livestock Showing Ruminants, Poultry and Swine

- All three are required for sustainability in food production and consumption, yet consumers don't always appreciate the need to balance them. Therefore, agriculture's carbon footprint and greenhouse gas emissions have, to some extent, become the proxy for negative environmental impacts in general.
- Livestock sectors in Malaysia include raising, rearing and maintaining of livestock primary for the purpose producing meat, milk and eggs. May also includes animals kept for recreation (riding or racing) and draft.
- According to FAO, livestock contribute 40 % of the global value of agricultural output and support the livelihoods and food and nutrition security of almost 1.3 billion people.

2.4 Terminologies

The following terms are used in this guideline:



Livestock Industry

- Comprises of domesticated ruminants and non-ruminants.



Ruminants

- Sectors which consists of beef and dairy cattle, sheep and goats.



Non-ruminant

- Sub-sector such as poultry (broilers and eggs) and swine productions.

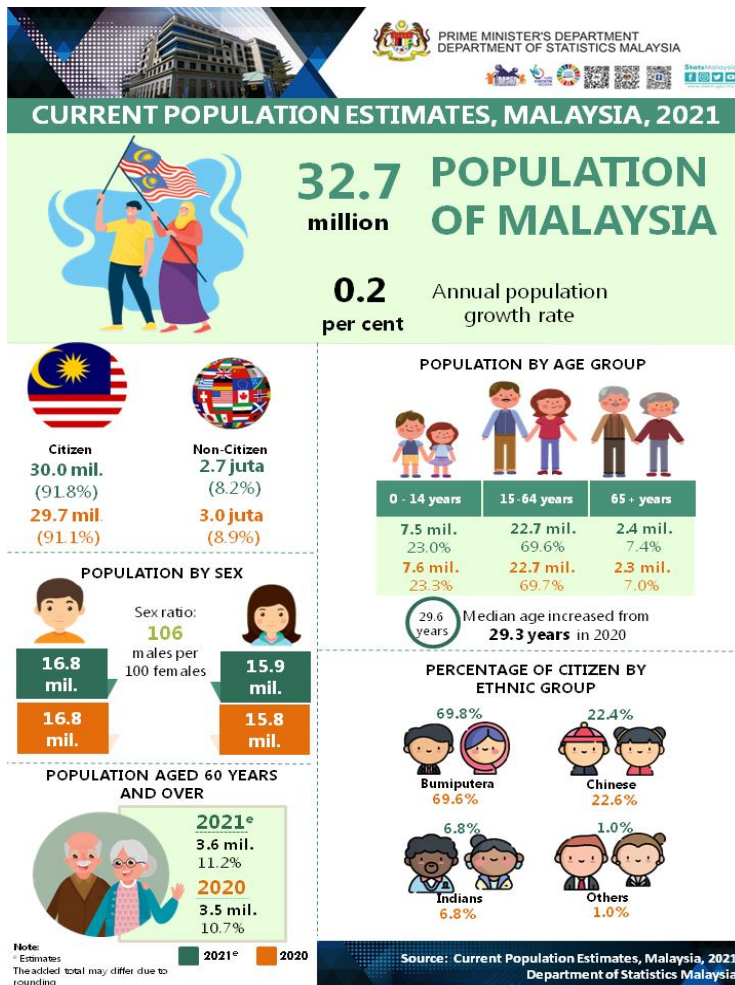




PART III: GREEN PRACTICES IN
LIVESTOCK MANAGEMENT

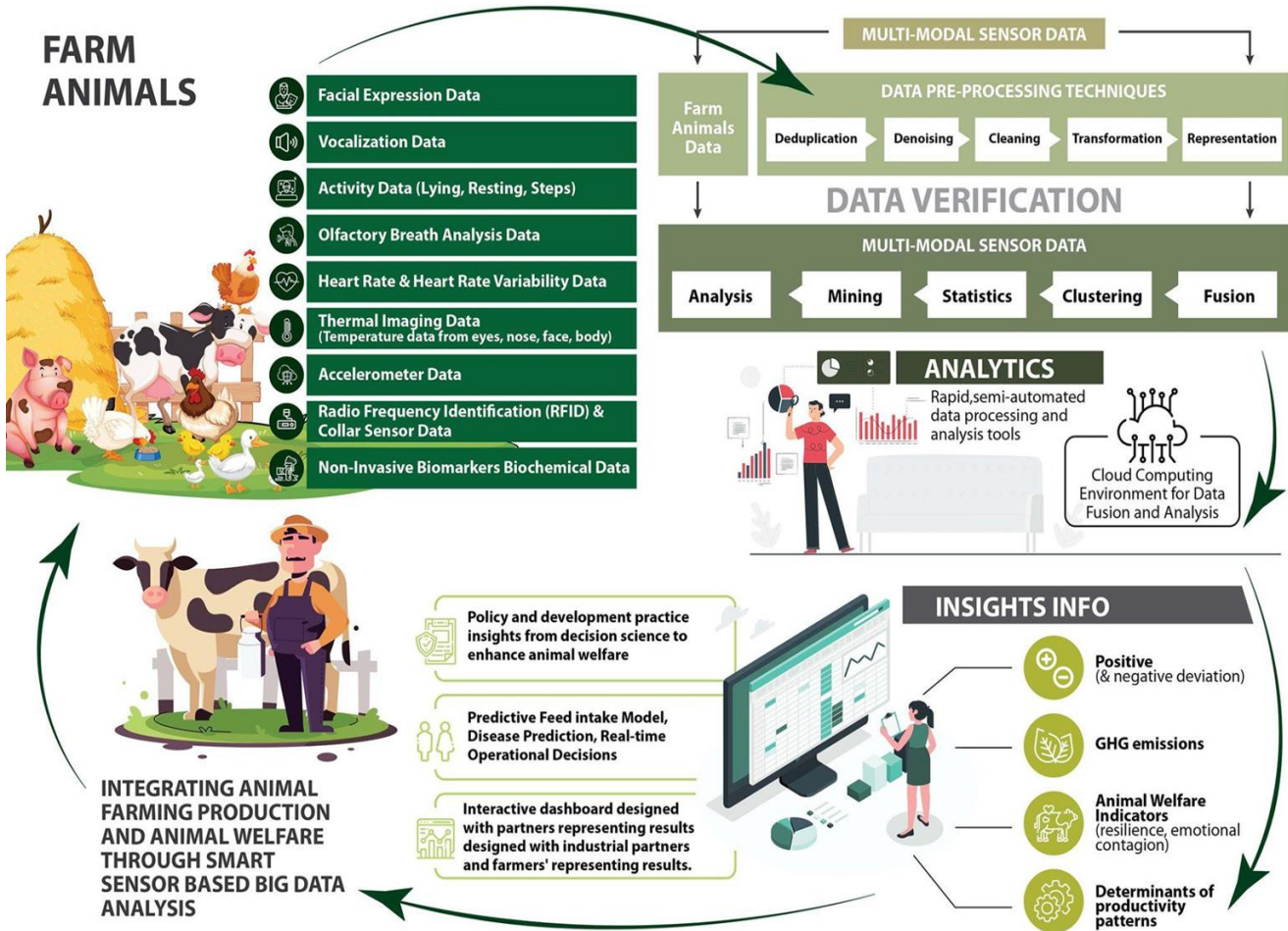
3.1 Introduction

- Livestock industry vary tremendously in terms of their organizational structures and business operations. This variation poses a challenge to ensuring that green practices are included in their activities in a consistent way over time, both within and across agencies. Thus, the greening of livestock industries requires a holistic approach to ensure continuous support to ensure smooth implementation of industry policies and green initiatives.
- At the same time, the greening of industries has become a core determinant of economic competitiveness and sustainable growth especially in developed nations. Since resource inputs represent an important production cost for industries, improving efficiency gives industries a competitive advantage by means of increased productivity.
- The increased demand for agricultural production particularly livestock caused by the booming population has led to the adoption of advanced methods and approaches to sustain agile operations and continuous production.



DOSM, 2021

- This has been seen through organic replacement of social domains such as human sensory and mental input in agriculture by artificial intelligence (AI), big data and information and communication technologies (ICT), in association with automation systems, that has provided an increase in capacity, performance and productivity.



