ERIA Research Project Report FY2025, No. 4

Preliminary Scoping Study on Building and Enhancing Sustainable Agriculture and Food Systems in ASEAN Countries

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List of Abbreviations and Acronyms

AMR	antimicrobial resistance
ASEAN	Association of Southeast Asian Nations
BPK	Badan Pemeriksa Keuangan
BCA	biological control agent
BCG	bio-circular-green
CGIAR	Consultative Group on International Agricultural Research
CLMV	Cambodia, Lao PDR, Myanmar, and Viet Nam
CSA	climate-smart agriculture
ERIA	Economic Research Institute for ASEAN and East Asia
FGD	focus group discussion
G20	Group of 20
GAP	good agricultural practices
GHG	greenhouse gas
GMO	genetically modified food
HHPs	highly hazardous pesticides
ICT	information and communication technology
isIPM	integrated pest management
IUU	illegal, unreported, and unregulated
LCD	low carbon development
M&E	monitoring and evaluation
MRLs	minimum residual limits
MSMEs	micro, small, and medium-sized enterprises
MyGAP	Malaysia Good Agricultural Practices
NAPA	National Adaptation Programs of Action of Myanmar
isR&D	research and development
SDGs	Sustainable Development Goals
SFM	sustainable forest management
SRP	Sustainable Rice Platform

SMEs	small and medium-sized enterprises
SPS	sanitary and phytosanitary
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFAO	Food and Agriculture Organization of the United Nations
WWF	World Wide Fund for Nature

Overview

The global population has reached nearly 8 billion in recent years, and this upward trend continues to accelerate. As such, increasing the food supply is essential for ensuring human prosperity. This will become even more important as the world strives for stable economic growth while simultaneously addressing the environmental impact and the broader aspects of social well-being. These considerations – underpinned by good governance, often referred to as sustainability – will play a critical role in the future.

The ASEAN region has experienced both economic expansion and population growth. Agriculture remains one of the key sectors in terms of economic contribution and employment generation. Moreover, in the context of ongoing global volatility – such as climate change and geopolitical uncertainty – ensuring stable food production and food security is becoming an increasingly urgent priority for the region.

To address these challenges, the ASEAN Regional Guidelines for Sustainable Agriculture in ASEAN: Developing Food Security and Food Productivity in ASEAN with Sustainable and Circular Agriculture was adopted by the ASEAN Ministers on Agriculture and Forestry during the 44th AMAF Meeting on 26 October 2022. These Guidelines aim to promote sustainable agriculture across the region while enhancing food security. As a follow-up to the adoption of the Guidelines, a practical action plan must be formulated. This plan should incorporate national priorities, urgency of action, and country-specific needs for transitioning to sustainable agricultural practices.

As an initial step, a scoping study was conducted to identify priority areas for strengthening sustainable food systems within the ASEAN context and according to the national goals of each Member State. This report presents the findings and analysis from the study, which are primarily based on a questionnaire survey of 774 respondents from ten ASEAN countries. Chapter 2 of the report outlines the survey topics and consolidated results, while Chapters 3 to 12 provide country-specific summaries, highlighting recent policy developments related to the identified subjects.

Sustainable Key Actions and Initiatives Across ASEAN

The respondent countries in ASEAN have identified three primary sustainable agriculture initiatives: enhancing soil health, fertility, and biodiversity; reducing agricultural inputs; and promoting sustainable crop production and intensification. Notably, disparities were observed between Cambodia, Lao PDR, Myanmar, and Viet Nam (CLMV) and non-CLMV countries. For example, initiatives such as digital agriculture and the use of disruptive technologies, which require robust policy frameworks and significant technological investment, are more prevalent in non-CLMV countries.

From a national perspective, ASEAN countries have consistently applied sustainable crop production and intensification, safe and sustainable agriculture and food standards, and agroecology as their top three initiatives. These actions are aligned with the broader regional strategies aimed at institutionalising sustainable agriculture and resilient food systems.

Prioritised Strategies in the Short and Mid-to-Long Term

Amongst the 28 key strategies outlined in the Guidelines, improving soil health ranks as a top priority in both the short term and the mid-to-long term. In the short term, strategies are generally more oriented towards economic outcomes, such as connecting smallholders to markets. In contrast, the mid- to long-term strategies reflect broader sustainability concerns, focusing on ensuring food security and reducing greenhouse gas emissions (GHGs) from agriculture-related activities.

Challenges and Proposed Solutions for Sustainable Agriculture and Food Systems

The implementation of the Guidelines faces several challenges, which fall into six main categories. CLMV countries experience the most significant barriers in access to finance and markets, whereas non-CLMV countries face more critical limitations in terms of resources, including human capital and agricultural inputs.

Solutions have been categorised and mapped at three levels: farm, provincial, and national. At the farm level, the most frequently cited solutions involve education and the application of knowledge. At both the provincial and national levels, financial and market support emerge as the most dominant and impactful solutions across the ASEAN region.

Creating an Enabling Environment for Implementation

To facilitate the implementation of sustainable agriculture and food systems, the enabling environment was assessed in terms of policy frameworks, education, and financial support. The findings revealed that 51.4%, 76.0%, and 64.1% of respondents recognised the importance of these respective aspects. Across all three dimensions, non-CLMV countries reported higher levels of readiness compared to their CLMV counterparts.

When it comes to the adoption of innovative technologies, biofertilisers, biopesticides, and pest management technologies are the most widely adopted in the ASEAN region, particularly in non-CLMV countries. In contrast, advanced manufacturing, post-harvest processing, and packaging technologies are more prevalent in most CLMV countries.

Chapter 1

Introduction: Progress of Concerted and Collective Efforts Towards Sustainable Agriculture in ASEAN

Masanori Kozono and Venkatachalam Anbumozhi

1.1. Global Efforts to Realising Sustainable Agriculture

Globally and regionally, agriculture and food systems are facing unprecedented challenges. These include rising food demand from a growing population, increasing malnutrition, the adverse impacts of climate change, overexploitation of natural resources, escalating carbon emissions, biodiversity loss, and food waste. In addition to these long-term issues, recent external shocks – such as the COVID-19 pandemic and geopolitical tensions – have had significant direct and indirect effects on agriculture and food systems. These disruptions have exacerbated food insecurity, driven food prices to record highs, and led to shortages of essential agricultural inputs like fertilisers.

Recent international discussions have underscored the urgent need to transform agriculture and food systems into more sustainable and resilient models. Addressing both immediate challenges and long-term sustainability concerns requires strengthening not just agriculture but the entire food system, encompassing all actors and activities from production to consumption. Ensuring food availability and affordability for all hinges on this transformation.

In 2021, the United Nations (UN) Food Systems Summit and its Pre-Summit were held in New York (September) and Rome (July), respectively. These global events brought together heads of state, ministers, government representatives, international organisations, private sector stakeholders, non-governmental organisations, and other key actors to leverage food systems in advancing all 17 Sustainable Development Goals (SDGs). The discussions highlighted the need to enhance both productivity and sustainability in agriculture and food systems. Many ASEAN countries emphasised these priorities during the summit, recognising that there is no 'one-size-fits-all' approach to food system transformation. Instead, strategies must be tailored to local environmental and socio-economic conditions (UN Food Systems Summit, 2021).

At the G20 level, the interconnectedness of food security, nutrition, environmental sustainability, and economic development has been widely acknowledged. The 2023 G20 Declaration emphasised the importance of adopting sustainable and resilient agricultural practices, including climate-smart agriculture, to mitigate and adapt to climate change (G20, 2023). The declaration also underscored the need to reduce food loss and waste, promote healthy diets, and empower smallholder farmers. By fostering innovation,

investing in research and development, and strengthening international co-operation, the G20 aims to create a more sustainable and equitable global food system.

1.2. Efforts Towards the Development of Sustainable Food Systems in Developed Countries: The Case of Japan and Others

Since around 2020, many developed countries have actively implemented national and regional initiatives to transform agriculture and food systems into more resilient and sustainable models.

In Japan, the Prime Minister announced in October 2020 that the country aims to achieve net-zero greenhouse gas (GHG) emissions by 2050, creating a carbon-neutral and carbon-free society. In line with this commitment, the Ministry of Agriculture, Forestry, and Fisheries (MAFF) introduced the 'Measures for Achievement of Decarbonization and Resilience with Innovation' ('MIDORI') in May 2021. This medium- to long-term strategy seeks to develop a sustainable food system by engaging stakeholders across the supply chain and promoting innovations that reduce environmental impact (MAFF Japan, 2021). The strategy outlines the following key targets:

- Achieve zero CO_2 emissions from fossil fuel combustion in agriculture, forestry, and fisheries by 2050.
- Reduce the risk-weighted use of chemical pesticides by 50% through Integrated Pest Management and newly developed alternatives by 2050.
- Reduce chemical fertiliser use by 30% by 2050.
- Expand organic farming to 1 million hectares (25% of farmland) by 2050.
- Improve food manufacturing productivity by at least 30% by 2030.
- Ensure sustainable sourcing for imported materials by 2030.
- Achieve 90% or higher adoption of superior forestry seed varieties.
- Reach 100% artificial seedling rates in aquaculture for species such as Japanese eel and Pacific bluefin tuna.

MAFF has emphasised that these targets will be achieved through the development and dissemination of innovative technologies. In July 2022, Japan enacted a law to support the implementation of the 'MIDORI' strategy. This legislation establishes the basic principles for achieving 'MIDORI', certifies plans by stakeholders working to reduce environmental impact, and provides financial support measures such as tax incentives and loans (MAFF Japan, 2023).

Prior to Japan's 'MIDORI' strategy, the European Union (EU) launched the 'Farm to Fork Strategy' in 2020, aiming to create a fair, healthy, and environmentally friendly food system. The strategy set quantitative targets for 2030, including a 50% reduction in the overall use and risk of chemical pesticides and a 50% reduction in food waste per capita (European Commission, 2020). Similarly, in 2020, the United States (US) Department of Agriculture introduced the 'Agriculture Innovation Agenda', which aims to increase US

agricultural production by 40% while halving the sector's environmental footprint by 2050 through innovation-driven solutions (USDA, 2020).

Developed countries have taken the lead in enhancing agricultural productivity while minimising environmental impact, offering valuable insights and models for ASEAN countries as they work towards more sustainable food systems.

1.3. The Collective Efforts of ASEAN Countries

As a regional framework for ensuring food security, ASEAN adopted 'The ASEAN Integrated Food Security (AIFS) Framework and Strategic Plan of Action on Food Security in the ASEAN Region (SPA-FS) 2021–2025' (ASEAN Secretariat, 2020) during the ASEAN Ministers of Agriculture and Forestry (AMAF) meeting in October 2020. The framework aims to ensure long-term food security while improving the livelihoods of farmers across the region.

Although the AIFS Framework and SPA-FS 2021–2025 recognised sustainable agricultural production as an emerging challenge, concrete initiatives to address it remained limited, mainly focusing on reducing post-harvest losses and food waste. At the time, sustainable agriculture and food systems had yet to become central concepts in ASEAN's food security agenda, and a comprehensive action plan with clear performance indicators and monitoring mechanisms had not been established.

However, the 'ASEAN Comprehensive Recovery Framework (ACRF)', adopted at the ASEAN Summit in November 2020 as a consolidated exit strategy from COVID-19, highlighted the importance of investing in sustainable agriculture and food systems. The ACRF Implementation Plan also called for the development of 'ASEAN Guidelines for Sustainable Agriculture', though it did not specify a timeline.

In response, AMS adopted the 'ASEAN Regional Guidelines for Sustainable Agriculture' at the 44th AMAF meeting in October 2022. The guidelines introduced five core principles and recommended 28 key strategies to promote sustainable agriculture across the region. These principles and strategies laid the foundation for regional, national, and subnational policies, providing a framework for transforming agriculture into a more productive, sustainable, and inclusive sector. Notably, this document marked ASEAN's first consolidated regional strategy dedicated to enhancing the sustainability of agriculture.

Following the directive from the 45th AMAF meeting in October 2023, AMS worked together to develop the 'Action Plan for Sustainable Agriculture in ASEAN', which was officially adopted at the 46th AMAF meeting in October 2024. This action plan serves as a roadmap to enhance regional cooperation, coordination, and knowledge-sharing in sustainable agricultural transformation. It focuses on five strategic priority areas:

1. 'Decarbonisation'
2. 'Reduction of harmful agrochemicals'
3. 'Digitalisation in agriculture'

4. 'Climate change adaptation'
5. 'Public–private partnerships'

Each priority area includes specific projects with defined timeframes outlined in the annex, making it a practical and actionable plan that fosters cross-sectoral coordination amongst AMS.

Furthermore, the 'ASEAN Leaders' Declaration on Strengthening Food Security and Nutrition in Response to Crises', adopted at the ASEAN Summit in September 2023, reaffirmed ASEAN's commitment to strengthening preparedness for long-term resilience and sustainability in agri-food systems. In this context, achieving sustainable agriculture has become a crucial goal for ensuring food security in ASEAN, addressing the four interrelated dimensions:

- 'Physical availability of food'
- 'Economic and physical access to food'
- 'Food utilisation'
- 'Stability of food supply'

Over the past 5 years, sustainable agriculture has evolved into a central focus of ASEAN's agricultural policy, reflecting the region's growing commitment to food security, environmental sustainability, and economic resilience.

1.4. Collaborative Framework with ASEAN Partners to Realise Sustainable Agriculture in ASEAN: ASEAN–Japan MIDORI Cooperation Plan

ASEAN has established various collaborative frameworks with its development partners, including the ASEAN Plus Three (China, Japan, and the Republic of Korea), one of the region's most comprehensive cooperation mechanisms.

In the context of bilateral cooperation, ASEAN–Japan relations have spanned over 50 years. In the agriculture, forestry, and fisheries sectors, Japan proposed the 'ASEAN–Japan MIDORI Cooperation Plan' at the 22nd Meeting of ASEAN Ministers on Agriculture and Forestry Plus Three (AMAF+3) in October 2022. This initiative aimed to strengthen ASEAN–Japan collaboration in sustainable agriculture. In 2023, marking the 50th anniversary of ASEAN–Japan friendship and cooperation, discussions led to the elevation of the MIDORI Cooperation Plan to a joint initiative between AMS and Japan.

On 4 October 2023, the inaugural 'ASEAN–Japan Ministers on Agriculture and Forestry Meeting' was held in Malaysia to commemorate the 50th anniversary of ASEAN–Japan Friendship and Cooperation. During this meeting, the ASEAN–Japan MIDORI Cooperation Plan, proposed by Japan's Minister of Agriculture (who served as co-chair), was unanimously adopted by AMS. Following this, a 'Symposium on Promoting Resilient and Sustainable Agriculture and Food Systems through Innovation' was held on 21 November

2023 in Jakarta, Indonesia. At this event, an overview of the MIDORI Cooperation Plan and its specific cooperation projects was presented and discussed (MAFF Japan, 2024).

The MIDORI Cooperation Plan has since become a key framework for transferring cutting-edge Japanese agricultural technologies to AMS, with a focus on agricultural innovation. It aims to accelerate the adoption of advanced technologies to enhance productivity, mitigate the impacts of climate change, and promote resilience and sustainability in ASEAN's agricultural sector. The initiative leverages smart agricultural practices, strong public–private partnerships (PPPs), and innovative solutions to address pressing challenges in the region.

Through initiatives like the MIDORI Cooperation Plan, sustainable agriculture and food system transformation – driven by technological innovation – are increasingly becoming central themes in ASEAN's cooperation frameworks with development partners.

1.5. ERIA's Collaboration with ASEAN in Realising Sustainable Agriculture and Food Systems

As outlined above, ASEAN has taken significant steps toward achieving sustainable agriculture by developing key policy frameworks such as the 'ASEAN Regional Guidelines for Sustainable Agriculture', establishing partnerships like the 'ASEAN–Japan MIDORI Cooperation Plan', and implementing various practical projects at both national and regional levels.

These efforts come at a critical moment when agriculture in ASEAN Member States faces the urgent need to transition toward sustainable practices. Climate change, environmental degradation, and increasing global demand for food security necessitate a fundamental shift in how food is produced and consumed across the region.

Rising temperatures, erratic rainfall patterns, and extreme weather events threaten crop yields and livestock productivity. Soil erosion, deforestation, and water pollution degrade agricultural land and ecosystems, compromising long-term productivity. Overreliance on synthetic fertilisers and pesticides harms soil health, contaminates water sources, and poses risks to human health. Meanwhile, a growing population and changing dietary patterns place additional pressure on agricultural systems to increase food production while ensuring nutritional security.

Addressing these challenges requires a concerted effort to promote sustainable agriculture, encompassing practices that enhance environmental, social, and economic sustainability. In support of this transition, ERIA has been working closely with the ASEAN Secretariat and AMS. Recognising the need for a comprehensive regional assessment, ERIA initiated a survey on sustainable agriculture in ASEAN to provide critical insights into its current state and identify key areas for improvement.

To support the implementation of the ASEAN Guidelines on Sustainable Agriculture, adopted in 2022, ERIA conducted a baseline study titled 'Building and Enhancing

Sustainable Agriculture and Food Systems in ASEAN: A Preliminary Scoping Study' in 2023. This study involved interviews with farmers and other stakeholders across all AMS to gather primary data on sustainable agricultural practices, identify priority areas for improvement, and assess the challenges faced by farmers and industry stakeholders.