Adapted from Neethirajan and Kemp, 2021



- The challenges posed by climate crisis to the livestock sector requires a holistic and strategic approach to scientific knowledge with policy action. In Malaysia, there is a strategic direction to use information and communication technologies in the Dasar Agromakanan Negara 2.0 (DAN 2.0)
- Among the key essentials of this are greater understanding and collaboration between policy-makers and industry players in all sub sectors of agriculture, greater collaboration among researchers and livestock communities and consideration of interdependencies across the whole climate-agrifood nexus.



- Livestock operations management focuses on the design, planning, operation of machine and human operations in livestock. Operators generally seek to reduce the risk of adopting a new practice. Green practices which are observable, trial-proven, and less complex are generally more quickly adopted than complex green practices.
- Green livestock practices which provide economic and other advantages will be adopted more rapidly. For this to happen, guidelines should be tailored so that green practices benefit livestock communities while safeguarding soil, water, and biodiversity, and prioritising energy efficiency and conservation.

The framework of Green Livestock Industry Guideline

SITUATION

01

- UN SDGs – sustainability
- Increasing demand for green products and/or practices

COMPLICATION

02

- Knowledge gap
- Perception that going green is costly

IMPLICATION

03

- Knowledge gap leads to varying readiness levels among livestock industry players
- If/when policy changes to include green/sustainable indicators, some industries may face issues

POSITION

04

- Guideline developed for industries to implement green practices
- Reduce redundancies; identify points of similarities with existing policies or practices

ACTION

05

- Assess readiness level at organization level
- Identify key challenges and barriers
- Identify enablers and buy-in factors

BENEFIT

06

- Guideline developed for industries to implement green practices
- Reduce redundancies; identify points of similarities with existing policies or practices

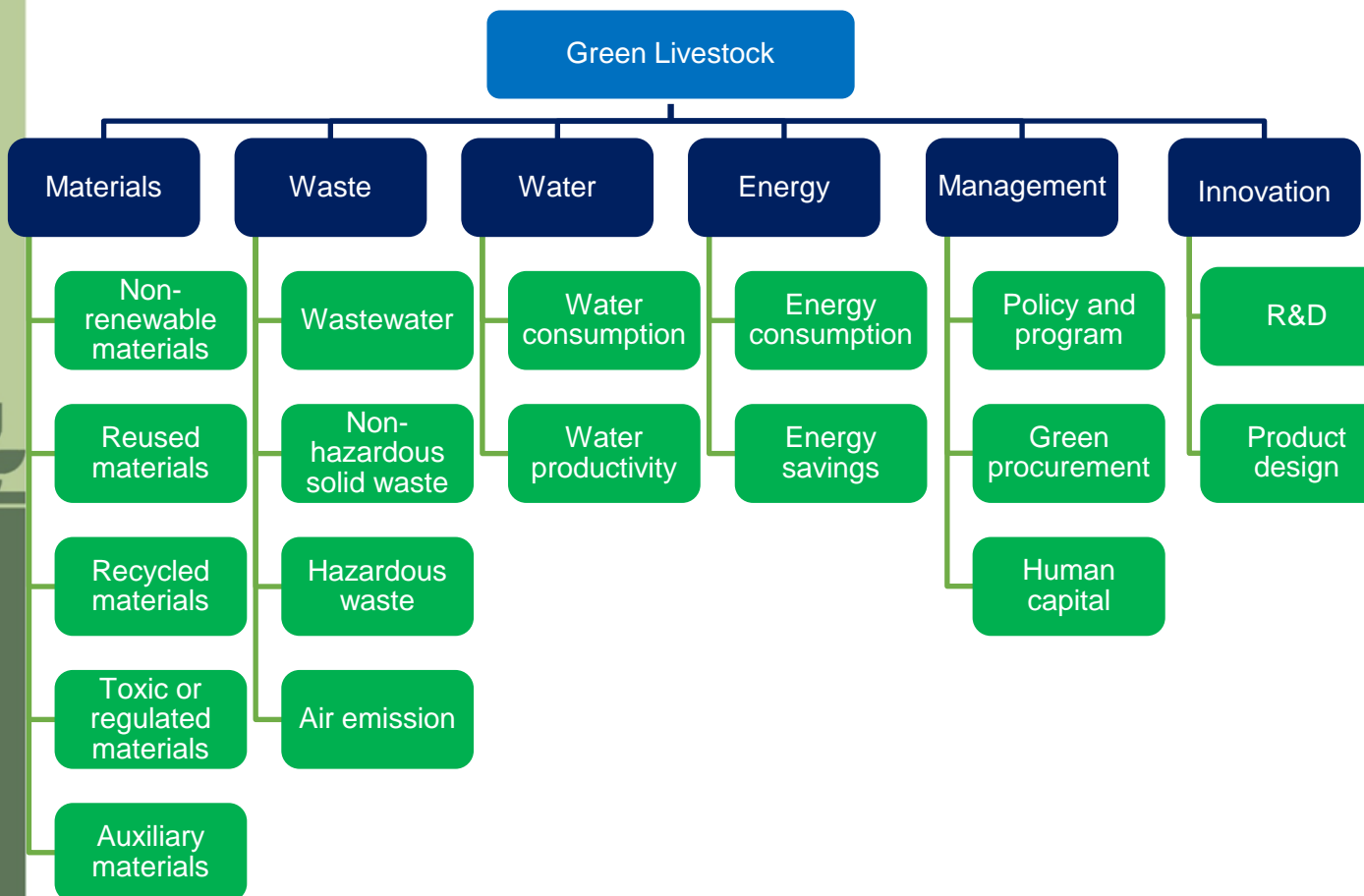


- Operations in livestock includes operations analysis, operations planning (e.g., mission planning, task time analysis, scheduling and allocation of resources), and operations optimization (e.g., capacity dimensioning, route optimization), among others. It is good to note that in meeting the current trend of increased sustainability concerns in production systems, operations tasks and processes must make the connection between decision-making and the corresponding environmental impacts.
- This guideline highlighted the gap in knowledge on recent advances in management and operations of livestock farms in Malaysia by exploring aspects on a specific topic with advanced technical approaches that have been applied in agricultural operation. The latest technologies in livestock such as use of sensors, robotics and big data and on the management measures with potential environmental impact were also considered.
- Consultation with government officers, implementers, business and other stakeholders is imperative during guideline development processes. Under normal circumstances, governments can establish multi stakeholder consultative bodies or task forces which may include representatives from the community, non-governmental organizations (NGO's), industry and trade unions.
- Indicators are instrumental to guideline development as a means of tracking progress against policy targets and to assess the effectiveness of implementation programs. We suggest innovative and strategic thinking be adopted in developing guidelines targeted towards the greening of livestock industries. The operational measures identified in this guideline have been organized into four indicators which reflect the nature of livestock business. The explanation for each indicator is summarized in the next subsection.



3.2 General Indicators

- The indicators of green livestock have an important influence on the greening of livestock, providing the environment through which livestock 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;





3.2.1 Materials

MATERIALS

INTRODUCTION

- Livestock farm use various types of materials in their routine animal husbandry activities. Some farms require the use of virgin materials exclusively, while others may utilize recycled materials.
- The sustainability of farms depends on the used of efficient materials. This is linked with the availability of natural resources and achieving high material efficiency which is highly recommended.
- Three important features when dealing with material efficiency are i) generate less waste per livestock production cycle; ii) reduce the amount of material used for livestock production improvement process via recycling, and; iii) achieve better waste separation and management by prioritizing on managing waste efficiently.
- These led to prevention and reduction in extraction and consumption of pristine raw materials, cost and energy savings in livestock production, transformation, transportation and disposal, reduction of livestock waste volumes, increased recycling and reusing in waste management as well as reduced energy demands, carbon emissions and overall environmental impact.

TARGET

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

SCOPE

The scope is on facilitating the stakeholders to implement the use of sustainable materials and promote a shift towards sustainable livestock production in ways that promote meaningful change.

The scope for Livestock Materials (LMAT) include five (5) sub-indicators:

- Non-renewable materials (LMAT1)
- Reused materials (LMAT2)
- Recycled materials (LMAT3)
- Toxic or regulated materials (LMAT4)
- Auxiliary materials (LMAT5)

Non-renewable materials (LMAT1)

A non-renewable resource (also called a finite resource) is a natural resource that cannot be readily replaced by natural means at a pace quick enough to keep up with consumption. An example is carbon-based fossil fuels. The original organic matter, with the aid of heat and pressure, becomes a fuel such as oil or gas.