The findings of this study were presented at the 45th ASEAN Ministers on Agriculture and Forestry (AMAF) Meeting. Additionally, the results and policy recommendations informed discussions amongst AMS, contributing to the development of the 'Action Plan for Sustainable Agriculture in ASEAN', which was adopted at the AMAF Meeting in 2024.

The survey findings are crucial for guiding ASEAN toward a more sustainable and resilient food system. By offering a comprehensive understanding of the current sustainability landscape, identifying key challenges and opportunities, and supporting evidence-based decision-making, this research plays a pivotal role in ensuring food security, environmental sustainability, and economic prosperity in the region.

The following chapters will detail the findings of this preliminary scoping study and the corresponding policy recommendations.

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Chapter 2

Sustainable Agriculture and Food Systems in ASEAN Countries

Achmad Solikhin, Sahara Sahara, Kentaro Yamada, Siti Mustaqimatud Diyanah

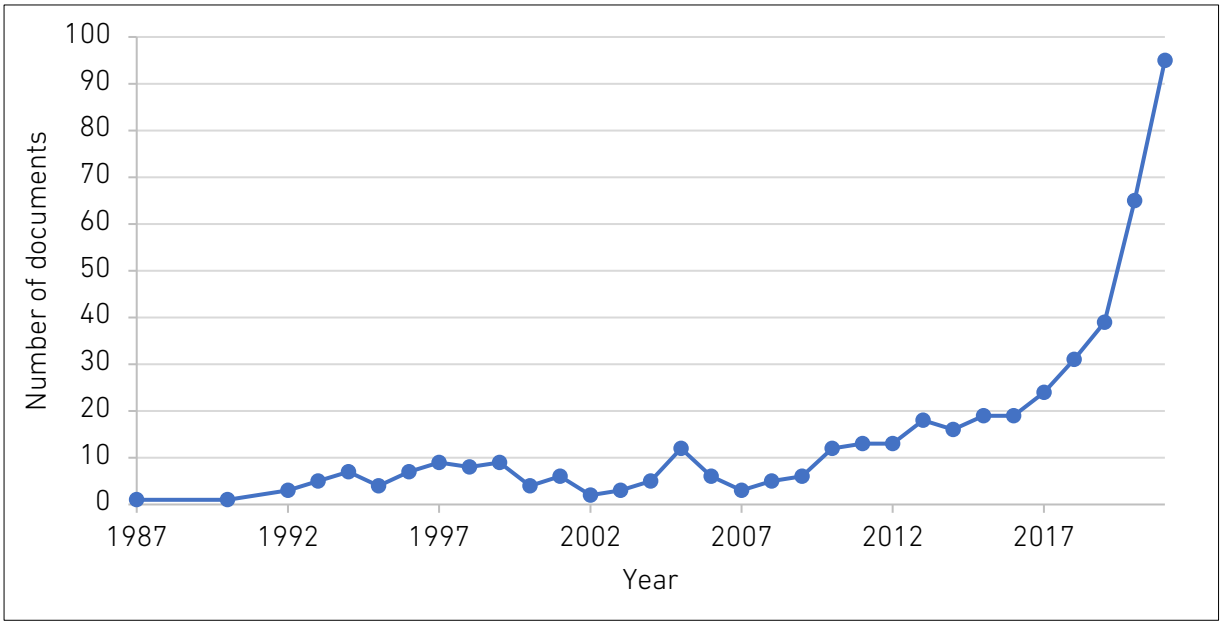
2.1. Background

Sustainable agriculture and food systems, which were emphasised by the United Nations (1987) and UNFAO (1989), has been the focal point for developing the economy whilst promoting environmental conservation, good governance, and social well-being for more than 30 years. The various frameworks have been developed (e.g. Velten et al., 2015) and applied in many regions and countries for the implementation of practical and effective initiatives related to sustainable agriculture and food systems. The frameworks would have been adopted in many contexts to keep the economic resiliency and maintain it for the future, whereas the recent initiatives of Sustainable Development Goals (SDGs) are also prominent.

ASEAN countries have been proceeding with many initiatives in line with the global trend for sustainable agriculture and food systems. Figure 2.1 shows that the number of published documents in ASEAN countries for studying sustainable agriculture and food systems has drastically increased since 2016 (see Appendix chapter 1 for the method to tally up the documents). The topical areas have variant dimensions and mainly include environmental integrity, economic resilience, social well-being, and good governance. Sustainable agriculture and food systems are, hence, not the targeted concept but the comprehensive and practical initiative that will keep proceeding in the future.

As one of the global initiatives, the ASEAN Regional Guidelines for Sustainable Agriculture in ASEAN – Developing food security and food productivity in ASEAN with sustainable and circular agriculture – (hereinafter called 'the Guidelines') was officially endorsed by the ASEAN Ministers on Agriculture and Forestry on 25 October 2022 (ASEAN Secretariat, 2022). The Guidelines proposed 5 principles and 28 key strategies for building and enhancing the sustainable agriculture and food systems for ASEAN countries whereas a practical action plan is needed to implement the Guidelines. To support the development of the action plan, a preliminary scoping study was conducted. In this report, the results, implications, and recommendations are presented based on country and regional surveys.

Figure 2.1. Number of Documents by Year for Sustainable Agriculture and Food Systems in ASEAN



Source: Scopus Bibliometric (2022), https://www.scopus.com/home.uri

2.2. Methods of Questionnaire Survey

2.2.1. Questionnaire Development

The questionnaire was developed in three steps: (i) building a draft of the questionnaire, (ii) pretesting the questionnaire, and (iii) refining and finalising the questionnaire. The draft of the questionnaire was developed according to information from a review of the literature or scoping reviews related to sustainable agri-food practices.

The pretesting of the questionnaire was conducted in Bogor, Indonesia to determine whether it was relevant and easily understood by farmers and actors along the agri-food value chain. This included assessing the wording of the questions, evaluating the reliability of all categories and items in the questionnaire, and obtaining feedback from respondents. The composition of the finalised questionnaire is presented in Table 2.1, and the detailed questionnaire is shown in the Appendices.

Table 2.1. Composition of the Questionnaire

No.	Question	Response Format
1	Key sustainable action/initiatives already applied	Choose all actions/initiatives applied by respondents and by others in the respondents' country respectively
2	Priority order amongst 28 key strategies in the Guidelines	Choose and rank the key strategies for short and mid- to long term, respectively
3	Challenges and constraints in implementing the Guidelines	Write three answers
4	Possible solution	Write who will do and what the solution is for the three levels
5	Policies, legislations, and regulations to implement sustainable agriculture	Answer Yes or No, and write the case if respondents know
6	Innovative technologies adopted for sustainable agriculture	Choose all technologies which the respondents know its adoption or implementation in their country
7	Education and training on sustainable agriculture	Answer Yes or No, and write the case if respondents know
8	Financing mechanism to finance sustainable agriculture	Answer Yes or No, and write the case if respondents know
9	Readiness in terms of economic dimension	Choose the readiness levels from 1 to 4 for each indicator respectively
10	Readiness in terms of environmental dimension	Choose the readiness levels from 1 to 4 for each indicator respectively
11	Readiness in terms of social well-being dimension	Choose the readiness levels from 1 to 4 for each indicator respectively

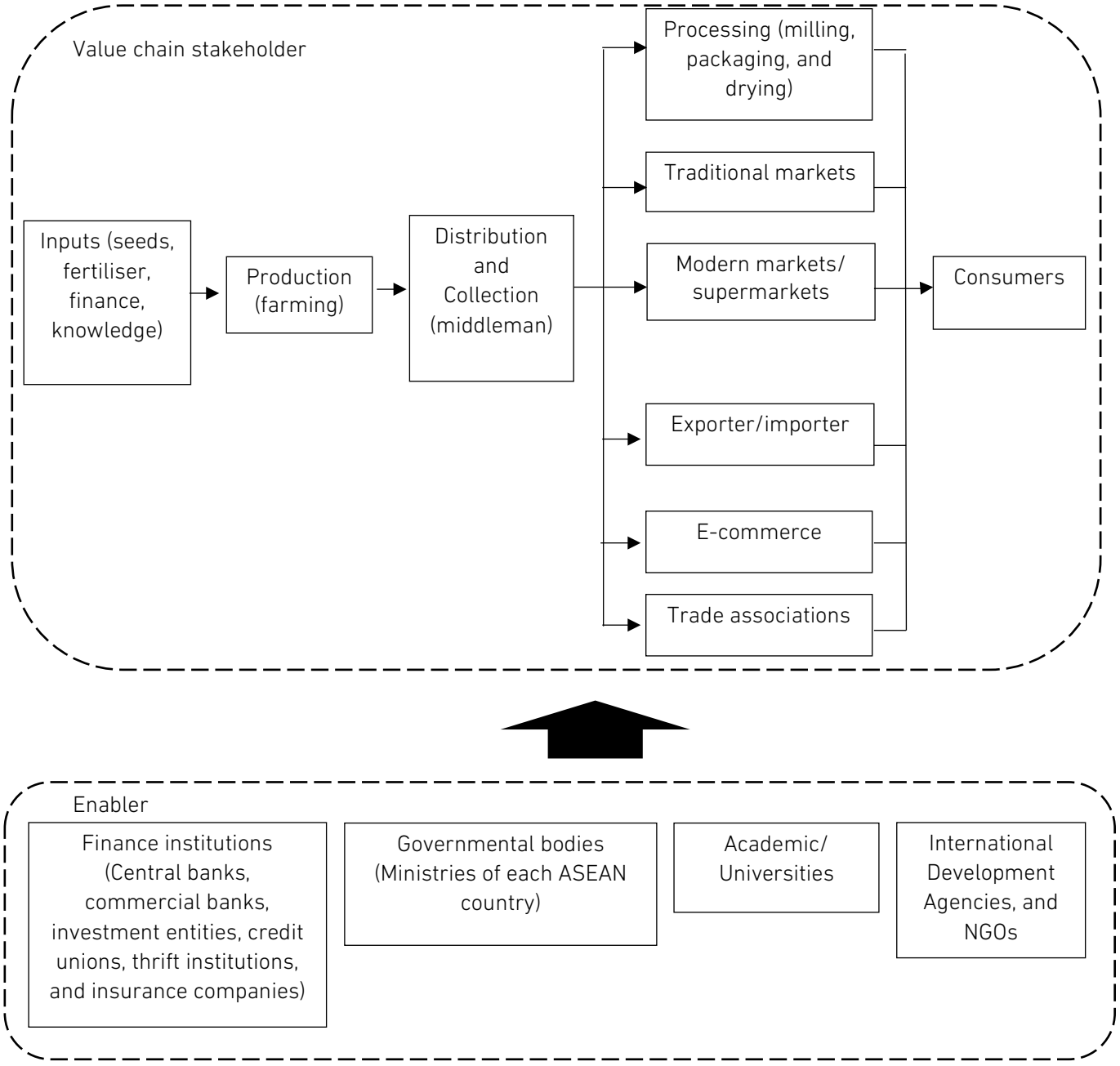
Source: Authors.

2.2.2. Respondents and Interview

The respondents are chosen by non-probability sampling and include the actors and the enablers of production, distribution and collection, food processing, marketing and market development, purchasing, preparation and consumption, resources, and waste recovery along the food value chain (Figure 2.2). The agriculture commodities are selected based on the priority food products in each country (Table 2.2). The interview arrangements were

carried out in the form of face-to-face interviews or focus group discussions (FGDs) by online, offline, and hybrid.

Figure 2.2. Components of Respondents



Source: Authors.

Table 2.2. Extracted Metadata on Methods, Agriculture Commodities, and Attributions of Respondents

ASEAN Countries	Methods Used	Date	Locations	Agriculture Commodities Studied
Brunei Darussalam	FGD, face-to-face interview, and online survey	2 December 2022–15 March 2023	Online, Gadong, Kuala Belait, Tutong, Brunei Muara	Rice and aquaculture
Cambodia	FGD, face-to-face interviews, online-interview	20 January–20 February 2023	Battambang City and Phnom Penh City	Rice and cassava
Indonesia	FGD and interview	27 January–24 February 2023	Bogor, Sukabumi, Cianjur, and Jakarta	Rice, crops, vegetables, sweet potato, cassava
Lao PDR	Face-to-face interview	11–16 January 2023	Vientiane capital	Rice and vegetable
Malaysia	Face-to-face interview and online interview	19 January–24 February 2023	Peninsular Malaysia	Rice and cocoa
Myanmar	Face-to-face interview	14 December 2022–18 January 2023	Zayarthirit Township and Pyinmana Township	Rice and vegetable
Philippines	Face-to-face interview and online interview	01 February–11 March 2023	Biliran Biliran, Silago Southern Leyte, Ormoc City, and Northern and Eastern Samar	Jackfruit
Singapore	Online survey	27 January–01 March 2023	Singapore city	Multiple, aquaponic products, coffee, crops, agri-food, cricket, fish, and cell line products

ASEAN Countries	Methods Used	Date	Locations	Agriculture Commodities Studied
Thailand	Online survey, face-to-face interview, and on-site survey	28 December 2022–10 February 2023	Thailand	Rice, cassava, and horticulture
Viet Nam	Online and offline survey	01 December 2022–28 February 2023	Hanoi, Nam Dinh, Bac Giang, Son La, Can Tho, An Giang	Rice, vegetable, fruit, pig, and aquaculture products

(continued)

ASEAN Countries	Number of Respondents (person)	Respondents' Sex (person)		Respondents' Type (person)		Respondents' Education (person)			
		Male	Female	Stakeholder	Enabler	Primary	Secondary	Vocational	Higher Education
Brunei Darussalam	75	51	24	44	31	6	26	0	43
Cambodia	63	32	31	46	12	23	14	0	19
Indonesia	80	60	20	51	29	24	21	1	34
Lao PDR	60	26	34	45	15	3	13	6	38
Malaysia	66	48	18	42	26	5	13	5	43
Myanmar	60[1] and 62[2]	58	64	122	62	22	34	1	64

ASEAN Countries	Number of Respondents (person)	Respondents' Sex (person)		Respondents' Type (person)		Respondents' Education (person)			
		Male	Female	Stakeholder	Enabler	Primary	Secondary	Vocational	Higher Education
Philippines	70	44	26	54	17	1	12	0	57
Singapore	32	20	12	12	20	0	0	0	32
Thailand	139	73	65	108	32	13	22	15	86
Viet Nam	67	48	19	55	12	8	33	11	15
TOTAL	774	460*	313*	579**	255**	105*	188*	39*	431*

FGD = focus group discussion.
Note:
*The total number of respondents varies, particularly in terms of sex, type, and education, due to incomplete information provided by the respondents.
**Some respondents were included as both stakeholders and enablers.
[a] Stakeholders
[b] Enablers
Source: Authors.

2.2.3. Compiling Each Result for Analysis

The survey data was entered in an Excel spreadsheet. Before the data analysis, it is important to verify whether the data file contains incomplete or inconsistent data. To avoid these problems, the study team performed the data cleaning process.

The data cleaning data process is primarily based on validating the ratio of responses, along with the comments and opinions from the respondents for prioritisation with integrity. For Q1 and Q6, the respondents can choose multiple answers, and the results are compiled as ratios. For Q2, prioritised key strategies are ranked first to fifth on each answer so that the scores are calculated to reflect the priority as follows.

(i) The numbers of first-ranked answers for each strategy are divided by total respondents in each country.

(ii) Number (i) is repeated for second- to fifth-ranked answers.

(iii) Each ratio led by (i) and (ii) is multiplied by fixed coefficients: 5 for the ratio of first-ranked answers, 4 for second-ranked, 3 for third-ranked, 2 for fourth-ranked, and 1 for fifth-ranked.

(iv) The scores are calculated with the sum of the ratios multiplied by the coefficients of each rank for each strategy.

(v) The scores are calculated for 'short term' and 'mid- to long term' each.

For Q3, the comments by the respondents are categorised, summarised, and calculated as the ratios for each category. For Q4, the answers are enumerated and summarised by country. For Q5, Q7, and Q8, the understanding of the respondents are calculated as ratios, and specific initiatives are enumerated and summarised by country.

The results based on the questionnaire and the analysis for the ASEAN region are introduced in Chapters 2 and 3.

2.3. Sustainable Key Actions or Initiatives Applied in the ASEAN Region (Q1 of the Questionnaire)

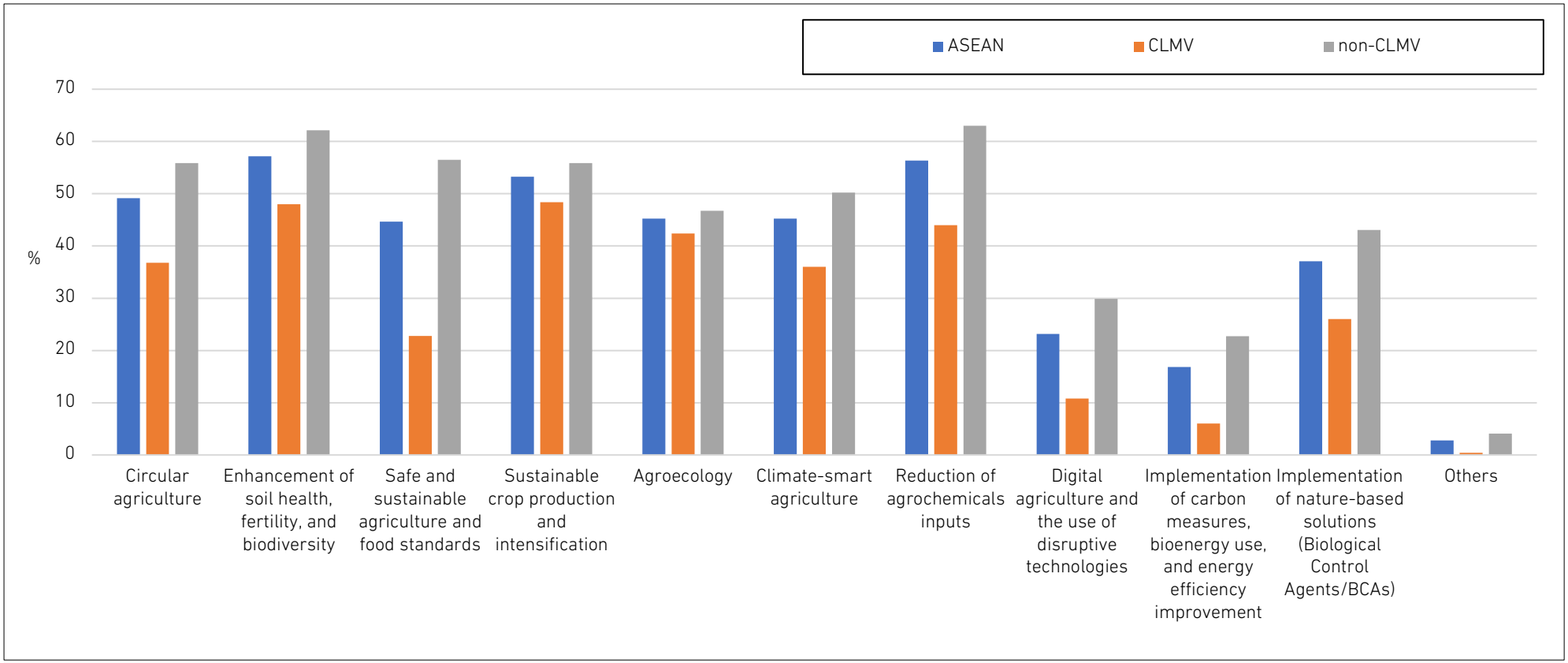
2.3.1. Applied by the Respondents

Figure 2.3 depicts the summarised graphs, showing that 11 initiated actions were questioned to respondents referring to the actions taken by respondents and the actions taken by other persons in the country. According to the result of respondents' personal views, the respondents of ASEAN countries have undertaken enhancement of soil health, fertility, and biodiversity (57.2%); reduction of agricultural input (56.3%); and sustainable crop production and intensification (53.2%) as the top three initiatives. These practical actions undertaken by the respondents of ASEAN countries are also similar to those of CLMV countries in which the ranking of the top three initiatives staged on the ground is

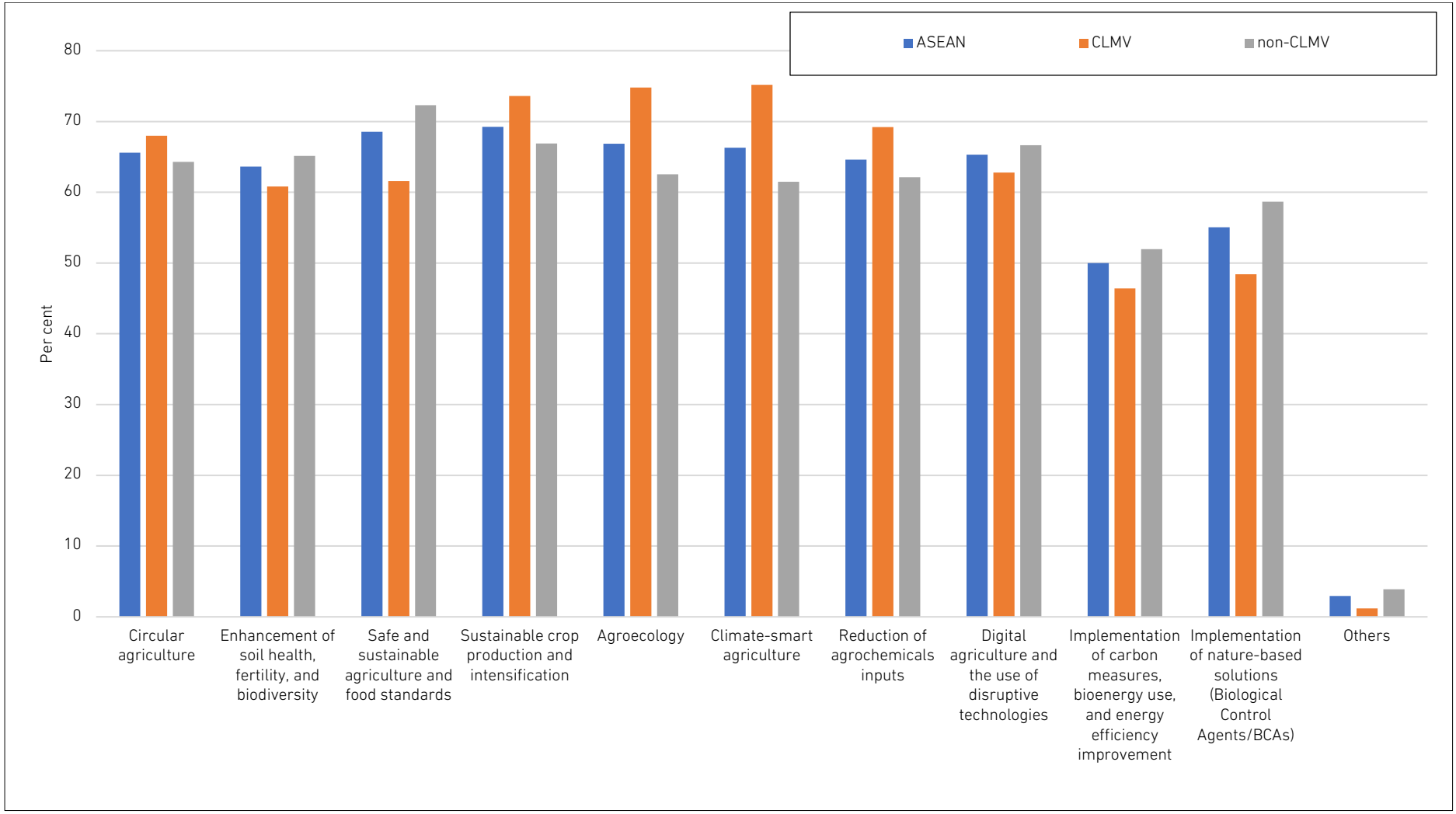
slightly different, namely, sustainable crop production and intensification (48.4%); enhancement of soil health, fertility, and biodiversity (48.0%); reduction of agrochemical input (44.0%). The gaps between the ratios of CLMV and non-CLMV countries are remarkable for safe and sustainable agriculture and food standards; digital agriculture and the use of disruptive technologies; and implementation of carbon measures, bioenergy use, and energy efficiency improvement. These actions need advanced public framework and technology, and the gaps between the CLMV and non-CLMV countries might easily emerge. It is also possible that the actions well undertaken in ASEAN countries have locally important roles for sustainability. For instance, the respondents' personal views on the initiative's implementation of soil health, fertility, and biodiversity enhancement are presumably performed to deliver multiple ecosystem services for sustainable agriculture, such as sustaining water quality and plant productivity, controlling soil nutrient recycling decomposition, and removing GHGs from the atmosphere (Tahat et al., 2020). Another example is the reduction of agricultural input, such as agrochemicals for antibiotics, fertilisers, pesticides, and food additives, to eliminate the pollution of groundwater, surface water, and soil and to overcome health problems in local communities (Thuy et al., 2012).

Figure 2.3. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in ASEAN Countries Applied (a) by the Respondents and (b) by Others in the Country

(a) By the Respondents



(b) By Others in the Country



Source: Authors.

2.3.2. Applied by Others in the Country

In terms of the country view, ASEAN countries have applied sustainable crop production and intensification (69.2%), safe and sustainable agriculture and food standards (68.5%), and agroecology (66.9%) as the top three initiatives. Meanwhile, CLMV countries have implemented slightly similar initiatives in sustainable agriculture and food systems, including climate-smart agriculture (CSA) (75.2%), agroecology (74.8%), and sustainable crop production and intensification (73.6%) for the top three. These surveyed initiatives align with the long-standing efforts of ASEAN countries to promote sustainable agriculture and food systems. These efforts include capacity building, educational projects, policy development, the creation of knowledge products, and the enhancement of legal and institutional frameworks. For instance, ASEAN established the Climate-Resilience Network, actively promoting and translating CSA at the bottom-up level and developed the policy documents on the ASEAN Guidelines on the Promotion of Climate-Smart Agriculture Practices: Vol I (ASEAN-CRN, 2015) and II (ASEAN-CRN, 2017). In addition, in recent years, ASEAN countries have well promoted three initiatives – circular agriculture, digital agriculture, and agroecology – although the actualisation of these initiatives has existed for a long time in several separate and localised places. In 2021, ASEAN adopted many initiatives related to the above matters, such as the Framework for Circular Economy for the ASEAN Economic Community, ASEAN Guidelines on Promoting the Utilisation of Digital Technologies for ASEAN Food and Agricultural Sector, and Consolidated Strategy on the Fourth Industrial Revolution for ASEAN. Resource efficiency and digitalisation in agriculture and food systems were mainstreamed in these documents (ASEAN Secretariat, 2021a, 2021b, 2021c). Another regional initiative is agroecology, which has been introduced to the ASEAN countries by several international institutions, such as the Consultative Group on International Agricultural Research (CGIAR, 2023); Food and Agriculture Organization of the United Nations (UNFAO, 2023) and the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP, 2023). This initiative integrates sustainable, transformative, and conformative practices, such as organic farming, regenerative agriculture, and some aspects of permaculture.

2.4. Prioritised Short- and Mid- to Long-Term Strategies on the Guidelines (Q2 Of the Questionnaire)

In the Guidelines, five principles must be followed to adjust the accession of sustainable agriculture in ASEAN (ASEAN Secretariat, 2022). These principles include:

1. Improving efficiency in the use of our resources;
2. Conserving, protecting, enhancing natural ecosystems, promoting and enhancing nature resources and communities;
3. Protecting and improving rural livelihoods and social well-being;
4. Enhancing the resilience of people, communities, and ecosystems; and
5. Promoting good governance of both natural and human systems.

To follow up measures for their actualisation, 28 key strategies are proposed. These strategies are the following:

'1. Improving overall soil health

2. Reduction of greenhouse gases from agriculture-related activities

3. Closing nutrient cycles/loops and valorization of agricultural waste biomass and food wastes into cost-effective feeds and fertilizers

4. Collaboration along the agriculture and food chains

5. Improving biodiversity

6. Ensuring food security

7. Promoting the use of smart and precision agriculture systems in sustainable food production

8. Facilitating funding with productive resources, finance, and services

9. Connecting smallholders to markets

10. Encouraging diversification of production and income

11. Building farmers and food production personnel knowledge base and developing their capacity

12. Encouraging more research and development on sustainable and circular agriculture and food production

13. Promoting the set-up of new sustainable and circular initiatives

14. Aligning ASEAN agricultural standards and those of our major export markets

15. Strategising to replace highly hazardous pesticides (HHPs), broad-spectrum pesticides, and neonicotinoids in ASEAN agriculture

16. Encouraging private sector research participation in new, modern, and smart technologies in sustainable food production

17. Developing/setting aside the necessary funding for the research and development of practical sustainable and circular agriculture technologies

18. Reducing the reliance on the use of agrochemicals in agriculture, balancing the use of organic and chemical fertilisers

19. Encouraging the development of sustainable, environment-friendly farming input alternatives in ASEAN

20. Encouraging the participation and training of targeted marginalised communities to be involved in sustainable agriculture systems

21. Improving the participation of women and youth in sustainable smart systems

22. Adopting policies and strategies to reduce the development of antimicrobial resistance within ASEAN
23. Reducing the environmental impact of agricultural and food production
24. Improving the health and well-being of the farming community in ASEAN
25. Supporting and setting up the support policies, rules, and regulations necessary for the development of the entire sustainable and circular industry
26. Discouraging and disallowing any further clearing of primary jungles, mangrove areas, peat lands, and other areas deemed environmentally valuable
27. Developing and encouraging various sustainable urban agriculture initiatives to provide food within urban areas
28. Developing new sustainable and circular agriculture legislative frameworks'. (ASEAN Secretariat, 2022)

Based on our field survey of corresponding respondents from the food value chain actors and its enabling stakeholders, the prioritised key strategies are chosen into short-term (in 5 years) and medium- to long-term (more than 5 years) strategies, as depicted in Figure 2.4.

Figure 2.4. Key Priority Strategies of The Guidelines: (a) Short and (b) Mid- To Long Term

(a) Key Priority Strategies in the Short Term

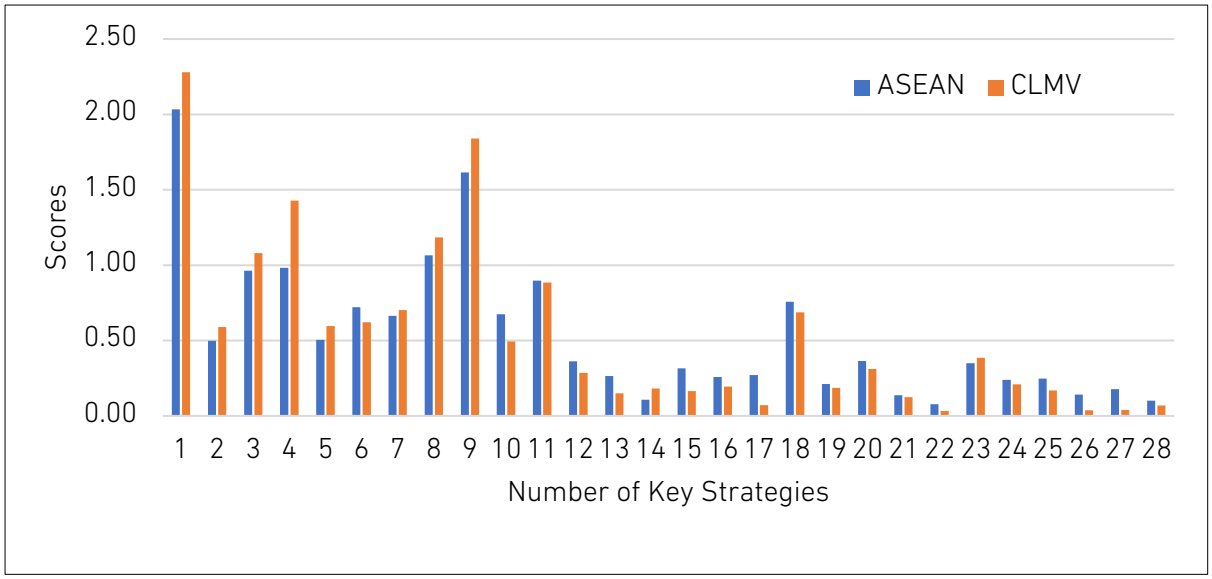
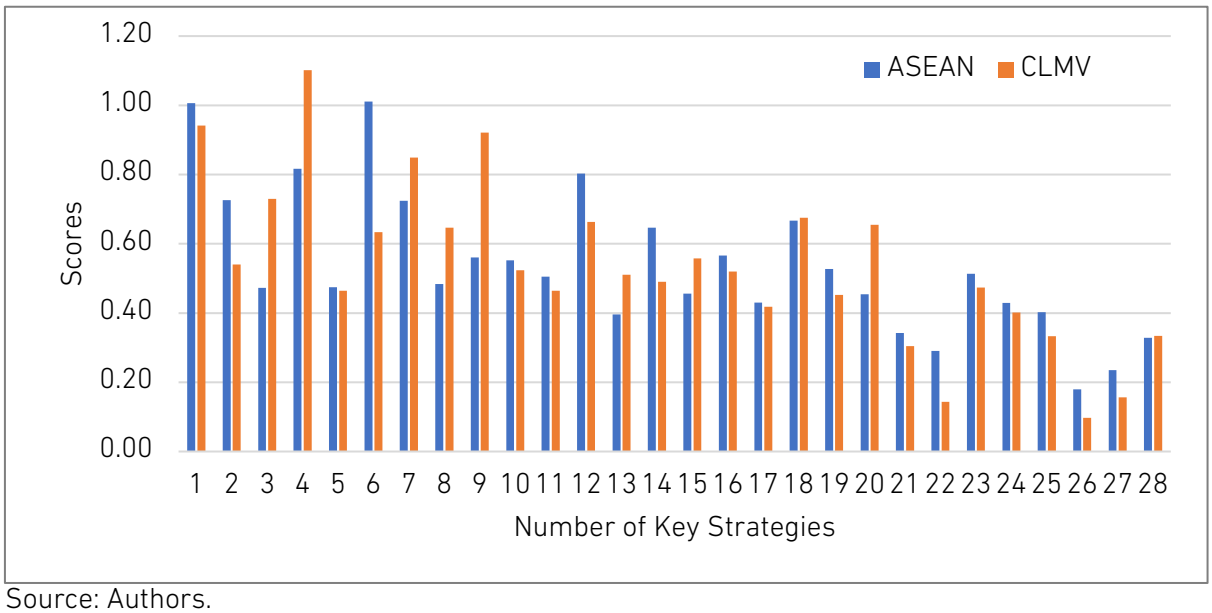


Figure 2.4. *Continued*

(b) Key Priority Strategies in Mid- to Long Term



Source: Authors.