Reused materials (LMAT2)

Reusing a certain material means to use it again for the same purpose that it was originally made for. Sometimes a product that is being reused is referred to as being refurbished, or pre-owned. The original product is usually not altered in any significant way before being used again.

Recycled materials (LMAT3)

Recycled materials include those used in livestock production processes and those used in consumer products. The recycled material is often degraded somewhat by use or processing and therefore must be converted to another purpose.

Toxic or regulated materials (LMAT4)

Toxic materials are substances that may cause harm to an individual and the livestock if it enters the body. Toxic materials may enter the body in different ways. The most common route of exposure is through inhalation (breathing it into the lungs).

Auxiliary materials (LMAT5)

Auxiliary Materials means any and all materials, ingredients and components required and/or necessary for the livestock production of the Formulation and/or the Product under and pursuant to the livestock husbandry practices and production Process, respectively, except the Active Ingredient.



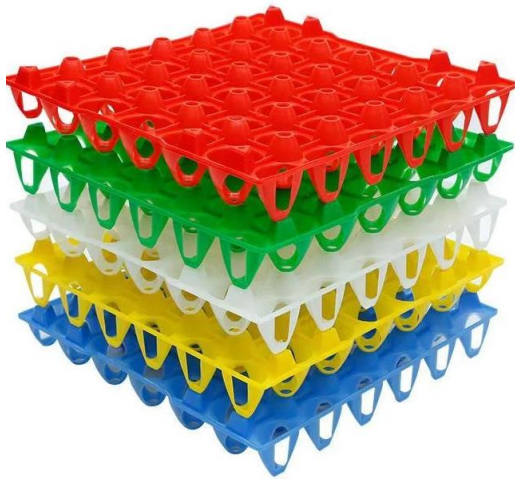
Sub-Indicator	Green Practices for Materials
LMAT1	Non-Renewable Materials
	<ul style="list-style-type: none"> • Incorporate the use of materials which are renewable, recyclable and/or recycled • Extending the lifetime of products may reduce the need for non-renewable materials • Reducing the use of materials that require high energy Consumption (e.g. LED light bulb) • Design products that reduce material use (e.g. used of plastic slab instead of wood shaving as bedding in poultry.)
LMAT2	Reused Materials
	<ul style="list-style-type: none"> • Incorporate designs to improve lifetime of products to allow the materials to be reused extensively • Incorporate sharing economy and circular design into existing network of manufacturers, suppliers, and consumers
LMAT3	Recycled Materials
	<ul style="list-style-type: none"> • Minimize and recycle residues and waste from farming processes, within the barn or outside it (e.g. papers, glass, aluminium tin, plastic bottle etc.) • Incorporate designs to improve lifetime of products to allow the materials to be reused extensively • Increase recyclability and ease the sorting process
LMAT4	Toxic or Regulated Materials
	<ul style="list-style-type: none"> • Avoid or minimize the use of hazardous, toxic or in any other way environmentally unfriendly materials (e.g. used of plant-based detergent) • Incorporating green chemistry into production processes that traditionally use hazardous substances or require slightly toxic chemicals
LMAT5	Auxiliary Materials
	<ul style="list-style-type: none"> • Minimize the use of periodical consumables such as batteries, cartridges and containers, and liquid materials used for maintenance such as coolants or lubricants (e.g. rechargeable batteries) • Maximise use of refillable or reusable containers where appropriate • Decrease the number of consumables used by a product during its lifetime • Developing eco-friendly packaging materials



Plastic slab to replace wood shaving



Plant-based detergent



Egg tray from recycle plastic



Rechargeable batteries

(Source: Google image)



3.2.2 Waste

WASTE	
INTRODUCTION	
<ul style="list-style-type: none"> • The laws of Malaysia (Act 672 – Solid Waste and Public Cleansing Management Act 2007) define “solid waste” as – <ol style="list-style-type: none"> i. Any scrap material or other unwanted surplus substance or rejected products rising from the application of any process; ii. any substance required to be disposed of as being broken, worn out, contaminated or otherwise spoiled; or iii. any other material that according to this Act or any other written law is required by the authority to be disposed of, but does not include scheduled wastes as prescribed under the Environmental Quality Act 1974 (Act 127), sewage as defined in the Water Services Industry Act 2006 (Act 655) or radioactive waste as defined in the Atomic Energy Licensing Act 1984 (Act 304). • Solid wastes have a mass, weight, and constant volume (World Bank, 1999a). However, solid waste does not include scheduled wastes as prescribed under the Environmental Quality Act 1974 [Act 127]. On the other hand, sewage and radioactive waste are defined accordingly as in the Water Services Industry Act 2006 [Act 655] and the Atomic Energy Licensing Act 1984 [Act 304], respectively. Solid wastes are generally categorized into five groups, namely municipal wastes, industrial wastes, hazardous wastes, agricultural wastes and e-wastes. • Livestock waste means animal excreta and associated feed losses, bedding, spillage or overflow from watering systems, wash and flushing waters, sprinkling waters from livestock cooling, precipitation polluted by falling on or flowing onto a livestock operation, and other material polluted by livestock, or their direct • Implementing an effective waste management plan requires strategic and necessary measures. It must be structured and account for all the necessary stages • Livestock farmers must analyze the current collection, handling, treatment, and disposal streams and identify current or potential problems. From this, specific goals and action plan can be designed and implemented with regular monitoring and reviewing. 	

TARGET

- To ensure livestock waste not only can be reduce, but also can minimise the environmental impacts and decrease hazardous emissions from livestock 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.

SCOPE

- The scope for Livestock Waste (LW) include four (4) sub-indicators:
 - Wastewater (LW1)
 - Non-hazardous solid waste (LW2)
 - Hazardous waste (LW3)
 - Air emission (LW4)
- **Wastewater (LW1)**
 Wastewater (LW1) is a type of water that has been used at any stage of the livestock farming activities. Impacts of this scope are;
 - The wastewater may contain various substances and toxic materials which must be treated before it can be released into water bodies.
 - Environmental impact of untreated effluent.
- **Non-hazardous solid waste (LW2)**
 Non-hazardous solid waste (LW2) means animal excreta and associated feed losses, bedding, spillage or overflow from watering systems, wash and flushing waters, sprinkling waters from livestock cooling, precipitation polluted by falling on or flowing onto a livestock operation, and other. Impacts of this scope are;
 - Increasing amount of solid waste which will eventually end up in landfills causing many environmental problems.
- **Hazardous waste (LW3)**
 Hazardous waste (LW3) is a waste that is listed as a known hazardous waste or meets the characteristics of a hazardous waste, such as air releases from manure, digestive emissions, and urea, including livestock waste mixed with bedding, compost, and other specified materials. LW3 are those that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity. Impacts of this scope are;
 - Decrease hazardous emissions from livestock farming activities.
 - Hazardous waste treatment is costly and causing health issues to human and the animals.



- **Air emission (LW4)**
Air emission (LW4) is gases and particles which are released into the air or emitted at various points of the livestock farming activities. Air emission in livestock activities include GHGs that covers gases including methane (CH₄), ammonia (NH₃) and hydrogen sulphide (H₂S). Impacts of this scope are;
 - Human health issue e.g. ammonia (NH₃) and hydrogen sulphide (H₂S) from poultry manure contribute to the irritation of eyes and respiratory system (EPA, 1999, 2002).
 - Emission of GHGs (methane produce during rumen fermentation) lead to exacerbation of climate crisis and its impacts.