The following sentences present 28 key strategies, each labeled with its corresponding number and name. These align with the original numbering and descriptions found in ASEAN Secretariat (2022). For short-term strategies, both ASEAN countries and CLMV countries have similarly aligned strategies to be achieved to attain enhancement of the sustainable agriculture and food systems. The top-five strategies observed for ASEAN and CLMV countries are the same whereas the orders of the scores are slightly different: key strategy number 1 (improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity); 3 (closing nutrient cycles/loops and valorisation of agricultural waste biomass and food wastes into cost-effective feeds and fertilisers); 4 (collaboration along the agriculture and food chains); 8 (facilitating funding with productive resources, finance, and services); and 9 (connecting smallholders to markets).

For mid-long-term strategies, ASEAN countries came up with top-five key priority strategies for enhancing agriculture and food systems including key priority of number 1 (improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity); 2 (reduction of greenhouse gases from agriculture-related activities); 4 (collaboration along the agriculture and food chains); 6 (ensuring food security); and 12 (encouraging more research and development on sustainable and circular agriculture and food production). On the other hand,

CLMV countries have partially different key priorities, including 1 (improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity); 3 (closing nutrient cycles/loops and valorisation of agricultural waste biomass and food wastes into cost-effective feeds and fertilisers); 4 (collaboration along the agriculture and food chains); 7 (promoting the use of smart and precision agriculture systems in sustainable food production); and 9 (connecting smallholders to markets)

It Is important to note that soil health improvement (key strategy no. 1) and agriculture and food chain collaboration (key strategy no. 4) remain to be prioritised in the short- and mid-long-term key strategies of ASEAN and CLMV countries. This is presumably because of the important values of these strategies in enhancing sustainable agriculture and food systems in ASEAN and CLMV countries, tailored to the demand of each country in Southeast Asia.

The key strategy on soil health already aligns with the most frequent sustainable actions or initiatives taken by ASEAN countries in addressing the issues of soil health, fertility, and biodiversity (Figure 2.3). In addition, soil health issues are considered indispensable in many studies, especially for providing integrative properties that support both agricultural production and the provision of other ecosystem services (Kibblewhite et al., 2008). Soil functions as a dynamic living system that delivers multiple ecosystem services, such as sustaining water quality and plant productivity, controlling soil nutrient recycling and decomposition, and removing GHGs from the atmosphere (Tahat et al., 2020). The Guidelines mention that, for example, several actions can be staged to improve soil health, including reducing overfertilisation of the soil base, applying targeted organic fertilisers and amendments, and reducing the overapplication of agrochemicals to meet optimum soil productivity.

Establishing and sustaining collaboration along the agriculture and food value chain is also a relatively focused key strategy. Matopoulos et al. (2007) stated that most collaboration centres focus primarily on operational issues and logistics propositions. This situation is exacerbated by the nature of the industry's products and the specific structure of the sector. As a result, an integrated and collaborative partnership vertically and horizontally, coupled with a sustainability model, is necessarily considered to minimise cost, increase profit, fulfil quality assurance, and gain the trust of consumers (Dania, Xing, and Amen, 2016). In the Guidelines, bridging the gap between research bodies and the farming communities is also expected. Such comprehensive encouragement for collaboration along the agriculture and food value chain is needed.

The initiatives related to sustainable production are prioritised such as the valorisation of agricultural waste biomass and food wastes into feeds and fertilisers (key strategy no. 3), facilitating funding (key strategy no. 8), and connecting smallholders to the market (key

strategy no. 9) for in ASEAN and CLMV as the short-term strategies. However, for mid-long-term strategies, the reduction of GHG emissions (key strategy no. 2), ensuring food security (key strategy no. 6), and encouraging R&D (key strategy no. 12) are prioritised in ASEAN whereas the valorisation of agricultural waste biomass and food wastes into feeds and fertilisers (key strategy no. 3), promoting the use of smart and precision agriculture systems (key strategy no. 7), and connecting smallholders to the market (key strategy No. 9) are prioritised and intersected except no. 7 in CLMV. It is apparent that ASEAN initiatives focus more on the strategies that need the longer term to tackle, and CLMV initiatives seem to be based on the extension of the recent issues.

2.5. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 of The Questionnaire)

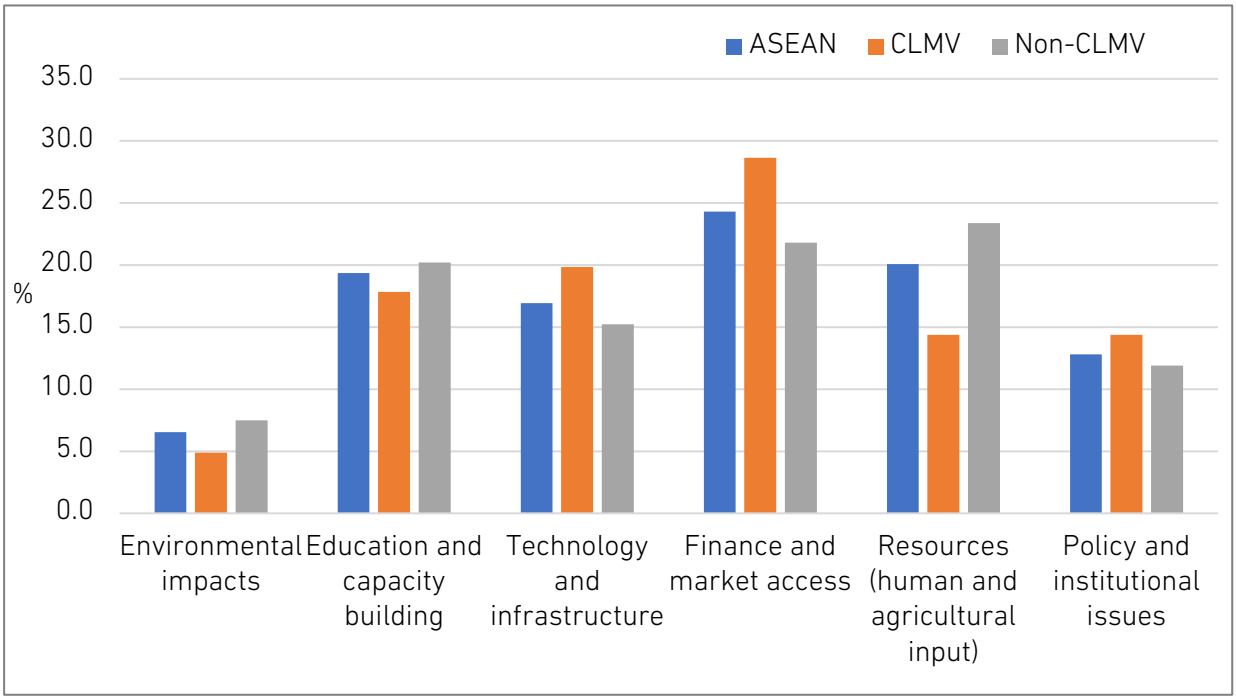
2.5.1. Challenges in Applying the Guidelines (Q3 of the Questionnaire)

ASEAN countries have encountered constraints in applying the Guidelines. These challenges are depicted briefly and mapped in Figure 2.5 and Table 2.3. Figure 2.5 shows that most of the obstacles in the ASEAN region stem from 1) finance and market access, 2) resources (human and agricultural input), 3) education and capacity building, 4) technology and infrastructure, 5) policy and institutional issues, and 6) environmental impacts. However, CLMV and non-CLMV show different distributions from ASEAN. For instance, CLMV countries have the most challenging barriers to applying the Guidelines in finance and market access, followed by technology and infrastructure, education and capacity building, resources, policy and institutional issues, and environmental impacts. In contrast to CLMV countries, non-CLMV countries have been faced with the most pressing challenges in resources, followed by finance and market, education and capacity building, technology and infrastructure, policy and institutional issues, and environmental impacts.

These challenges are in line with the previous studies on ASEAN sustainable agriculture issues from Zamora et al. (2014) on agriculture education and skills enhancement, WWF (2021) on financing issues, especially smallholder farmers, and ADB (2021) on Asia's agriculture and food policies, market structure, and technologies. Table 2.3 maps different challenges that each ASEAN country possibly experiences in actualising the Guidelines. In terms of environmental impacts, all the food value chain stakeholders are aware of climate change and its impacts (flooding, water crisis, unpredictable weather), deforestation and forest degradation, pest and disease attacks, and new pandemics. In a study by Chopra et al. (2022), carbon dioxide emissions and forest and natural resource degradation reduce agricultural productivity in ASEAN countries. In education and capacity-building issues, ASEAN countries still need more education, research, and awareness on sustainable agriculture, have limited knowledge exchange and training for farmers, keep persistence to benefit from conventional farming and agrochemicals input, and disregard indigenous knowledge or values.

According to Maini, De Rosa, and Vecchio (2021), more inclusive education for farmers equipped with effective, life-long training systems can impact strategic decision-making for sustainable agriculture transitioning. ASEAN countries also have perceived innovation and technology challenges in implementing sustainable agriculture and food systems. These challenges are such as limited agriculture plant varieties, complex operation of technologies, limited infrastructure and laboratory facilities, retarded irrigation systems, and traditional agriculture technologies, problematic technologies transfer, adoption, and cost, limited exposure to digital, smart, and modern farming, lack of technical means and methods, and lack of user-centricity in adopting new digital technologies. These challenges need solutions that, to date, can create radical and disruptive changes. For instance, the use of integrated technologies, Internet of Things or IoT, and information and communication technology (ICT)–based techs, along with the supply chain plays an essential role in addressing food security, traceability, and food quality, which help achieve sustainable development goals (Nayal et al., 2021). Finance and market access in ASEAN also become problems that are perceived to hamper the actualisation of the Guidelines. Lack of financial support and difficult access to implementing a sustainable agriculture system; high-cost operationalisation of the system; unequal distribution of financial support for farmers; unstable and limited market access/opportunities for farmers; unfair prices; and lack of marketing network, system, and communication are the examples of the problems observed in the ASEAN countries. This is in line with a study by WWF (2021) on financing sustainable agriculture and Marks (2019) on stakeholders' challenges in better market access and fairer prices.

Figure 2.5. Challenges in the implementation of the Guidelines in CLMV, non-CLMV, and ASEAN



Source: Authors.

In terms of resource issues, ASEAN countries commonly face a lack of skilled human resources with skilled talents, an ageing farmering population, labour workforce challenges, difficulties in establishing agriculture collaborations, high and volatile agricultural input prices, and the mismanagement of agricultural inputs (agrochemicals, energy, and water)

Carlisle et al. (2019) suggested replacing non-renewable resources with ecologically skilled people for transition to sustainable agriculture. Thanh (1996) also recommended the Low External Input and Sustainable Agriculture system to optimise the use of locally available resources and minimise the use of external inputs in the concept of a circular economy. Regarding the issue of policy and institutional framework, respondents emphasised the need for more practical and transparent policies for stakeholders, as well as improved cooperation amongst ministerial departments and harmonised regulations. These challenges must be addressed through proper policy conceptualisation, implementation, and operationalisation for sustainable agriculture. These policies need to be supported by strong law enforcement, scientific evidence, and sustainable practices, such as circular economy and low carbon development.

Table 2.3. Challenges Mapping the Implementation of the Guidelines

Challenges	Brunei Darussalam	Cambodia	Indonesia	Lao PDR	Malaysia
Environmental impacts	N/A	Climate change and its impacts, pest and diseases, soil degradation and pollution	Pest and diseases, climate change and its effects, land conversion	Environmental impacts of food production	Climate variabilities
Education and capacity building	Lack of education and knowledge, persistence to continue using conventional farming	Unskilled human resources, limited knowledge and training	Low education and knowledge of farmers, non-optimal agricultural research	No extensive and limited knowledge, underdeveloped education, persistence to use agrochemicals	Different research systems and their data sharing, inability to change actors' and farmers' mindsets, lack of skills, training, awareness, and control of agricultural input
Innovation and technology	Limited rice varieties and technologies, difficulties in technology operation	Limited facilities, infrastructures, and laboratories, difficulties in adopting agriculture irrigation techs, lack of techniques, knowledge, and	Traditional facilities and infrastructure, low tech at the farmer level and non-optimal use of post-harvest handling, low renewable tech adoption	Unavailable and low techniques and innovation, limited modern technologies	Challenges in technology transfer, adoption and costs, exposure to modern and smart farming

Challenges	Brunei Darussalam	Cambodia	Indonesia	Lao PDR	Malaysia
		capacities for post-harvest			
Finance and market access	Lack of financial support to apply and expand sustainable agri-food business, high cost of operation	Limited R&D finance from government or external sources, unequal distribution of farmers' funds Low price and lack of market support	Limited market access to agricultural products	Lack of funding and access to loans, difficulties in accessing finance, high cost of trading	Difficulties to access loans, a monopoly in the supply chain, inefficient financial support, incentives, and subsidies
Resources (human and agricultural inputs)	Not available skilled human resources, ageing farmers, difficulties in securing workforce	Lack of skilled human resources, difficulties in collaborating amongst stakeholders, excessive use and expensive agrochemicals	Lack of skilled farmers, ageing farmers, high and volatile prices of agricultural inputs and crops, limited agricultural business capital	Not enough labour, high cost of production, unwell-rounded knowledge farmers in technology	Ageing farmers and lack of labour, co-operation, and government support, fluctuated prices, high cost of agricultural inputs, technologies, farmers' living standards
Policy and institutional framework	How to decrease procedure and uncertainty of policies	Difficulties in creating new agriculture regulation	How to improve ineffectiveness of implementation and socialisation of policies, security of land and agricultural products,	Deficient market access policies, insufficient supporting policies, how to increase policy responses,	Inefficient process, no fixed policy on sustainable agriculture, and inaccessibility on agriculture guidelines

Challenges	Brunei Darussalam	Cambodia	Indonesia	Lao PDR	Malaysia
			standardisation amongst various cultures, how to decrease differences in programmes by central and local governments	less-instilled policies amongst farmers	

(continued)

Challenges	Myanmar	Philippines	Singapore	Thailand	Viet Nam
Environmental impacts	N/A	Climate change and its impacts, pest and diseases, soil degradation	Forest degradation and land issues	Climate change and its impacts	Climate crisis and its impacts, energy crisis, new pandemics
Education and capacity building	Lack of understanding and socialisation	Lack of training and technology, knowledge	Lack of education, awareness, and capacity building, disregarding indigenous knowledge	Lack of education, understanding, and training	Low education, training, and capacity building, limited knowledge, understanding, and awareness
Innovation and technology	Organic farming technologies	Infrastructure for agriculture and transportation, and its expensive costs	Technical innovation and techs, lack of user-centricity in agritech and digital agriculture, lack of digital infrastructures	Access and funding to digital technology, expensive and inaccessible technology,	Lack of technology investment, transfer, and adoption, limited advanced technologies and high

Challenges	Myanmar	Philippines	Singapore	Thailand	Viet Nam
				technologies for product quality	installation, outdatedinfrastructures
Finance and market access	Issues in unstable market and market opportunities	Lack of financial support and marketing network	Lack of funding for education, technology, investment, adoption of sustainable agri-food sytstem, homogenisation of funding within the region	Lack of finance and credibility for the end market with production standards, limitation of farmers in bargaining powers, challenges in marketing system, networks, and communication	Lack of funding and its slow funding execution, no market information, organic markets available, low market price, and unstable market
Resources (human and agricultural inputs)	N/A	High agricultural input costs and lack of capital, alternative sources of farmers' income	Lack of skilled and knowledgeable farmers Increased cost in sustainable practices, high-cost requirements for agro inputs	Lack of collaborations, lack of capital support, limited skilled and expertise human resources	Lack of high-quality human resources and lack of resources, high cost and unstable agricultural inputs
Policy and institutional framework	Challenges in establishments of farmer organisations, ineffective	Inactive association and lack of coordination amongst associations	Homogenisation and harmonisation of regulation, inconsistency in the implementation of the guidelines,	Insufficiency of clear, conducive, and asynchronous policy for sustainable agriculture, deficient	How to improve the effectiveness of policy support and implementation, insufficient policy, and

Challenges	Myanmar	Philippines	Singapore	Thailand	Viet Nam
	implementation of national and international standards, understanding and socialisation of relevant policies		changeable laws and regulations, economic factors dominating decisions, and lack of urgency in driving agricultural transformation	shared vision between policy departments and relevant practitioners	regulation on sustainable agriculture and contract farming, uunsuitable legal regulation

N/A = not available.
Source: Authors.

2.5.2. Solutions at the farm, provincial, and national levels for sustainable agriculture (Q4 of the questionnaire)

Referring to Section 2.5.1 on the challenges for the implementation of the Guidelines, ASEAN countries filed solutions to address these challenges. All these challenges are mapped in Table 2.3. Referring to Section 2.5.1, ASEAN countries filed solutions to address these challenges. The solutions are categorised into four types: (i) education and its application, (ii) technology and infrastructures, (iii) financial and market support, and (iv) policies and regulations enactment. Table 2.4 shows that various multi-stakeholders have committed to these solutions at the farm, provincial, and national levels, including individual farmers, local leaders, farmer groups, universities, financial institutions, and relevant local, provincial, and national government bodies.

Most of the actions taken for the solutions at the farm level are executed by individual farmers, farmer groups, local leaders, local authorities, and universities. However, at the provincial and national levels, these are commonly operationalised by provincial and national government bodies, supported sometimes by national and international agencies. In addition, different solutions are aggregated at the distinct levels. For instance, in CLMV and all ASEAN countries, the most dominant solutions implemented at the farm level focus on education and its application, followed by financial and market support, technology and infrastructure, and policy enactment. Financial and market support is the most frequent solution in CLMV and ASEAN countries at the provincial and national levels since the implementing agencies for the solutions are dominantly conducted by governmental bodies with the help of non-government and intergovernmental organisations. Both CLMV and ASEAN countries have a decrease in the percentage of solutions related to education, technology, and infrastructure at both the provincial and national levels. In contrast, the percentage of solutions in policy has increased due to the effects of implementing agencies responsible for taking action. It indicates that at the provincial and national levels, the implementing agencies are still concerned about the importance of finance, market support, and policy enactment. The importance of fostering these solutions for sustainable agriculture in ASEAN is presumably to (i) improve the financial position of the farmers and enable them to promote agriculture (plants, forests, crops, and livestock); (ii) keep the environment safe from environmental impacts (Vo and Ngo, 2021); (iii) provide a positive and significant effect on the food security (Ume, 2023) and raise the income of smallholder farmers (Markelova et al., 2009).

Table 2.4. Solutions to Address Challenges in Implementing Sustainable Agriculture and Food Systems in ASEAN

			Brunei Darussalam	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar
Percentage of Solution Level (%)	Farm	Education and its application	73.2	93.8	17.5	58.8	60.3	23.1
		Technology and infrastracture	9.8	4.2	65.0	7.8	12.8	4.6
		Financial and market support	14.6	2.1	12.5	33.3	25.6	60.0
		Policy enactment	2.4	0.0	5.0	0.0	1.3	12.3
	Province	Education and its application	52.5	32.3	20.0	27.3	28.0	45.1
		Technology and infrastracture	16.9	9.7	17.5	3.6	6.0	8.5
		Financial and market support	22.0	54.8	35.0	61.8	56.0	35.4
		Policy enactment	8.5	3.2	27.5	7.3	10.0	11.0
	National	Education and its application	36.2	9.6	6.0	20.3	10.5	34.5
		Technology and infrastracture	0.0	15.4	19.0	13.0	8.8	12.7
		Financial and market support	43.1	69.2	42.9	58.0	50.9	30.9
		Policy enactment	20.7	5.8	32.1	8.7	29.8	21.8

Table 2.4. *Continued*

			Philippines	Singapore	Thailand	Viet Nam	CLMV	ASEAN
Percentage of Solution Level (%)	Farm	Education and its application	31.3	38.9	60.7	54.4	54.8	50.7
		Technology and infrastracture	56.3	13.9	19.7	10.5	6.8	21.0
		Financial and market support	6.3	36.1	14.5	31.6	33.9	23.6
		Policy enactment	6.3	11.1	5.1	3.5	4.5	4.6
	Province	Education and its application	15.0	33.3	29.5	17.6	31.5	30.9
		Technology and infrastracture	5.0	10.0	15.2	27.9	12.7	13.3
		Financial and market support	75.0	20.0	40.0	45.6	47.9	42.6
		Policy enactment	5.0	36.7	15.2	8.8	7.9	13.3
	National	Education and its application	0.0	5.6	12.0	10.5	18.9	15.5
		Technology and infrastracture	0.0	11.1	6.8	15.8	14.2	11.0
		Financial and market support	83.3	27.8	29.3	49.1	51.9	43.7
		Policy enactment	16.7	55.6	51.9	24.6	15.0	29.8

Source: Authors.

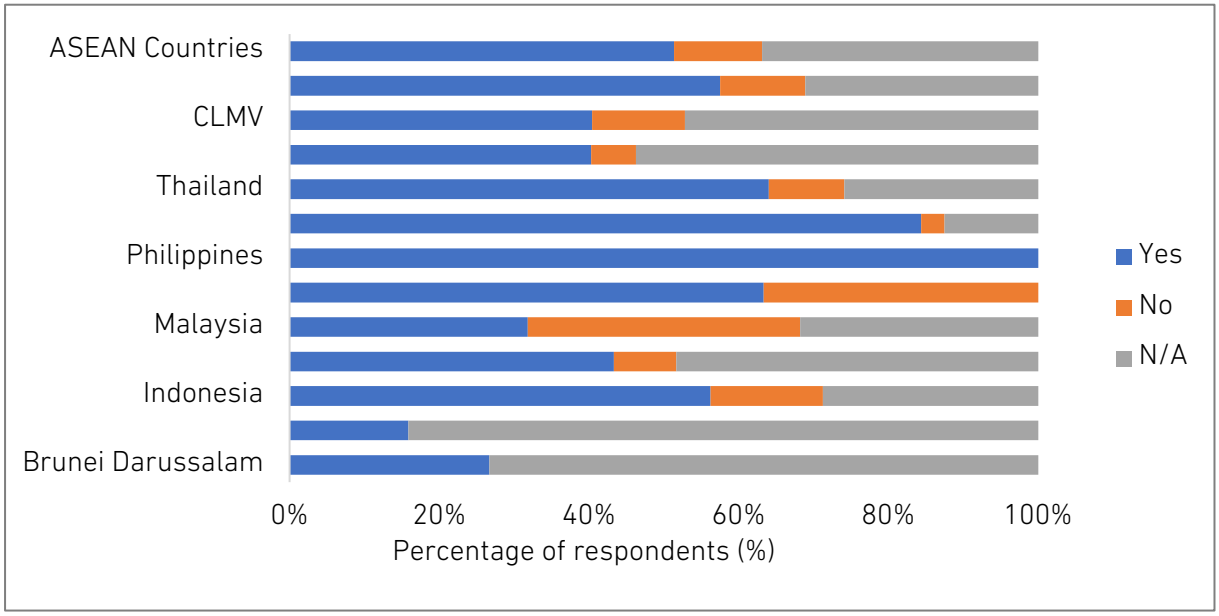
2.6. Enabling Environment for the Guidelines

This section expounds the enabling environment or factors affecting the implementation of sustainable agriculture and food systems in ASEAN. Four parameters of the factors – policies, innovative technologies and infrastructures, education, and financing mechanisms – are detailed based on the results of Q5-Q8 of the questionnaire.

2.6.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

Each ASEAN country has its regulatory framework, which can be mandatory, coercive, or voluntary. Figure 2.6 shows that 51.4% of the respondents in ASEAN countries understand the sustainable agriculture and food systems policies. In comparison, respondents in non-CLMV countries demonstrate a relatively high level of policy understanding (57.5%) regarding sustainable agriculture and food systems, whilst the percentage of policy understanding in CLMV countries is lower at 40.4%. Understanding the policies is pivotal for providing guidance, consistency, accountability, efficiency, and clarity on how sustainable agriculture and food systems operate. In addition, it can be used to provide cooperation guidelines and principles amongst stakeholders and elemental actors along the agri-food value chain. This is also in accordance with the systematic review of the policies, legislations, constitutions, and agreements enacted in the ASEAN countries, as stipulated in Table 2.5. Table 2.5 shows that there are many specific policies legalised in each ASEAN country to support the implementation of sustainable agriculture and food systems, although systemic and integrated policies on the issue still need to be made available. For instance, Indonesia is one of the countries in the region that endorsed the policy addressing sustainable agriculture; that is, Indonesia issued Law No. 22 Year 2019 on Sustainable Agriculture Cultivation on 18 October 2019. New policies that assist the transition process of conventional agriculture to sustainable agriculture are demanded to meet the meets of improving yields without compromising environmental integrity, social well-being, and public health (Abubakar and Attanda, 2013). In addition, the policies must be compatible with the stakeholders and institutions, technologies, and other enabling environments that help accelerate the goal achievement of sustainable agriculture.

Figure 2.6. Percentage of Respondents' Understanding of Policies Applied to Support Sustainable Agriculture and Food Systems in ASEAN



Source: Authors.

Table 2.5. Agriculture and Food Systems Constitutions, Policies, Legislations, and International Agreements in ASEAN Countries

ASEAN Countries	Number and Period	Key Focuses	Purview
Brunei Darussalam	35 (1979–2020)	Chemicals management and pollution reduction, antimicrobial resistance (AMR), plant and animal diseases, sustainable fisheries, halal food, fish farming, healthy food, biodiversity, illegal, unreported and unregulated (IUU) fishing, water resources management, agro-biodiversity, organic agriculture, good agricultural practices (GAP), sustainable diet, sustainable consumption, plastic reduction, plant varieties protection, and climate change	Crops, livestock and veterinary, fisheries, environment, food, climate change, chemistry, and public health
Cambodia	55 (1985–2022)	Natural resources management, circular economy, water resources management and wastewater treatment, sustainable forest management (SFM) and reducing emissions from deforestation and forest degradation (REDD+), animal health and	Environment, circularity, digitalisation, water, forestry, veterinary and

ASEAN Countries	Number and Period	Key Focuses	Purview
		hygiene, sustainable fisheries and aquaculture, food safety, pesticides and fertiliser management, modified organism biosafety, seed management, sustainable land use, GAP, green growth, climate change, antimicrobial resistance, gender mainstreaming, low carbon development (LCD), biological control agents (BCAs), animal health, food security and nutrition, smart farming and sustainable agriculture, digital economy, small and medium-sized enterprises (SMEs), sustainable consumption and production (SCP), conservation agriculture, agroecology, sustainable intensification, and sustainable investment and public–private partnership	livestock, crops, fishery, chemicals, food, climate change, chemistry, investment and partnership, economy, and gender
Lao PDR	55 (1989–2021)	Agrobiodiversity, water resources management, food safety and hygiene, organic farming, sanitary and phytosanitary (SPS), sustainable fisheries and aquaculture, pesticides and fertiliser, animal health, food security and nutrition, environment protection, plant variety, pollution control, farming management, circular economy, LCD, land use management, AMR, SFM, investment in agriculture, green growth	Biodiversity, water, food, crops, fisheries, chemicals, live stock, environment, circularity, economy, climate change
Indonesia	182 (1945–2022)	Sustainable agriculture, agrarian reform, family farming, fishery and marine resources management, halal food, carbon economy, digitalisation, IUU fishing, tax object notification letter food security and nutrition, food packaging plastics and marine debris, good fishing handling, farmers and fishermen cooperatives, AMR, pests and diseases, water resources management, SCP, organic/inorganic fertilisers, business credits, facilities, and	Fishery, halal food, economy, digitalisation, food certification and standards, circularity, livestock, public health, agriculture cooperatives,

ASEAN Countries	Number and Period	Key Focuses	Purview
		incentives, SFM and REDD+, minimum residual limits (MRLs), genetically modified food (GMO), halal food, soil conservation, bioenergy, sustainable agroindustry, GAP, food additives and medicines, organic agriculture, agri-food certifications, agrofunds, GHGs, food and drink business, crops business, animal feed safety, hazardous materials, pesticides and other chemicals, agrosilvoforest extension, irrigation, land use, plant varieties protection and seed certification, plant and animal quarantine	forestry, crops, biotechnology, energy, chemistry, climate change, and water and land use
Malaysia	146 (1952–2021)	Animal diseases, irrigation, poisons management, natural rubber, fertiliser and pesticides, agroforestry, loan fund, animal quarantines, plant protection, meat and milk importation, aquaculture farming, consumer protection, control supplies, animal health, biodiversity conservation, SPS, livestock importation, integrated pest management (IPM), organic farming, aquaculture practices, zoonotic diseases, oil palm plantation, agro-based industries, food and nutrition safety, drinking water, biosafety, renewable energy, fisheries export, food grading and packaging, fishing vessels, food hygiene, food technologies, drugs control, IUU fishing, good manufacturing practices, agriculture modernisation, GAP, food waste, urban farming, AMR, digitalisation, green economy, smart farming, organic and vertical farming	Livestock, water, energy, agrochemicals, forestry, consumer protection, biodiversity, fishery, food safety and security, circularity, digitalisation, green economy, and food technologies
Myanmar	71 (1988–2022)	Pesticide and fertiliser, aquaculture and fishery farming, agriculture land, chemical enterprise, biodiversity, communicable diseases, fish products safety and hygiene, food safety, food additives (MRLs,	Crops, fishery, animal health, food safety and security, livestock,

ASEAN Countries	Number and Period	Key Focuses	Purview
		antibiotics, pesticides), hazard analysis and critical control points, livestock breeding, SPS, plants quarantine, food labeling, food security and nutrition, irrigation, mechanisation, sustainable agriculture, food packaging, climate change, farmlands, gender issues, farmers protection, hazardous waste management, water management, climate-smart agriculture (CSA), agriculture products importation and exportation, pulses development, plants health, AMR, forest conservation, refrigerants ban, and agriculture investment	climate change, gender, water, circularity, plant health, forestry, investment, trade, and enterprises
Philippines	210 (1916-2022)	Fish protection, biodiversity, agriculture extension, veterinary and AMR, feeds for animal, agriculture tenancy, rice and corn production, land and agrarian reform, irrigation, fertiliser and pesticide, IUU fishing, plants quarantine, fishponds lease, animal diseases and control, fish marketing, fishery and aquaculture farming, agriculture development and incentives, industrialisation and mechanisation of agriculture, GMO, agriculture science and technology, AMR, agroindustries, small farmers rights, seed industry development, coconut tree preservation, biological genetic resources, ecotourism, plant varieties protection, organic agriculture, oil palm plantation, rainforest farming, fishing vessels, GAP, agroforestry, bioenergy, floriculture establishment, good animal husbandry practices, credit and financing, food export and import, food and nutrition security, illegal logging, zoonotic diseases, animal welfare, fish port and cold storage, One Health, climate resilience, fish and its product traceability, industry	Fishery, biodiversity, livestock, agricultural extension, water, land use, agriculture research and development, agroindustries, forestry, food safety and nutrition, ecotourism, enterprise, food safety, animal health, and climate change

ASEAN Countries	Number and Period	Key Focuses	Purview
		competitiveness, anti-smuggling, fishing vessels, mangrove protection, marine hatchery, food wastes, enterprise development, financial grants for farmers, health certificate for animal, and food safety	
Singapore	118 (1965–2022)	Biodiversity conservation, cattle management, feeding stuffs for animals, fishing vessels, fish gear control, food supplies control, customer protection, nature and natural resources conservation, rubber industry, food hygiene, pesticide, sanitary and phytosanitary, plants control and plant varieties protection, chewing gum, hazardous waste management, food waste, agriculture goods marketing, meat and fish trade, animal slaughtering, wholesale markets, healthier food choices, animal diseases, veterinary, agri-food certification, GAP, good aquaculture practices, BCAs, AMR, safe water drinking and water supply for public, and resources management	Biodiversity, livestock, food safety and certification, fishery, natural resources, circularity, and water.
Thailand	54 (1942–2021)	Water resources management, chemicals management, soil health and fertility, irrigation, GMO, organic agriculture, MRls, agriculture standards and certification, MRLs, food safety, GAP, radioactive use, sustainable food security, One Health, fishery management, land management, IUU fishing, agrotech and innovations, AMR, SFM, community forest, bio-green-circular economy, and hazardous substances	Water, chemistry, food, standard and conformity, nuclear use, public health, fishery, forestry, economy, and environment
Viet Nam	200 (1993–2022)	Carbon market, chemicals and drugs, environmental protection, climate change, IUU fishing, SMEs, sustainable agriculture, green growth, genetic resources, land tax and rental, blue economy, circular economy, organic farming, investment, food security	Carbon economy, chemistry, environment, climate change,

ASEAN Countries	Number and Period	Key Focuses	Purview
		and nutrition, sustainable fishery and livestock management, irrigation, plant production, SFM, AMR, plant and animal quarantine and penalties, climate change, food safety, high-tech agriculture, fertilisers and pesticides, irrigation, pest management, agriculture incentives, credits, and insurance, agriculture land and soil management, green growth, safe and unsafe agro-forest food, LCD, biodiversity, biosafety, radioactive use, GMO, SPS, biotechnology, animal epidemics, animal breedings, plant varieties protection, and intellectual properties, desertification, GAP, agri-forest farms, aquatic economy and breeding development, fishermen safety, organic pollutants, and agricultural enterprises	fishery, economy, circularity, livestock, crops, forestry, public health, food, biotechnology, biosafety, employment, MSMEs, water, standards and conformity, food hygiene

Source: Authors.

2.6.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

Technologies are a pivotal instrument that can complement policies, education, and financial mechanisms to expedite the implementation of sustainable agriculture and food systems in ASEAN. In terms of innovative and advanced technologies and agriculture techniques, they are necessarily utilised to assist farmers in more productively and competitively producing enough food to feed the human population and or growing crops efficiently in agricultural areas for food production. According to Khan et al. (2021), advanced technologies and innovation are utilised essentially to promote sustainable food systems due to their faculties to answer some of the critical questions needed to transform sustainable agri-food systems and help us better understand global food security and nutrition. Subsequently, adopting the technologies requires social permits, regulations, and incentives. Furthermore, modern and innovative technologies also need intellectual property rights (IPRs), making R&D more attractive through new technologies investment and tradeable assets generation. Blakeney (2022) indicated that IPRs protecting innovative agriculture technologies have several principles that must be taken into account, such as patents, plant variety rights, trademarks and geographical

indications, layout designs of integrated circuits, confidential information law, and copyright.

From this survey, several types of innovative technologies were proposed to be mapped and highlighted, including such as digitalised and digitised technologies, biological control agents (BCAs) techniques, new and renewable energy technologies, and integrated pest management (IPM). Table 2.6 depicts types of innovative technology adopted or introduced to expedite the implementation of sustainable agriculture and food systems in ASEAN, such as 1) biofertilisers, biopesticides, and pest management techs, 2) IPM, 3) advanced manufacturing, post-harvesting, and packaging technologies, 4) BCA techniques, 5) digital technologies, and so forth.