Sub-Indicator	Green Practices for Waste and Emission
LW1	Wastewater
	<ul style="list-style-type: none"> • Incorporating green technology (e.g. used of effective microorganism-EM to speed-up solid denaturation process) into existing treatment pond process • Increasing the use of recycled water for processes that do not require high quality water (e.g. for pasture irrigation)
LW2	Non-Hazardous Solid Waste
	<ul style="list-style-type: none"> • Increase the use of solid waste into biomass (e.g. biocompost fertilizer, biofuel) (Ciaccia <i>et. al</i>, 2019). • Enhance the 3R's concept among staffs and workers • Reducing the use of auxiliary materials for packaging enable less waste to be produced
LW3	Hazardous Waste
	<ul style="list-style-type: none"> • Stimulate safer air filtering system by capturing toxic material and providing easy removal (e.g. filter NH₃ and H₂S gas, dust) • Choose less hazardous chemical processes whenever practicable (e.g. phyto-based detergent)
LW4	Air Emission
	<ul style="list-style-type: none"> • Minimise generation of gaseous emissions including greenhouse gases methane (CH₄), ammonia (NH₃) and hydrogen sulphide (H₂S), odours or any other undesirable emissions • Opt for processes that produces less emissions during the production (e.g. biogas fermenters to convert methane to renewable energy)



Pig waste pond before and after of EM inoculation



Methane fermenter and methane generator
-Pusat Pertanian Moden, Kluang-



Cattle waste liquid and solid separation process.
Solid waste used for bio-fertilizer.
-Farm Fresh farm @ UPM-



3.2.3 Water

WATER

INTRODUCTION

- Livestock water use is water associated with livestock watering, feedlots, dairy operations, and other on-farm needs. Water requirements vary with animal size and temperature. But on average, a 500 kg beef steer only drinks about 10 gallons (about 38 litres) of water per day to support its normal metabolic function.
- Other livestock water uses include cooling of facilities for the animals and products, dairy sanitation and wash down of facilities, animal waste-disposal systems, and incidental water losses. The livestock category excludes on-farm domestic use, lawn and garden watering, and irrigation water use.
- As demand increases, if the water withdrawn for industrial processes are not returned to the same water body in its original quantity and quality, significant depletion of rivers and lakes and the lowering of groundwater tables is expected.
- Increasing the rate or re-circulation and avoiding evaporation will reduce the amount required to be withdrawn from municipal, groundwater or surface waters.
- Therefore, it is advisable for farm to measure how much water is being recycled or recirculated.

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.

SCOPE

The scope for Livestock Water Management (LWM) include two (2) sub-indicators:

- Water consumption (LWM1)
- Water productivity (LWM2)

Water consumption (LWM1)

Water consumption (LWM1) can be used to measure the intensity of water used in the facility. The impacts of LWM1 include:

- Short supply, the dependence of the industry on fresh water may affect the production, reduce productivity and generate loss.

Water productivity (LWM2)

Water productivity (LWM2) links the water consumption with the product yield; hence the economic value of the industrial production can be measured based upon the water withdrawn. The impacts of LWM2 include:

- Resource depletion
- Low levels of water productivity indicate water is undervalued and may be used for low value purposes

Sub-Indicator	Green Practices for Water
LWM1	Water consumption
	<ul style="list-style-type: none"> • Improve water usage efficiency (e.g. using nipple drinker instead of water container) • Monitor and increase the rate of water being recycled or re-circulated
LWM2	Water productivity
	<ul style="list-style-type: none"> • Increase the level of water recirculation and reuse within and between farms (e.g. rain water harvester, treatment pond for pasture irrigation) • Improve process design based on targeted water productivity



Use of nipple drinker to prevent water waste
(Source: Google image)



Rain water harvester tank
-Pusat Pertanian Moden, Kluang-



3.2.4 Energy

ENERGY

INTRODUCTION

- The input of machinery, fuels, and fertilizers causes livestock to depend heavily on energy. For this reason, more industry players are seeking alternative energy sources to improve their energy independence.
- This creates a continued effort to find ways to reduce inputs by applying new technologies and methods capable of reducing, for example, direct fossil energy consumption.
- Through the National Energy Policy which is planned to be announced in 2022, the generation of renewable energy from solar, biomass and biogas are aimed to increase up to 31% of capacity in 2025. This will be achieved through several planned Acts related to energy efficiency and conservation to supervise energy consumption by high-intensity users in the livestock farm especially in the poultry sector sectors.
- The direct environmental impact and future energy and carbon tariffs indicate the urgency for which livestock farm should act.
- Actions must be taken at the facilities 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.

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.

SCOPE

The scope is to minimize overall consumption of energy in the livestock production processes, facilities, operations and management in order to make livestock activity a low carbon sector.

The scope for Livestock Energy Management (LEM) include two (2) sub-indicators:

- Energy consumption (LEM1)
- Energy savings (LEM2)

• **Energy consumption (LEM1)**

Energy consumption (LEM1) describes the overall consumption of energy in the livestock farm production process.

Impacts of LEM1 include:

- Energy production depletes non-renewable resources and generates greenhouse gases either during its production, transportation or use
- Energy consumption also add to the operation and overhead costs

• **Energy savings (LEM2)**

Energy savings (LEM2) means the reduction in the total consumption of energy through utilization of renewable energy, heat integration, or co-generation options.

Impacts of LEM2 include:

- Enable waste to be upgraded into energy resources, further reducing the dependency on electricity grid and energy cost
- Reducing the amount of waste to be treated
- Increasing the value of waste

Sub-Indicator	Green Practices for Energy
LEM1	Energy Consumption
	<ul style="list-style-type: none"> • Minimize use of energy-intensive equipment and optimize energy utilization of the processes involved (e.g. led light in the poultry house) • Minimize energy consumption during use by using lowest energy consuming equipment, using default power down mode and insulate heating components (e.g. use of sensor to switch on the light) • Decrease energy use and emissions from transport and avoid environmentally harmful ways of transport within the farm • Building system automation which optimizes energy flows, consumption and overall farm performance • Conduct energy audits to identify energy conservation options that can be applied
LEM2	Energy Savings
	<ul style="list-style-type: none"> • Utilization of renewable energy from process residues (waste materials, waste heat or solid waste), or from auxiliary facilities (solar, wind or equivalent). • Application of waste-to-energy technologies (e.g. biogas fermentation system to generate electricity) • Facilitate circular economy through resource sharing and fuel optimization



Methane fermenter and methane generator to generate electric from cattle waste

-Pusat Pertanian Moden, Kluang-



Use of solar panel on the barn's rooftop

(Source: Google image)

Use of energy star rating appliances

(Source: Google image)

3.2.5 Management

MANAGEMENT

INTRODUCTION

- The management aspect of green livestock produces an environmental friendly economic growth by advancing a comprehensive strategy which is flexible enough to be tailored to differing sub sector circumstances and stages of development.
- In livestock, the management policy for green livestock consists primarily of a mix of policy, regulations, support and research and development (R&D) directed to enhancing environmental friendly livestock farming.
- In the longer-term, environmental regulations and standards raise livestock improving productivity and eco-efficiency through cleaner production processes and enhanced resource management techniques.
- Being environmentally responsible entails more than just meeting legal requirements; it also means going beyond compliance and investing more in human capital and management practices that contribute to the livestock industry's green initiatives.

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.

SCOPE

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

Apart from that, this sub-sector is to focus on embedding green policies, practices, and systems that stimulate the creation and availability of green jobs within the organization.

The scope of Management (MAN) includes (3) sub-indicators:

- Policy and program (MAN1)
- Green procurement (MAN2)
- Human capital (MAN3)

**Policy and program (MAN1)**

Policy and program (MAN1) entail compliance to farm standards in environmental management and compliance to safety regulations. In addition, additional initiatives such as developing green metrics in the farm or conducting in-house and external programs to support the green initiative are also included. Impact of MAN1 includes:

- Promotion of recycling and reuse practices along with other sustainable environmental livestock management practices among farm workers.

Green procurement (MAN2)

Green procurement refers to procurement of materials, products, services and works that takes into consideration environmental criteria that minimizes the adverse impacts of human activities. Impacts of MAN2 include:

- Purchasing environmentally friendly products and services.
- Establish a mechanism to determine level of greenhouse gas emission generated by the supplier.

Human capital (MAN3)

Human capital refers to the creation and availability of green jobs at farm management levels. It also includes capacity building and training for existing farm workers to improve the skills, capabilities, attitude and commitments towards green practices. Impacts of MAN3 include:

- Shortage of skill in green technology implementation represent barriers towards ecological progress, delaying technological and economic transformation.
- The global move towards a green economy is changing the current scenario of job creation, skill evolution and job quality.
- Green human capital influences the successful implementation of green practices in the farm.