Table 2.6. Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in ASEAN

	ASE	CLM	CLM Nor	Bru	Cam	Indo	Lao	Mal	Mya	Phi	Sin	Tha	Viet
Digitalised and digitised technologies (robotics, automation, global positioning system, satellite, IoT, blockchain, artificial intelligence, ICT-based technologies, etc.),	49.9	50.0	49.8	49.3	76.2	12.5	78.3	75.8	0.0	0.0	90.6	74.8	44.8
GMOs	31.3	24.4	35.1	29.3	12.7	80.0	75.0	30.3	0.0	0.0	43.8	30.2	11.9
Nanotechnologies	19.4	13.6	22.5	17.3	3.2	3.8	28.3	39.4	0.0	0.0	18.8	40.3	22.4
Advanced manufacturing, post-harvesting, and packaging technologies	61.9	56.4	64.9	61.3	58.7	92.5	95.0	71.2	5.0	0.0	50.0	84.2	65.7
Advanced cold chain technologies and innovative value chain (upgrading value chain) for sustainable agriculture products	43.7	34.8	48.5	53.3	15.9	91.3	80.0	39.4	3.3	17.1	43.8	42.5	40.3

	ASE	CLM	CLN Nor	Bru	Cam	Indo	Lao	Mal	Mya	Phi	Sin	Tha	Viet
Biofertilisers, biopesticides, and pest management techs	71.8	54.4	81.2	72.0	36.5	100.0	90.0	83.3	16.7	68.6	43.8	89.2	73.1
Biological control agent techniques	60.0	46.0	67.5	50.7	14.3	93.8	96.7	74.2	8.3	55.7	21.9	74.8	64.2
Pestigation and fertigation technologies (Pesticides and fertiliser injection in irrigation)	47.9	40.4	52.0	57.3	22.2	11.3	51.7	77.3	13.3	40.0	28.1	71.9	71.6
New and renewable energy technologies	47.9	30.0	57.6	53.3	11.1	96.3	58.3	45.5	16.7	0.0	68.8	69.8	34.3
Agricultural biomass and waste valorisation technologies (biorefinery)	48.0	31.2	57.1	45.3	15.9	93.8	73.3	47.0	3.3	34.3	56.3	59.0	32.8
Integrated pest management	64.9	51.6	72.1	58.7	17.5	97.5	88.3	80.3	33.3	61.4	15.6	79.1	67.2
Others	1.8	0.8	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.9	2.9	3.0

GMO = genetically modified organism, ICT = information and communication technology, IoT = internet of things.
Source: Authors.

The order of the importance of technologies based on the respondents' votes is different in CLMV and non-CLMV countries. For instance, in CLMV countries, the top-five ranking of the technologies that have been adopted are as follows: (i) advanced manufacturing, post-harvesting, and packaging technologies; (ii) biofertilisers, biopesticide, and pest management techs; (iii) IPM; (iv) digitalised and digitised technologies; and (v) BCA techniques. For non-CLMV countries, it is clear that (i) biofertilisers, biopesticides, and pest management techs have the highest percentage of implementation and adoption. This is followed by (ii) IPM; (iii) BCA techniques; (iv) advanced manufacturing, post-harvesting, and packaging technologies; and (v) new and renewable energy technologies. In ASEAN countries, pro-environmental and eco-friendly technologies, such as biofertilisers, biopesticides, and BCAs, have already been widely adopted. Advanced technologies have also been highly adopted, including modern manufacturing, post-harvest, and packaging technologies, as well as advanced cold chain systems, pestigation and fertigation methods, and biomass and waste valorisation technologies, have also seen significant adoption. It is also shown that radical and disruptive technologies, including digital technologies and nanotechnologies, are still in the initial stage of implementation. However, especially in the last few decades and during the COVID-19 pandemic, these technologies have seen unexpectedly in a high adoption rates in ASEAN, CLMV, and non-CLMV countries (Table 2.7). For instance, in the realm of digital technologies, it is evident that ASEAN countries have established many regulatory frameworks and initiatives (Table 2.7) aimed at digitalising all social, economic, environmental, and governance sectors, including food and agriculture.

Table 2.7. Regional Digital Initiatives Developed by ASEAN Countries

Name of Digital Initiatives	Adoption Date and by Whom	Content of Regional Digital Initiatives	Relation to Food and agriculture
ASEAN Digital Master Plan 2025	N/A	This master plan provides guidance for ASEAN member states through 5-year actions to achieve both a digital economy and society.	Digital technologies, services, and ecosystems powering ASEAN are used to address agriculture issues interlinked with climate change.
ASEAN Declaration on Industrial Transformation to Industry 4.0	02 November 2019 by ASEAN Leaders	This declaration is intended to optimise and accelerate the use of Industry 4.0 for start-ups, MSMEs, e-government, smart cities, and vocational	N/A (not directly mentioned)

Name of Digital Initiatives	Adoption Date and by Whom	Content of Regional Digital Initiatives	Relation to Food and agriculture
		education with ultimate goals to achieve economic growth, inclusive and equitable economic development, and ASEAN centrality maintenance.	
Consolidated Strategy on the Fourth Industrial Revolution for ASEAN	26 October 2021 by ASEAN Leaders	This strategy guides ASEAN countries in building the ASEAN Digital Community in the fields of political and security, economy, and socio-culture.	The food and agriculture sector is included in the form of smart agriculture adoption.
ASEAN Leaders' Statement on Advancing Digital Transformation in ASEAN	26 October 2021 by ASEAN Leaders	This statement is addressed to advance digital transformation and integration in ASEAN by engaging community pillars, sectoral bodies, and external partners.	N/A (not directly mentioned)
ASEAN Comprehensive Recovery Framework and its Implementation Plan	12 November 2021 by ASEAN Leaders	This framework and its plan serve as a consolidated existing strategy and comprehensive recovery efforts from the pandemic, which consists of five broad strategies.	The ASEAN Guidelines on Promoting the Utilisation of Digital Technologies for ASEAN Food and Agricultural Sector was developed.
ASEAN Digital Integration Framework Action Plan 2019–2025	06 September 2021 by ASEAN Economic Ministers	This framework provides solutions to overcome critical barriers and accelerate existing ASEAN platforms for realising digital integration.	N/A (not directly mentioned)
ASEAN Comprehensive Framework on Care Economy	26 October 2021 by ASEAN Leaders	This framework provides strategic priorities for ASEAN's development of the care economy in response to complex crises and challenges.	N/A (not directly mentioned)
ASEAN–US Leaders' Statement on Digital Development	26 October 2021 by US–ASEAN Leaders	This statement articulates the US–ASEAN partnership and commitments in supporting digital development in ASEAN.	N/A (not directly mentioned)

Name of Digital Initiatives	Adoption Date and by Whom	Content of Regional Digital Initiatives	Relation to Food and agriculture
ASEAN Plus Three Leaders' Statement on Connecting the Connectivities Initiative	04 November 2021 by ASEAN Plus Three Leaders	This statement emphasises the importance of interdependence and connectivity amongst ASEAN Plus Three in realising collective efforts for regional integration and cooperation.	N/A (not directly mentioned)
The Bandar Seri Begawan Roadmap: An ASEAN Digital Transformation Agenda to Accelerate ASEAN's Economic Recovery and Digital Economy Integration	21 October 2021 by ASEAN Economic Ministers	This roadmap guides ASEAN countries to take immediate-term steps for digital transformation intended to accelerate economic recovery and digital economy integration.	N/A (not directly mentioned)
ASEAN Guidelines on Promoting the Utilisation of Digital Technologies for ASEAN Food and Agricultural Sector	27 October 2021 by ASEAN Agriculture and Forestry Ministers	The Guidelines provide five key guidelines for ASEAN countries and various stakeholders in the food and agriculture sector in making data-driven decisions for digital technology choices, utilisation, and assessment.	The Guidelines provide five guidelines to achieve Agriculture 4.0.

N/A = not available.
Source: Mangurai et al. (2021).

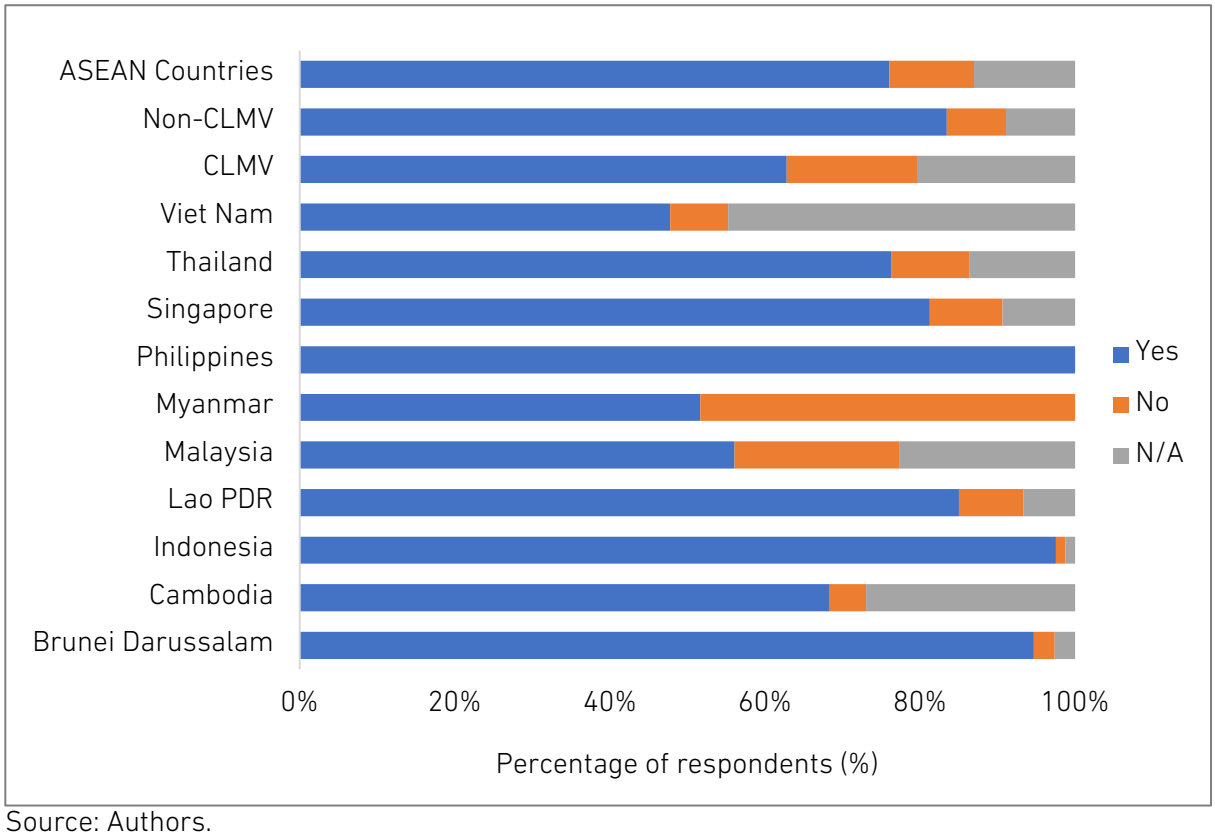
2.6.3. Education and Capacity Building (Q7 of the Questionnaire)

Other challenges that ASEAN countries have dealt with to translate the construct of sustainable agriculture and food systems in ASEAN are education and skills advancement for agri-food value chain actors and their enabling supporters. Education, knowledge sharing, training, capacity building, and farmers' schools are examples of proposed solutions at the farm, provincial, and national levels for overcoming the challenges in attaining sustainable agri-food systems.

Proposing the tagline 'Everyone is a teacher, and everyone is a learner' should be communicated to key actors in the agri-food value chain whilst embodying sustainable agriculture. Designing an efficient and effective framework for education and capacity building must address the entire landscape of sustainable education management. For

instance, sustainable agriculture education can be integrated into the school curriculum, along with practical applications that can help achieve these initiatives. One of the notable education programmes offered to farmers is the 'Farmers Field Schools', a participatory education approach established in 1989, amassing a group of farmers, livestock herders, or fisherfolk to apply sustainable agriculture (UNFAO, 2023). Francis and Carter (2001) reported that a participatory education for sustainable agriculture must have explicit learning goals, design programmes to meet people's expectations, and establish an environment of trust. In addition, they also suggested that the most effective sustainable agriculture education can be in the form of workshops, training, farm tours, decision cases, panel discussions, or farmer listening sessions.

Figure 2.7. Percentage of Respondents' Understanding of Education and Skills Development Implemented to Support Sustainable Agriculture and Food Systems in ASEAN



Source: Authors.

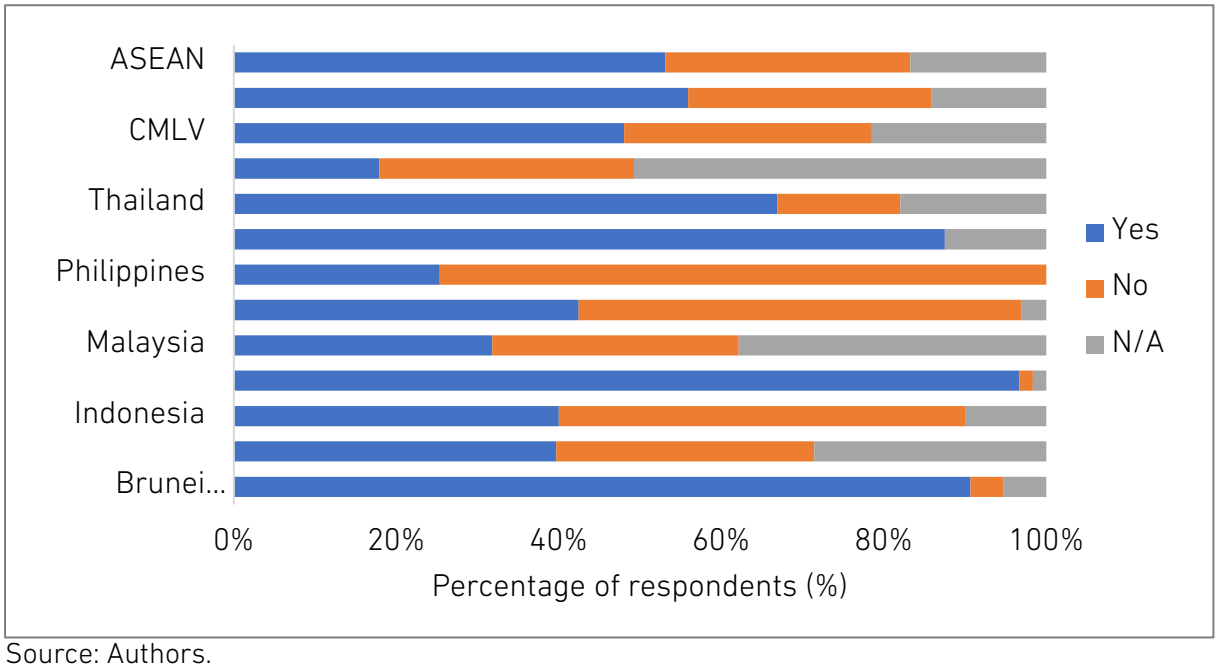
Regarding education in ASEAN, CLMV, and non-CLMV countries (Figure 2.7), it is clear that they have experienced education, training, and capacity building on sustainable agriculture at the farm to higher education level with a percentage of 76.0%, 62.8%, and 83.5%, respectively. It indicates the possibility that education, training, and capacity building have supported agri-food value chain actors and their enabling elements to support the application of the Guidelines. That is why these actions, in line with the

proposed solutions at the farm, provincial, and national levels (Section 2.5.2), could be the most demanding and powerful tool to address challenges that the member states have grappled with in education and capacity building proposition (Section 2.5.2).

2.6.4. Financing Mechanism (Q8 of the Questionnaire)

According to Lapenu (2007), there are two general characteristics of agricultural and rural financing: (i) one that takes the financial sector and its intermediary institutions (banks, microfinance institutions, and insurance or guarantee funds) as the starting point to organise financial services and financial inclusion; and (ii) one that formalises its funding by contracts, paired with the organisation of the agricultural and food sectors or 'value chains'. New innovative financing mechanisms are demanded to respond to the complexity of social, economic, and ecological dimensions. For instance, investment in agri-food production and technologies is desired to address economic issues, but sometimes these issues are amplified with climate issues so that sustainable financial support for climate change adaptation is necessarily coupled. Mo, Sun, and Zhang (2023) also recommended three pivotal points to optimise green finance for promoting climate smart agriculture (i) active development of green finance, (ii) optimisation of the agriculture industry, and (iii) advancement of agriculture technologies.

Figure 2.8. Percentage of Respondents' Understanding of Financing Mechanisms to Support Sustainable Agriculture and Food Systems in ASEAN



Source: Authors.

Based on the survey data depicted in Figure 2.8 on financing mechanisms for sustainable agriculture and food systems, it is observed that all ASEAN countries have harnessed the use of financing mechanisms to bolster sustainable agriculture and food systems, in which 64.1% have identified the existing finance mechanism. Compared to CLMV and non-CLMV respondents, a different trend emerges amongst non-CMLV respondents regarding their understanding of the financial mechanism, with approximately 47.6% and 66.4%, respectively. It can be surmised that ASEAN countries have applied financial mechanisms from various sources to promote the actualisation of sustainable agriculture and food systems, whereas the levels of awareness are varied between CLMV and non-CLMV. To further promote sustainable agriculture and food systems, new initiatives, including the implementation of innovative technologies, will be supported by the expansion of financial mechanisms.