Sub-Indicator	Green Practices for Management
MAN1	Policy and Program
	<ul style="list-style-type: none"> • Promotion of recycling and reuse practices, along with other sustainable environmental management practices among workers of the farm. • Raise awareness of responsible and sustainable consumption through internal campaigns. • Developing green policies or standard of operations that are applicable to all aspects of operation within the farm.
MAN2	Green Procurement
	<ul style="list-style-type: none"> • Purchasing environmentally friendly products and services. • Including environmental requirements in specifications with contractors, suppliers and service providers. • Establish a mechanism to determine level of greenhouse gas emission generated by the supplier.
MAN3	Human Capital
	<ul style="list-style-type: none"> • Opening opportunities for current workforce to become competent person for green practices (e.g. post for Green and Sustainable Officer at the farm level). • Implementing policies, practices, and systems that stimulate the creation and availability of green jobs within the farm. • Embedding green practices within human resource management functions.



CHALLENGES TO GREEN PROCUREMENT

PRICE

\$ People feel green products are expensive, but it can be economical in large quantities. Also, companies can save cost in terms of fewer permits required and avoid negative consequences

KNOWLEDGE

Procurement managers may be unfamiliar with green procurement or the availability of such.



AVAILABILITY

Green products may not be locally available and might have to be sourced from a specialty supplier leading to delay in procuring products.



NO ALTERNATIVES

Sometimes the current product may not have any available alternative at all. But growing demand can stimulate development of green products



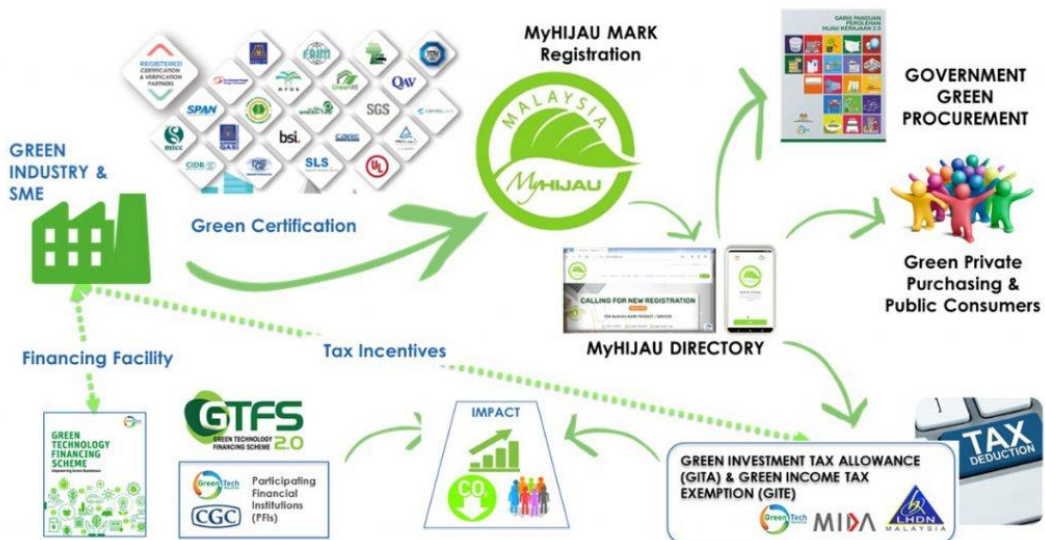




Green Human Resource Management (Source: meirc.com)



Green Procurement



Green Program

(Source: Google image)

3.2.6 Innovation

INNOVATION
INTRODUCTION
<ul style="list-style-type: none"> • Added to the problem of low productivity especially in smallholder livestock farming is critical and fact that the global population is estimated to reach almost ten billion people by 2050. • The capacity of the livestock 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 livestock markets will facilitate the sharing of technologies and innovations supportive of green livestock. • Technological innovation can improve the environmental performance of livestock systems through innovations in engineering, information technology and biotechnology. • Newer technologies can reduce the load of known toxins in livestock production, substitute safer alternatives, protect ground, or surface waters, conserve natural habitats, reduce nutrient loads in soils, lower gaseous nitrogen loss and reduce the amount of non-renewable energy used in the pasture and forage cycle. • These innovations imply changing current livestock farm practices and using different technologies to enhance resource productivity and eco-efficiency.
TARGET
<ul style="list-style-type: none"> • To ensure the support, recognize and advocate green innovations and sustainable practices within the conventional livestock 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.
SCOPE
<ul style="list-style-type: none"> • Innovations in the livestock sector have increased the incomes of small farming enterprises, boosted employment, and improved the regional food supply especially in the rural regions.



- The scope of Innovation (INN) includes two (2) sub-indicators:
 - Research and development (R&D) (INN1)
 - Product design (INN2)
- In the R&D sub-indicator, the elements include monetary and time investments, and number of patents or scientific paper published about green processes or innovations in specific livestock production farming processes, operations or practices. Impact of INN1 includes:
 - R&D allow new and emerging technologies to be applied directly into processes, further increasing the productivity and improving the products.
- Product design is the process of developing specific products that address specific needs in the market especially in green consumerism. Impact of INN2 includes:
 - Extending the lifetime of products will decrease the need for new products which subsequently will decrease material and energy use for production.



Sub-Indicator	Green Practices for Innovation
INN1	Research and Development (R&D)
	<ul style="list-style-type: none"> • Strategic investment on R&D and innovations which enables green technology to be embedded into existing infrastructure, systems and livestock production processes • Collaborative efforts with academia and research institution • Measure any reductions achieved in greenhouse gas emissions from livestock activity
INN2	Product Design
	<ul style="list-style-type: none"> • Optimize lifetime of product by increasing reliability and durability that will increase efficiency of farming activities. • Design for easier maintenance and repair of farm equipment and facilities (e.g. indicate opening instructions for cleaning and repair, allow location of wear to be detectable on parts which simplifies dismantling and replacement). Decrease the number of consumables used by the livestock farming activities product during its lifetime (e.g. using organic cleaning detergent) • Incorporate the use of recyclable materials with an existing market (use of poultry sawdust for nursery plant industry)



3.3 Sector-specific Indicators

Specific Indicators	Justification
Materials	<ul style="list-style-type: none"> ● Science and technology play a vital role in encouraging livestock's sector transformation towards green or sustainable production and growth. ● The use of autonomous machines and robotic technologies to further advance livestock systems' productivity and increase efficiency due to the automation and information technologies. ● Specific indicators for livestock are the use of local and improved animal breed, pasture and crop varieties to enhance genetic diversity and enhance adaptation to changing environmental conditions (Suharni <i>et al.</i>, 2021). ● Avoidance of unnecessary use of chemicals that adversely impact on the environment and on human health. ● Government assistance programs could be utilised to expedite 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 programs and the establishment of Centers of Excellence.
Energy	<ul style="list-style-type: none"> ● Based on the survey, securing livestock production methods with maximum net energy productivity and minimise 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 livestock farm.

Specific Indicators	Justification
<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 livestock farm 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 soil and water management. ● Improved water delivery systems with on-demand service. ● The use of advanced technologies (i.e. soil moisture sensors and satellite evapotranspiration measurements) to improve efficiency and productivity of water.
<p>Waste</p>	<ul style="list-style-type: none"> ● The livestock waste predominantly include manures from cattle, sheep, goats, pigs, and chickens is a major source of noxious gases, harmful pathogens and odour; are pollutants of increasing concern both to the public and to regulatory bodies because they have the potential to contaminate both surface and groundwater. ● Hence, livestock waste has to be managed properly to mitigate production of these pollutants in order to protect the environment. ● Proper utilisation of livestock waste into biogas, compost and vermin-compost making can be very useful to increase crop yield and sustainability.



Specific Indicators	Justification
Innovation	<ul style="list-style-type: none"> • The sustainable green innovations are aimed at the generation of high-quality innovative products that can reduce environmental footprint • To increase R&D expenditure in green technology as a target setting. • Monitoring and evaluation based on the current R&D expenditure and tangible benefits • Action plan should identify strategic partners for new mixing system that is more energy efficient. • The responsibility and timeline will be conducted by the Finance Dept. to report the current and past R&D spending. R&D Dept. should identify strategic partners
Management	<ul style="list-style-type: none"> • The processes of green knowledge management play a special role in sustainable development, more specifically the creation, acquisition, exchange, and use of knowledge, as well as its impact on green technologies, eco-innovations, and the socio-economic dimension of sustainable development • Livestock farm management indicators have the potential to help policy makers take into account the linkages and trade-offs between different management practices and their impact on the environment, including: whole farm management involving the overall livestock farming system; and livestock farm management aimed at specific practices related to nutrients, pests, soils, and waste. • Pest management indicators measure the share of cultivated agricultural area that is not treated with pesticides and the share of cultivated agricultural area under integrated pest management.



3.4 Implementation and Action Plan

3.4.1 Preparation and Target Setting

- An integrated and strategic approach is needed to support the greening of livestock, which includes a compromise between the environment and the economy. Targeted implementation of this guideline using methods used in other types of industries and adopted to the unique agricultural working environment and domain is suggested while guideline targeting the greening of the livestock industry should comprise a mix of market-based, regulatory, voluntary and information-based indicators.
- No single guideline can effectively promote the greening of livestock 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 livestock practices. 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 the livestock sector.
- However, this needs to be differentiated from just as a way of blaming farmers for non-adoption rather than explaining the often-tangible reasons for their attitude. The availability of support infrastructure is among the significant impediments to the adoption of green initiatives.



- Thus, strategies such as improved management of the existing green information, livestock-specific economic support programs and livestock 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. eco-labelling, public disclosure) can therefore strengthen the effectiveness of this guideline.

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

In this section, a framework is introduced to help industries in recognizing the various certificates, recognitions and benefits that exists within Malaysia. Using this framework, farmers can refer to the specific guidelines and best practices that support the application of green practices in the livestock industry. Farmers can also refer to the indicators that align with the various existing initiatives.



SUSTAINABLE LAND USED

- Ensure growth of local environment and social infrastructure through effective conservation, restoration, rehabilitation and resettlement and responsible livestock practices.
- Minimize risk to natural resources and biodiversity .



SUSTAINABLE WATER USED

- Rethink and redesign livestock activities to prevent and reduce impact on natural water resources.



WASTE MANAGEMENT

- Manage waste effectively and responsibly to reduce, reuse, recycle, recover and ensure safe disposal of livestock waste.
- Transform towards a circular economy and create value out of the waste.