2.7. Conclusion

In this study, the actions and initiatives for sustainable agriculture and food systems that have been enacted and are expected to be enacted in ASEAN countries are identified based on the survey using a structured questionnaire in the 10 ASEAN countries focused on the study.

This ASEAN regional survey on the status of sustainable agriculture and food system practices reveals a mixed picture. While there is a growing awareness of the importance of wide range of initiates at regional, national and subnational level among stakeholders, its implementation faces significant challenges.

Although sustainable agri-food systems construct is relatively newly acquainted in ASEAN countries, the 'enhancement of soil health, fertility, and biodiversity is the most practiced action applied by the respondents, whereas safe and sustainable agriculture and food standards are the most practiced action applied by others in the country. Twenty-eight key strategies of sustainable agriculture, as stipulated in the Guidelines, can be mapped into a regional development plan for short- and mid-long-term strategies stemming from the prioritisation in each ASEAN country. Dominant key priorities for short-term strategies are (i) improving overall soil health and (ii) connecting smallholders to markets in the ASEAN region and CLMV countries. In contrast, mid- to long-term strategies prioritise (i) improving overall soil health, (ii) ensuring food security in ASEAN region, (iii) collaboration along the agriculture and food chains, (iv) improving overall soil health in CLMV countries.

ASEAN countries have faced numerous challenges in implementing the Guidelines. These challenges can be grouped into six constraints in the following order: (i) finance and market access, (ii) technology and infrastructure, (iii) education, (iv) human and agri-input resources, (v) policy and institution, and (vi) environmental impacts. ASEAN countries can work towards developing possible solutions in theareas of policies, innovative

technologies and infrastructure, education, and financing mechanisms at the farm, provincial, and national levels. These are necessary for transitioning from conventional agriculture to sustainable agriculture.

2.8. Recommendations

Referring to the results of this study, recommendations are given to help ASEAN countries keep and make informed decisions.

- Stakeholders in ASEAN countries have applied sustainable agri-food initiatives, but gaps in the initiatives, especially in digital agriculture, carbon sequestration measures, bioenergy, and energy efficiency, and nature-based solutions, such as the use of biological control agents, need to be narrowed with more commitments or actions agenda.
- From the Guidelines, key strategies, short- and mid- to long-term plans referring to the national development agenda and its enabling environments identified in each ASEAN country should be designed by defining the targeted beneficiaries of sustainable agri-food practices. This involves taking interventions from identified solutions, developing key performance indicators from readiness level indicators and enabling environment indicators (policies, education, financing mechanism, and technologies), and designating implementing agencies based on power and interest.
- ASEAN countries have prioritised five key areas to enhance sustainable agri-food systems in the short and medium to long term. These selected priorities can serve as strategic thrusts to develop a regional action plan that aligns with the principles and key strategies of the Guidelines.
- Comprehensive results and data extracted from this study must be deep dive, especially in enabling environments, such as policies, education, finance and market opportunities, and technology and infrastructure. This part is indispensable to guide ASEAN countries to consider the development of baselines, indicators, and beneficiaries of the Regional Action Plan for ASEAN Sustainable Agriculture and Food Systems.
- From the action plan, piloting interventions into a regional project or projects is anticipated to be carried out, considering all the elements of the project management life cycle. It is intended to measure the effectiveness of the project interventions to address sustainable agriculture and food systems issues in ASEAN.
- A tool or instrument to assess agriculture and food systems sustainability needs to be developed and can be openly used by all ASEAN citizens to monitor and evaluate the progress of sustainable agriculture and food systems. In addition, ASEAN countries have already planned and implemented sustainable agri-food

practices. Monitoring and evaluation (M&E) instruments for agri-food systems sustainability assessments, along with readiness level assessment, can serve as initial frameworks for M&E and can be openly utilised by all ASEAN citizens.

- Continuous operations – rather than projects – equipped with strong M&E can provide lessons learned and recommendations to establish more sustainable and regenerative actions, identify successes and improvement areas, and ensure accountability and integrity of ASEAN for achieving sustainable agri-food systems goals.
- Reflecting on the survey, a common standardised and agreed-upon terminology for sustainable agriculture and food systems in ASEAN needs to be developed based on the region's geographical conditions, objectives and goals, and agri-food systems states, whilst considering the Guidelines and other international definitions. This will reduce many misinterpretations of the member states in defining sustainable agriculture and food systems.
- Regional mapping of siloed or localised and or aggregated actions of sustainable agriculture and food systems can be initiated to provide general depictions of the extent level of its sustainability.
- Foster partnerships across the sectors, the private sector, and civil society organisations to promote knowledge sharing and resource mobilisation is essential for the development and deployment of sustainable agricultural technologies.
- The paramount importance of education, finance and market access,and infrastructure, and policy is well recognised in ASEAN countries to promote the sustainability of agriculture and food systems. It suggests these instruments are required for continuity at the local, regional, and national levels.

The survey has identified challenges or constraints in implementing the Guidelines and mapped possible solutions to address the problems. These solutions, which are currently segregated, need to be centralised systemically to address various challenges that intersect with sustainable agriculture. The centralised solutions are intended to create more cooperative, cost- and time-effective, and efficient actions in overcoming branched and complex issues. By addressing these challenges and implementing the recommendations outlined, ASEAN can accelerate the transition to sustainable agriculture, ensuring food security, environmental protection, and rural development for all its citizens.

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Chapter 3
Brunei Darussalam Country Report

Cristalina Jalil, Kentaro Yamada, Siti Mustaqimatud Diyanah

3.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

National Food Industry Roadmap has been conducted to increase the production of safe, Halal, and high-quality food, and strengthen the value chain of the food system (Secretariat to the Special National Coordination Committee on SDGs Brunei Darussalam Prime Minister's Office, 2022). This policy framework is expected to address issues related to sustainable agriculture and food systems in Brunei Darussalam. These issues include a heavy reliance on imported raw planting materials, which results in high production costs, as well as manpower and knowledge gaps, difficulties in penetrating export markets, and other related challenges.

The Brunei Darussalam Food Authority has been established as a regulator and competent authority for food safety and quality in Brunei Darussalam (Secretariat to the Special National Coordination Committee on SDGs Brunei Darussalam Prime Minister's Office, 2022). In addition, Brunei Darussalam also focuses on the food sector that included as one of the five priority sectors in Brunei Darussalam Economic Blueprint. This blueprint will provide guidelines to develop a dynamic and sustainable economy in Brunei Darussalam (Ministry of Finance and Economy Brunei Darussalam, 2020).

As the strategic initiatives, increasing production in the agriculture and fisheries sectors, promoting research and development (R&D)through foreign direct investment and government-linked companies, providing conductive industrial infrastructure, increasing productivity and profitability, providing business supportive governance such as Brunei Good Agriculture Practice (Agriculture and Agrifood Department of Brunei Darussalam, 2019), providing marketable and employable manpower, and promoting sustainable environment, have been proposed (Secretariat to the Special National Coordination Committee on SDGs Brunei Darussalam Prime Minister's Office, 2022).

3.2. Result of the Questionnaire Survey and Discussion

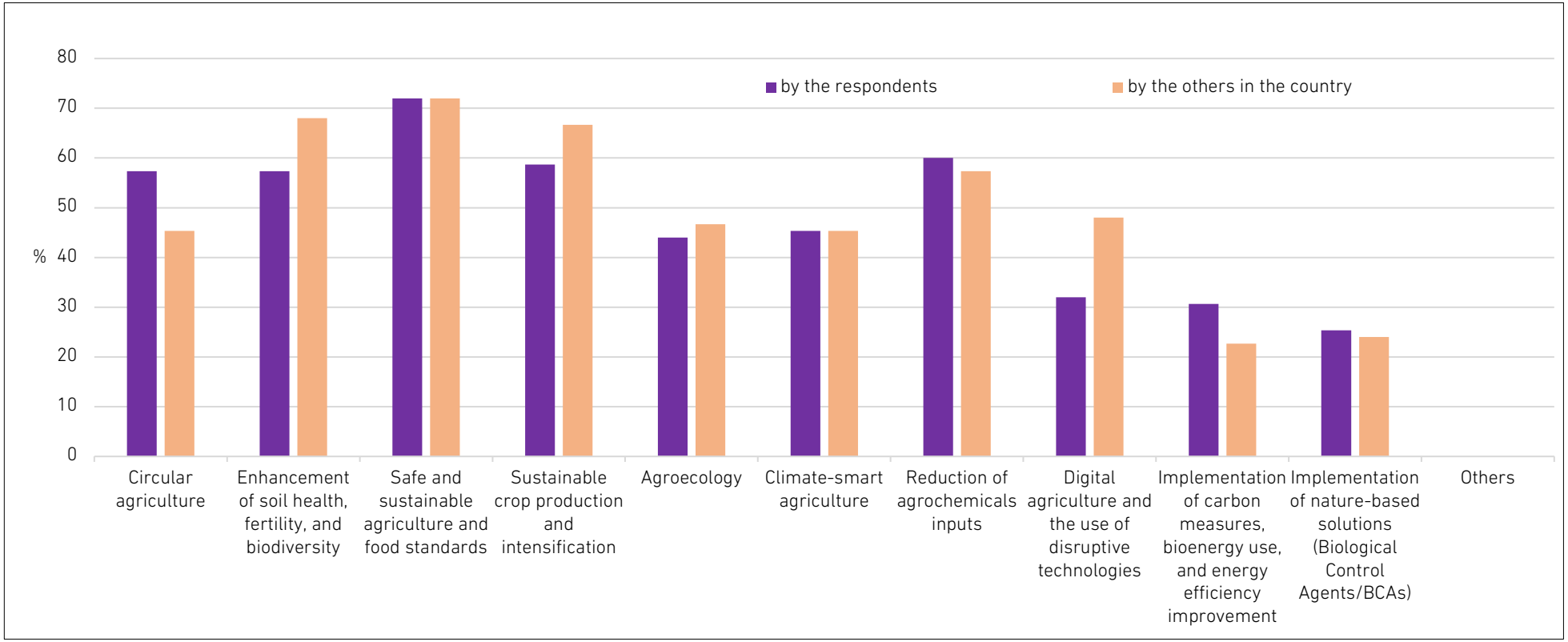
3.2.1. Sustainable Key Actions or Initiatives Applied in Brunei Darussalam (Q1 of the Questionnaire)

Figure 3.1 shows the actions taken by respondents, which include safe and sustainable agriculture and food standards (72.0%), reduction of agrochemical inputs (60.0%), circular agriculture (57.3%), and enhancement of soil health, fertility, and biodiversity (57.3%). In contrast, actions taken by others in the country rank the top three as safe and sustainable

agriculture and food standards (72.0%), enhancement of soil health, fertility, and biodiversity (68.0%), and sustainable crop production and intensification (66.7%).

Based on the aforementioned data, it is evident that food value chain actors engage in similar actions at both the individual and institutional levels, as well as in national initiatives, particularly regarding safe and sustainable agriculture, food standards, and the enhancement of soil health, fertility, and biodiversity. In terms of agriculture and food standards, Brunei Darussalam has been very active in translating the Public Health (Food) Act (Chapter 182) and its regulations. In addition, the country has actualised other international standards, such as Codex Alimentarius, Good Agricultural Practices, and Halal Food.

Figure 3.1. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in Brunei Darussalam Applied (a) by the Respondents and (b) by Others in the Country



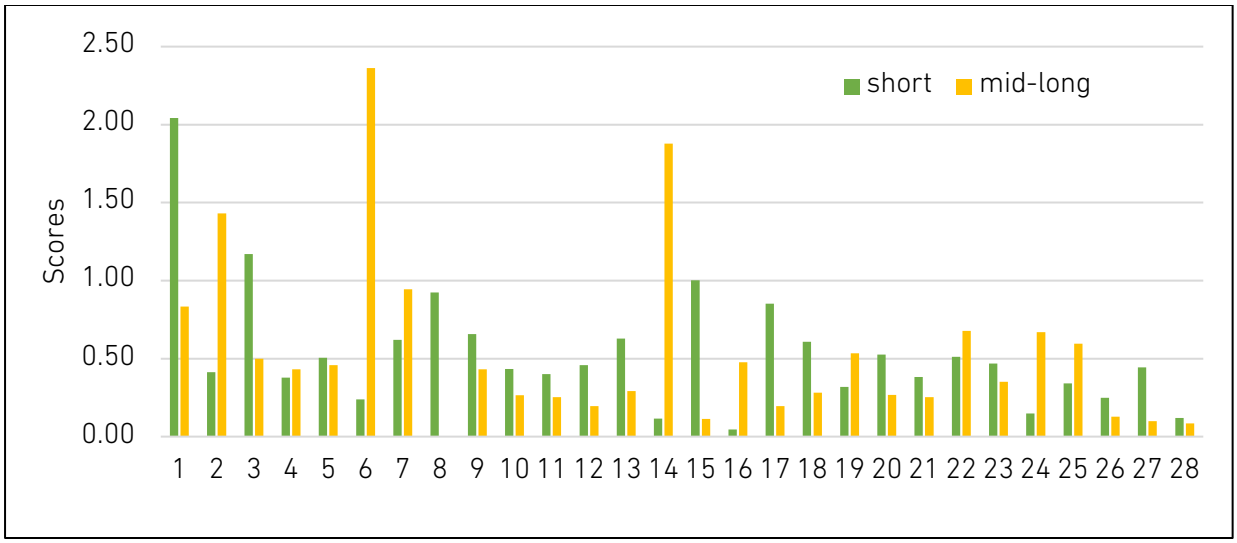
Source: Authors.

3.2.2. Prioritised Short- and Medium- to Long-term Strategies on the Guidelines in Brunei Darussalam (Q2 of the Questionnaire)

Figure 3.2 shows that amongst the short-term strategies, '(1) improving overall soil health: reducing overfertilization of the soil base, applying targeted organic fertilizers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (3) closing nutrient cycles/loops and valorization of agricultural waste biomass and food wastes into cost-effective feeds and fertilizers; (15) strategizing to replace highly hazardous pesticides (HHPs), broad-spectrum pesticides, and neonicotinoids in ASEAN agriculture; (8) facilitating funding with productive resources, finance, and services; and (17) developing/setting aside the necessary funding for the research and development of practical sustainable and circular agriculture technologies', are prioritised by the top five scores.

Amongst the medium to long-term strategies, the top five priorities are '(6) ensuring food security, (14) aligning ASEAN agricultural standards and those of our major export markets, (2) reduction of greenhouse gases from agriculture-related activities, (7) promoting the use of smart and precision agriculture systems in sustainable food production, and (1) improving overall soil health: reducing overfertilization of the soil base, applying of targeted organic fertilizers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity'.

Figure 3.2. Key Priority Strategies of the Guidelines: Short and Mid- to Long-term in Brunei Darussalam



Source: Authors.

3.2.3. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 and Q4 of the Questionnaire)

Table 3.1 shows that challenges for finance and market access, resources (human and agricultural inputs), and education and capacity building show the highest ratios in descending order. All ratios are ranked the same as those in the ASEAN region; however, no respondent provided answers regarding environmental impacts.

Table 3.1. Challenges mapping the implementation of the Guidelines in Brunei Darussalam

Categories	Challenges	Ratios (%)
Environmental impacts	N/A	0.0
Education and capacity building	Lack of education and knowledge, persistence to continue using conventional farming	22.2
Technology and infrastructure	Limited rice varieties and technologies, difficulties in technology operation	15.1
Finance and market access	Lack of financial support to apply and expand sustainable agri-food business, high cost of operation	28.4
Resources (human and agricultural inputs)	Not available skilled human resources, ageing farmers, difficulties in securing labourers	24.0
Policy and institutional framework	How to decrease procedure and uncertainty of policies	10.2

N/A = not available.
Source: Authors.

Table 3.2 shows the solution mapping across four categories – education and its application, technology and infrastructure, financial and market support, and policy enactment). It also illustrates three levels: farm, provincial, and national. As shown in Table 3.2, the ratio of education and its application is the highest at the farm and provincial levels, and that of financial and market support is the highest at the national level.

This indicates, similarly to ASEAN, that financial support could be provided by governmental bodies to address the most prioritised challenge. Additionally, capacity building is also necessary to resolve the human resource issues at the farm and provincial levels.