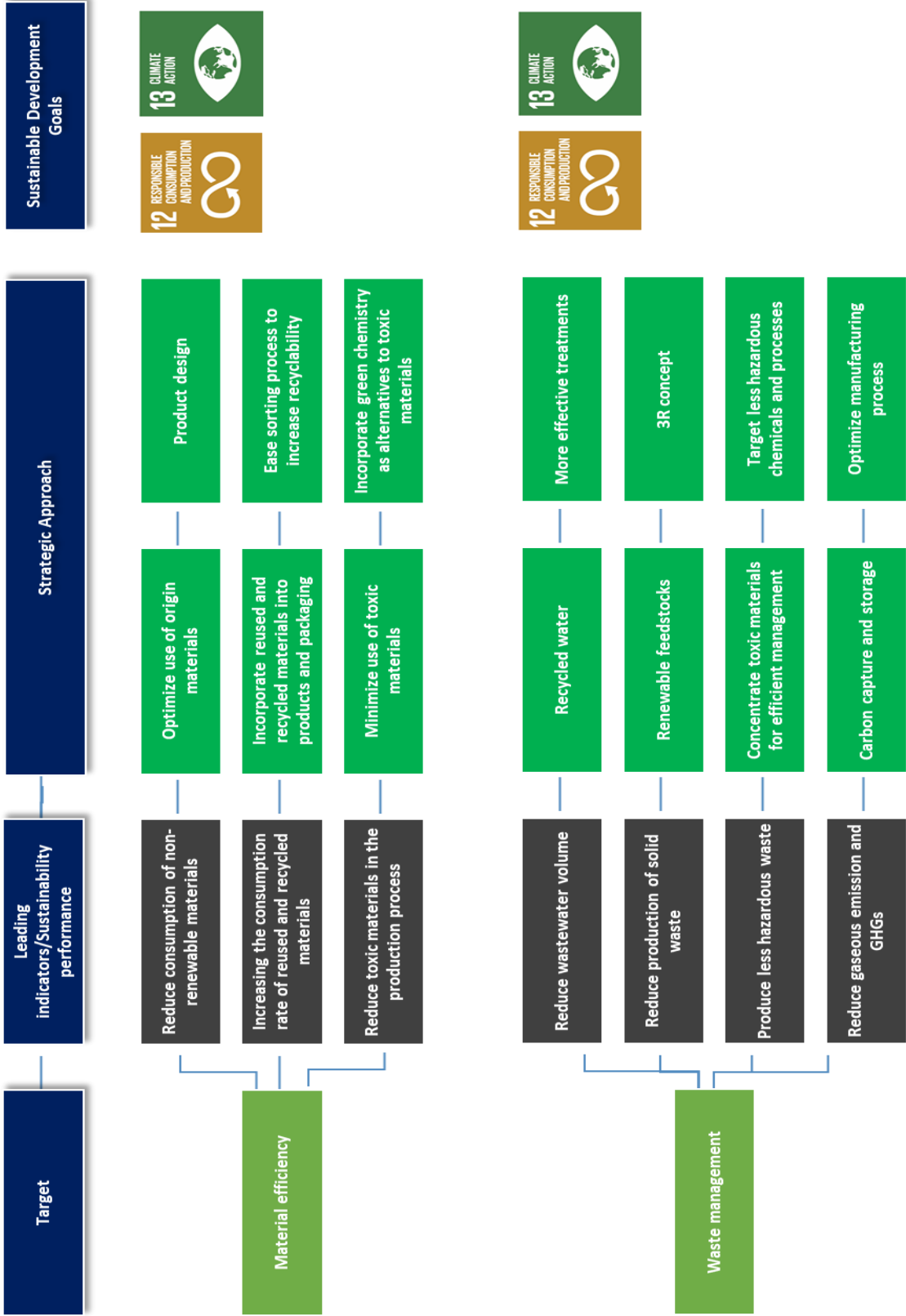


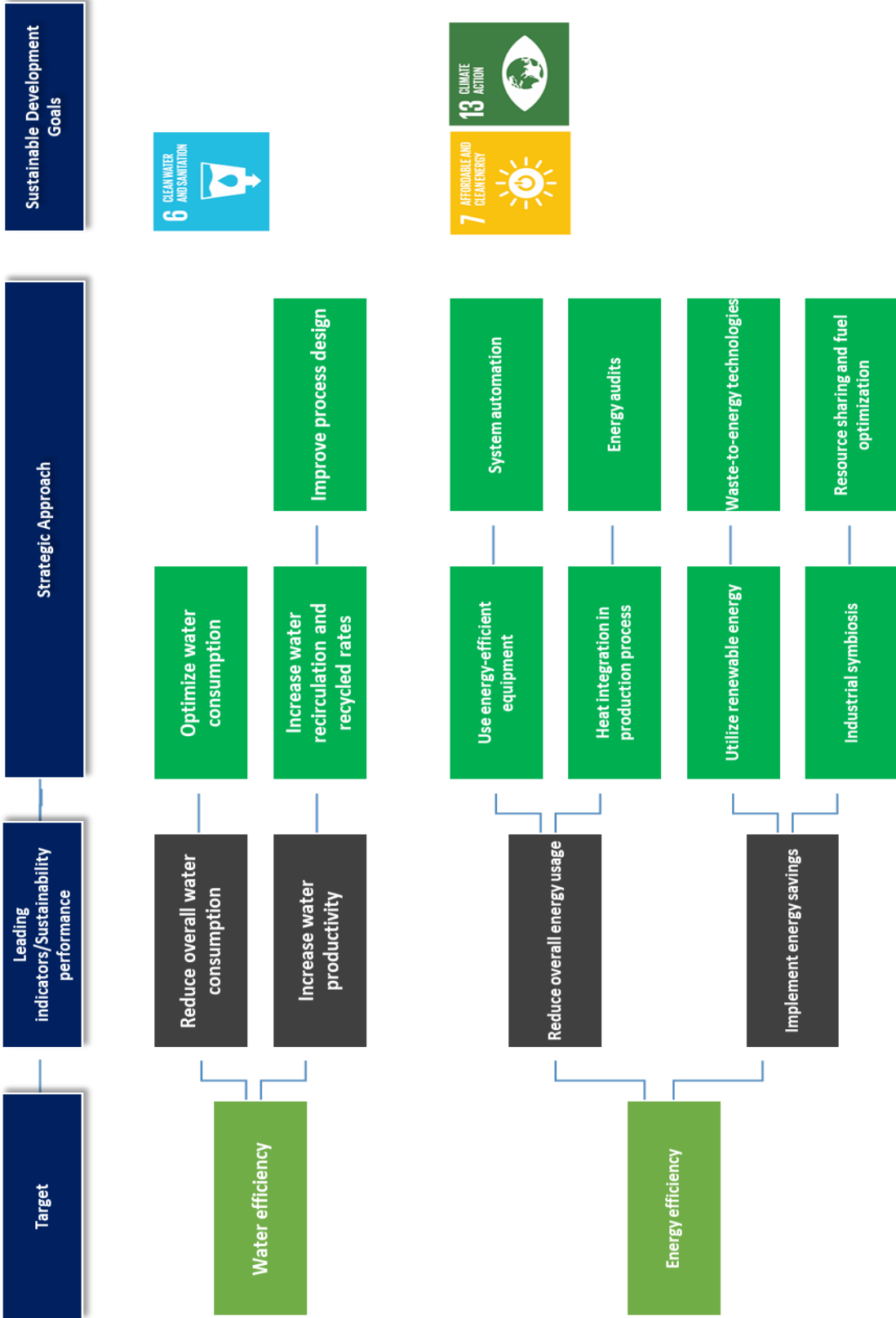
EMISSION REDUCTION

- Adopting low-carbon emission strategies.



Green Initiatives	Agency/ Institutions	Description	Criteria for assessment	Green Practices Indicator	Benefits	References
Green Investment Tax Allowance (GITA)	MIDA	Incentive for companies that undertake Green Technology projects involving capital investments.	<ul style="list-style-type: none"> Renewable Energy (RE) Energy Efficiency (EE) Green Building Green Data Centre Integrated Waste Management 	<div style="background-color: red; color: white; padding: 2px; text-align: center;">WASTE</div> <div style="background-color: blue; color: white; padding: 2px; text-align: center;">ENERGY</div>	Tax allowance	https://www.mida.gov.my/wp-content/uploads/2020/12/Green-technology-High-Res-Final.pdf
Anugerah Industri Hijau	Dept. of Environment (DOE)	An initiative by the DOE to provide special recognition and encouragement to SMEs for the efforts of implementing green livestock industry practices.	Green activities and initiatives on water usage, electricity, fuel, raw materials, packaging materials, waste production, product lost, raw materials lost and wastewater production	<div style="background-color: green; color: white; padding: 2px; text-align: center;">WATER</div> <div style="background-color: red; color: white; padding: 2px; text-align: center;">WASTE</div> <div style="background-color: blue; color: white; padding: 2px; text-align: center;">ENERGY</div> <div style="background-color: orange; color: white; padding: 2px; text-align: center;">MATERIAL</div>	Improved reputation and branding	http://www.doe.gov.my/portal/v1/wp-content/uploads/2014/07/Syarat-penyertaan-dan-borang-penyertaan-AIH.pdf
National Green Technology Policy (NGTP)	KASA *previously developed under KeTTHA	This policy recognises green technology as a driver to accelerate the national economy and promote sustainable development	<ul style="list-style-type: none"> Energy sector Building sector Water and waste management sector 	<div style="background-color: green; color: white; padding: 2px; text-align: center;">WATER</div> <div style="background-color: red; color: white; padding: 2px; text-align: center;">WASTE</div> <div style="background-color: blue; color: white; padding: 2px; text-align: center;">ENERGY</div> <div style="background-color: black; color: white; padding: 2px; text-align: center;">MANAGEMENT</div>	Reduction in the rate of GHG emission	https://policy.asiapacificenergy.org/sites/default/files/National%20Green%20Technology%20Policy%2009.pdf
Feed-in Tariff (FiT)	SEDA	Mechanism under the Renewable Energy Policy to catalyse generation of Renewable Energy (RE) up to 30 MW in size.	<ul style="list-style-type: none"> Biogas Solar Photovoltaic 	<div style="background-color: green; color: white; padding: 2px; text-align: center;">WATER</div> <div style="background-color: red; color: white; padding: 2px; text-align: center;">WASTE</div> <div style="background-color: black; color: white; padding: 2px; text-align: center;">MANAGEMENT</div> <div style="background-color: blue; color: white; padding: 2px; text-align: center;">ENERGY</div> <div style="background-color: yellow; color: black; padding: 2px; text-align: center;">INNOVATION</div>	Reduce CO2 emissions and secure domestic energy supply, and guarantee investment security for renewable energy investors	http://www.seda.gov.my/portal/fit/
MyGAP	MOA	Good Agricultural Practice (GAP) is an agricultural practice that addresses environmental, economic, and social aspects in order to ensure healthy and excellent quality products.	<ul style="list-style-type: none"> Livestock sites (private / rented / temporary possession / lease) are lawfully maintained and operated. For at least 1 year or one cycle, the person should be running livestock and has a record production of harvests. 	<div style="background-color: yellow; color: black; padding: 2px; text-align: center;">INNOVATION</div> <div style="background-color: black; color: white; padding: 2px; text-align: center;">MANAGEMENT</div>	Improved reputation and branding	https://www.mafi.gov.my/skim-amalan-pertanian-baik-malaysia-mygap-

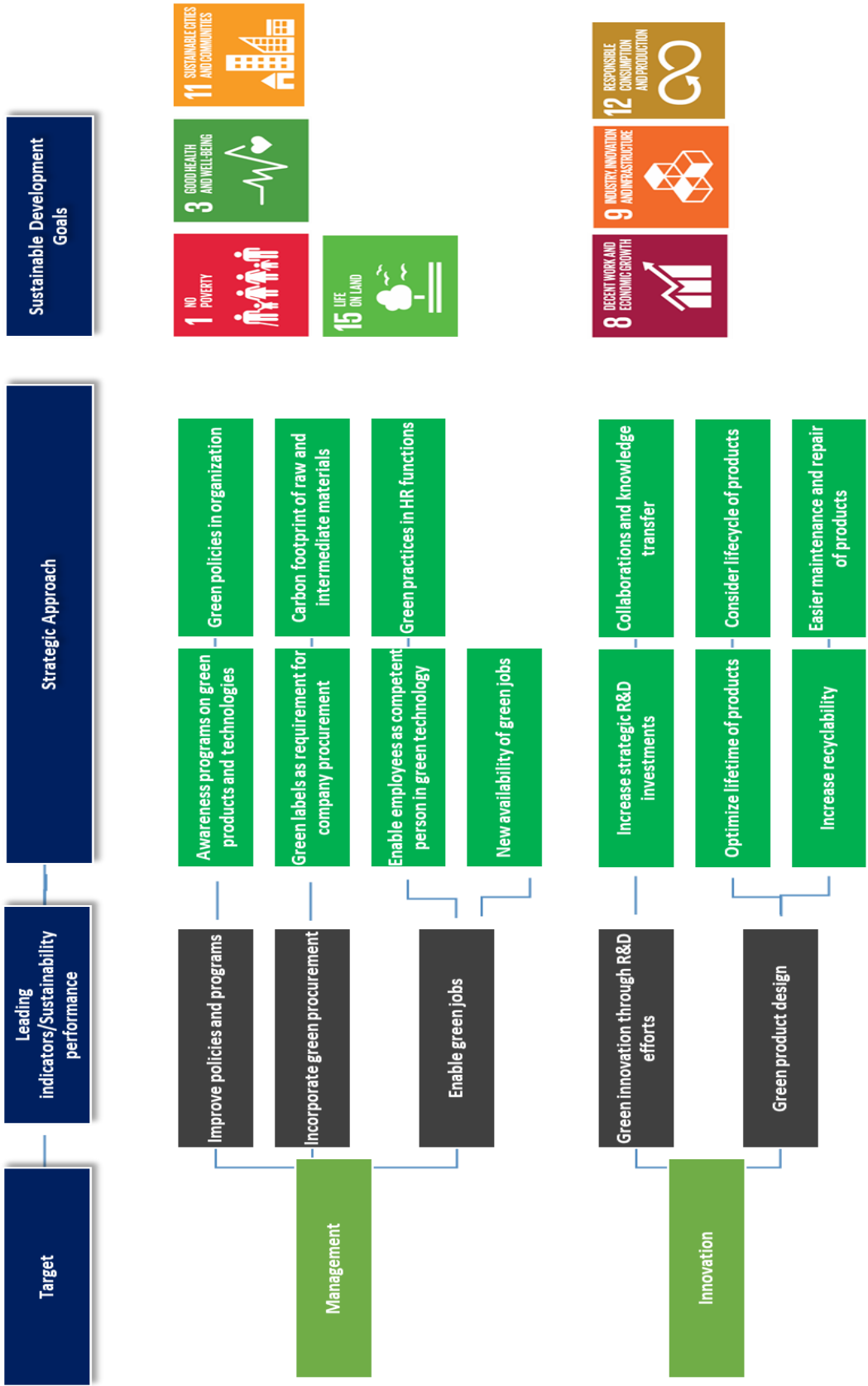




Green and Climate-Smart Livestock Farm



Green and Climate-Smart Livestock Farm





3.6 Roadmap toward Greed Certification

3.6.1 Issues and Challenges.

- Governments should consider Market-Based Instruments (MBIS) such as taxes, charges, tradable permits as least-cost guidelines, yet spur technological innovations. Moreover, successful implementation of guidelines requires a system of monitoring. To be effective, guidelines should be flexible and well-designed so as not to stifle technological innovations among livestock industries.
- Despite having support in terms of government policies and technical assistance, livestock farmers rarely adopt green practices.
- Livestock farmers often struggle to obtain accurate information about the benefits of green practices. Government support programs need to encourage adoption despite the lack of funding, inappropriate design, and ineffective targeting of incentives.
- 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. A growing, progressively more affluent, and urbanised Malaysian population will increasingly demand high-value foods, including meat, milk and other livestock products. As a response, farmers will exponentially increase livestock production and productivity.
- The future growth and transformation of the Malaysian livestock sector will be unprecedented. It will contribute to meet the consumers' demand for animal products and improve food security and nutrition. However, it might also generate negative effects on society: outbreaks of zoonotic diseases, such as avian influenzas and animal food borne diseases, can be disruptive; inappropriate production practices can pollute and degrade soil, water, and air; small farmers might be forced to exit the livestock sector, with negative impacts on their livelihoods.



- Apart from that, weak public pressure on green products or processes may also create barriers towards the adoption of green livestock, other than supply barriers and poor supplier commitment.
- It is crucial that an enabling environment can be achieved where strategic partnerships are made among all stakeholders (industry, government, academia and the public) to develop the regulatory and institutional framework, the fiscal instruments of incentives and investment mechanisms, the capacity, and public advocacy in terms of the green market.

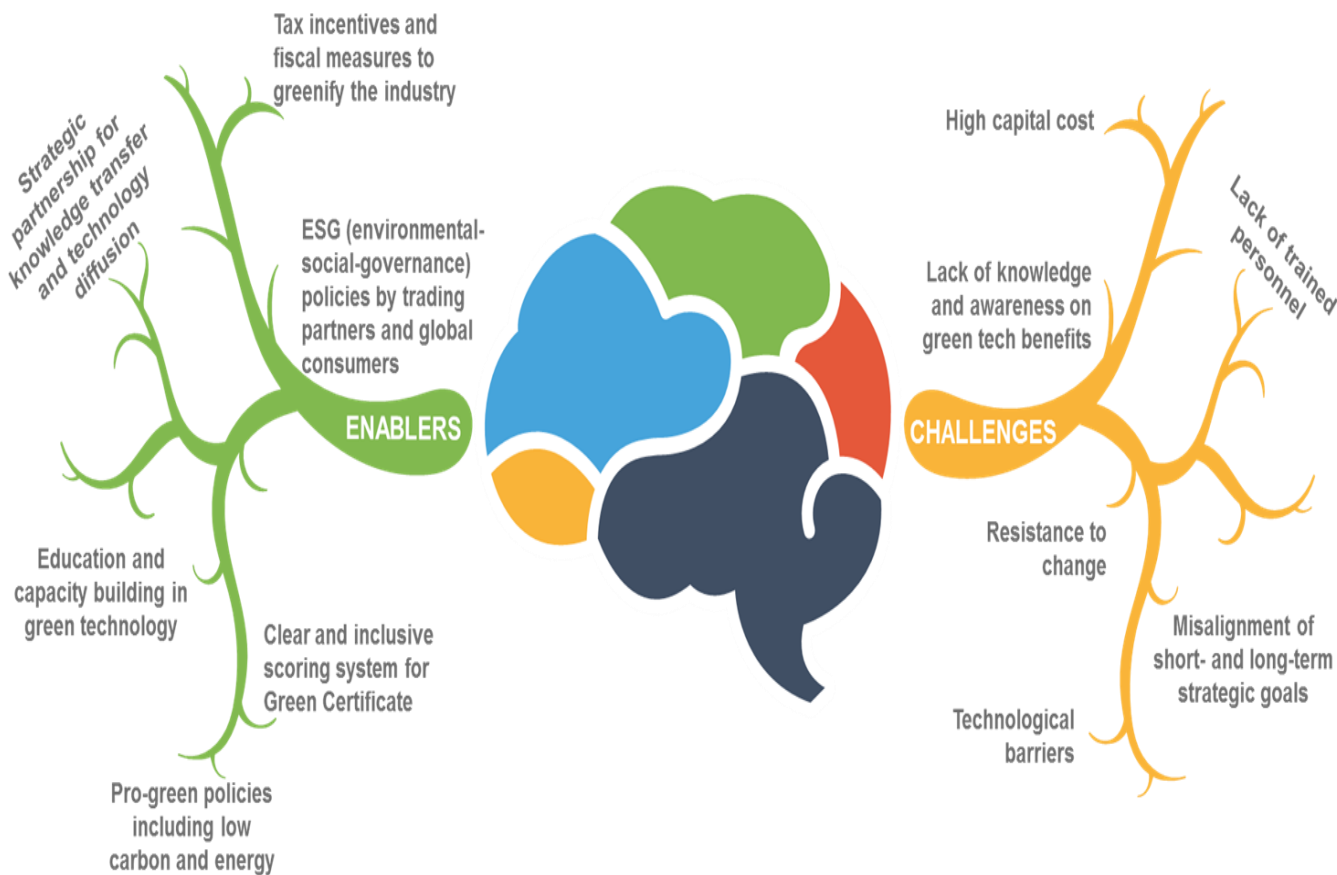


Figure 3.11. The challenges and enablers for the successful implementation of green practices in the livestock sector



Towards Green Recognition and Certification Roadmap

- The guideline describes the recommendations and proposed actions that livestock farmers can adopt to implement green practices in their daily operations. This is driven by the eventual development of a Green Certificate which recognizes the green practices in the industry.
- The Green Certificate Roadmap is proposed as shown below. This roadmap is developed to ensure that the industry is facilitated in implementing green practices within their operations.



Figure 3.12. The Green Certificate Roadmap

- The **Development phase** mainly sets the stage for any approaches that allow various entities to diagnose the current situation and plan a strategic framework. It is aimed at low-hanging fruits; such as education and capacity building are at a systemic level and require long-term commitment before the impacts can be seen.
- The **Facilitation stage** involves an assessment of actions taken during the initial stages and the performance of all strategic partners. This provides a foundation in developing financial mechanisms to increase buy-ins from the industry, as well as communication strategies to facilitate adherence to the new green regulatory framework. A clear cost-benefit analysis, both monetary and non-monetary, must be in place.
- Finally, the **Implementation stage** describes the requirement for a clear advisory support system with full capacity to fund and implement the program. Another key item is the scoring mechanism for the Green Certificate which the industry must adhere to, to be awarded. Only once all these capacities are in place, can the Green Certificate Scheme be implemented successfully.
- It is envisioned that livestock farmers who have implemented green and best practices in the industry may apply for the Green Certificate, which is recognized by the Government of Malaysia, hence being eligible for, as of now, proposed financing benefits and support.

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