Table 3.2. Solution mapping at the farm, provincial, and national levels, including ratios for the implementation of the Guidelines in Brunei Darussalam

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	Connection on business workshop and knowledge, development of short courses, dissemination of knowledge via farm managers, training support and experiences, sharing information	Farm management, machinery assistance, sustainable activities at the farm	Connection business network and marketing, initiation on capital, finance, and subsidies	Involvement of stakeholders in infrastructure work, creation of policies
	73.2%	9.8%	14.6%	2.4%
Province	Technical training, district-level programmes, roadshow, and technical know-how	Modernisation of post-harvest facilities, infrastructures and facilities support, exposure to aquaculture farming	Financial support	Issuance of policies
	52.5%	16.9%	22.0%	8.5%
National	Opportunities creation for youth and distribution channels, knowledge sharing through workshops and lecturing, facilitation of agriculture meetings, creation of agriculture jobs, learning from neighbouring countries, and arrangement of	–	Financial and trading support	Development of agriculture policy, monitoring the policy, and development of a national plan or blueprint for sustainable agriculture

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
	agricultural expos			
	36.2%	0.0%	43.1%	20.7%

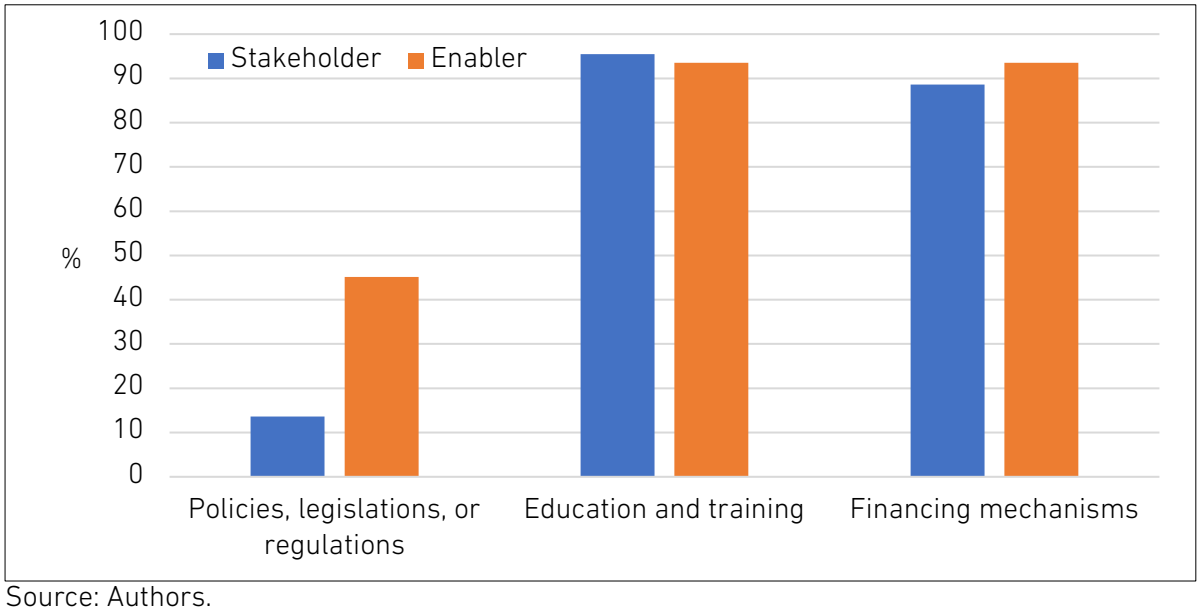
Source: Authors.

3.2.4. Enabling environment for the Guidelines

3.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

The respondents answered that policies on Brunei Halal, GAP, use of herbicides and post-harvest management, one village one product, good aquaculture practices, and hazard analysis and critical control points are recognised in the country. Notably, the ratio of stakeholders who recognise the policy for sustainable agriculture and food systems is 13.6%, whereas that of enablers is 45.2% (Figure 3.3). It is suggested that promoting policies for stakeholders is especially important.

Figure 3.3. Percentage of Respondents' Understanding of (i) Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to Support Sustainable Agriculture and Food Systems in Brunei Darussalam

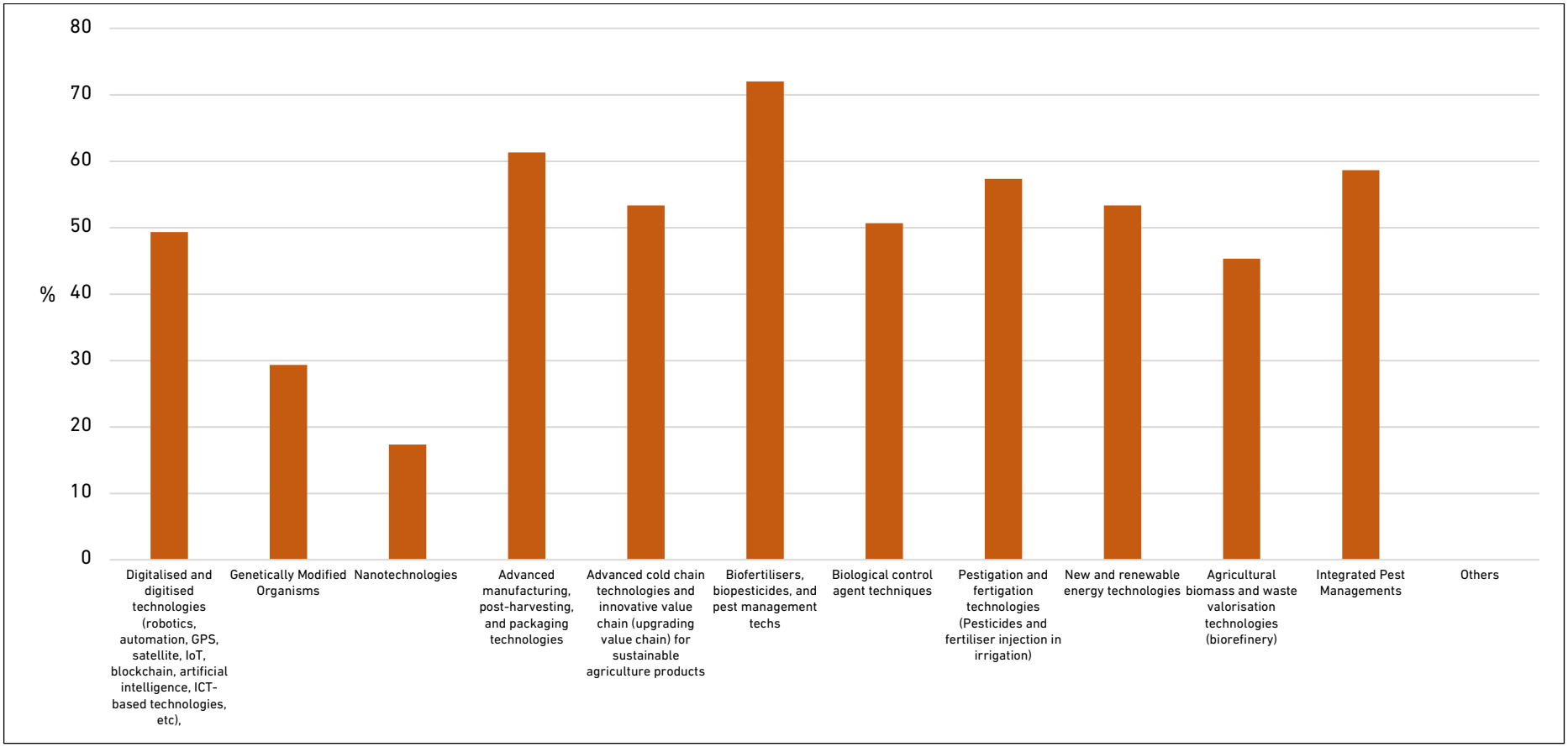


Source: Authors.

3.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

Figure 3.4 shows that all innovative technologies have been relatively adopted. Biofertilisers, biopesticides, and pest management techs have been adopted in the highest percentage of implementation extent (72.0%); these are then followed by advanced manufacturing, post-harvesting, and packaging technologies (61.3%), integrated pest management (58.7%), pestigation and fertigation technologies (57.3%), and other listed technologies in Figure 3.4. In addition, prioritised key strategies highlight the need for the improvement of soil health and the replacement of HHPs (see Section 3.1.2.2). This underscored the ongoing necessity for innovative technology, such as pestigation and fertigation technologies, to be adopted and utilised.

Figure 3.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in Brunei Darussalam



Source: Authors.

3.2.4.3. Education and Capacity Building (Q7 of the Questionnaire)

Sustainable agriculture education has been integrated in schools, universities, and governmental bodies, but no specific types of education have been fully adopted in these institutions. Figure 3.3 shows that the ratios of stakeholders and enablers are 95.5% and 93.6%, respectively, which shows almost no gap between them. Education and capacity building is the third most prioritised challenge in implementing the Guidelines, but it is still necessary to improve awareness of sustainable agriculture and facilitate the transition from conventional agriculture.

3.2.4.4. Financing mechanism (Q8 of the questionnaire)

Brunei Darussalam has benefited from using financial support (90.7%; Figure 3.3) to apply sustainable agriculture. There are no detailed explanations of the sources and types of finance used by the respondents; 88.6% of stakeholders and 93.6% of enablers understand the financing mechanism, whereas the financial issue is the topmost challenge to implement the Guidelines. In addition, the strategy related to finance is shown as one of the prioritised short-term strategies (see Section 3.1.2.2). It is possibly interpreted that the financial support is broadly recognised but well applied by farmers so that promotive activity such as capacity building for finance would be required.

3.3. Conclusion

Awareness of sustainable agriculture and food systems in Brunei Darussalam is considered good, with a solid understanding of innovative technologies needed to support the initiative. However, awareness of the policies amongst the respondents is still considered low. Awareness programmes and initiatives will need to be developed for all stakeholders involved in the activities of sustainable agriculture and food systems, with particular attention to the financial, resource, and technological issues. These initiatives would be led by the strategies related to the production in the short term, eventually expanding to encompass broader medium- to long-term strategies.

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Chapter 4

Cambodia Country Report

Kong Thong, Kentaro Yamada, Siti Mustaqimatud Diyanah

4.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

The National Agricultural Development Policy 2022–2030 was developed to transform Cambodia's agriculture into a modern, competitive, inclusive, climate-resilient, and sustainable sector (Royal Government of Cambodia, 2022). In addition, 'Land Degradation Neutrality Targets' have been established to achieve various, including increasing forest cover, promoting agricultural growth, enhancing soil organic carbon stock in forests and croplands, and improving ecosystems and their services (Ministry of Agriculture, Forestry and Fisheries of Cambodia, 2018).

The practices for sustainable agriculture, integrated pest management, climate-smart agricultural initiatives, smart crops production, and safe vegetable production have been initiated (Council for Agricultural and Rural Development and the Technical Working Group for Food Security and Nutrition, 2021). The Sustainable Rice Platform initiated in 2015 is also the remarkable enactment (Swiss Contact, 2022). Organic agriculture has been practiced in the production of rice, cassava, cashew, and other crops (GIZ, 2022). Cambodia Good Agriculture Practices are installed (FAO, 2020). Agroecology, such as minimum or no tillage, permanent soil cover, species diversity and rotation, and alternate wetting and drying, has been implemented. That leads to halting erosion, carbon sequestration, enhancement of diversity, and reduction of GHG emission (FAO, 2023).

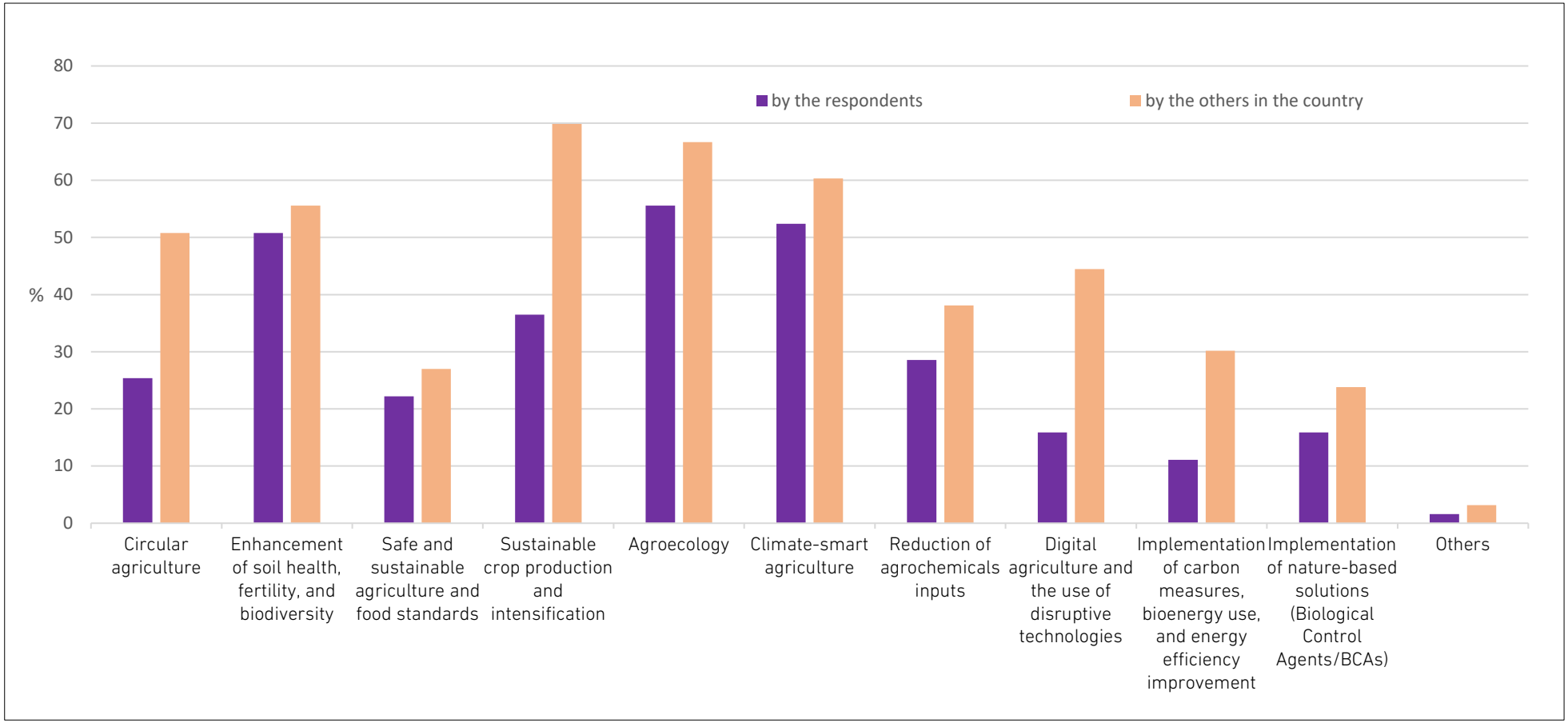
4.2. Result of the Questionnaire Survey and Discussion

4.2.1. Sustainable Key Actions or Initiatives Applied in Cambodia (Q1 of the Questionnaire)

Figure 4.1 shows that agroecology (55.6%), climate-smart agriculture (CSA) (52.4%), and enhancement of soil health, fertility, and biodiversity (50.8%) have been applied well by the respondents. Sustainable crop production and intensification (69.8%) is the most applied action in the country, whilst agroecology (66.7%) and CSA (60.3%) have also been effectively implemented, similar to the actions taken by the respondents. In line with the most and second-most applied actions, Cambodia started the implementation of conservative agriculture, sustainable intensification, and agroecology in 2004. It was formally recognised with the establishment of the Cambodia Conservation Agriculture and Sustainable Intensification Consortium in 2020 (Saruth, 2022). In addition, Cambodia has also developed CSA in partnerships, such as with the Asian Development Bank and

SNV Netherlands Development Organisation (SNV Netherlands, 2015; ADB, 2023). The projects are concerned with developing CSA techniques and creating a sustainable value chain system.

Figure 4.1. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in Cambodia Applied (a) by the Respondents and (b) by Others in the Country



Source: Authors.

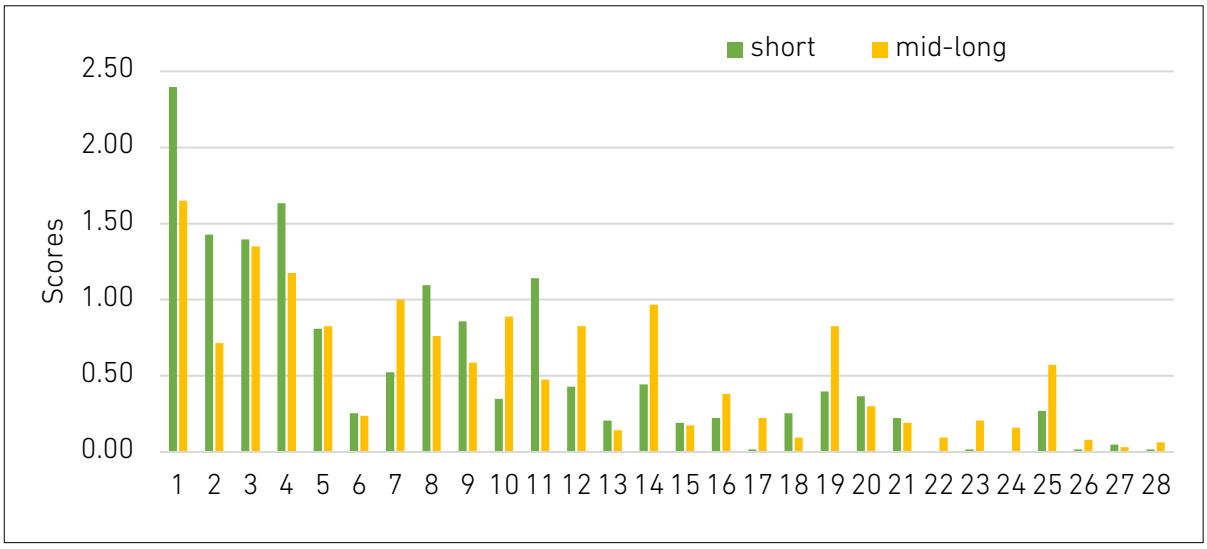
4.2.2. Prioritised Short-term and Mid- to Long-term Strategies on the Guidelines in Cambodia (Q2 of the Questionnaire)

Figure 4.2 shows that amongst the short-term strategies, (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (4) collaboration along the agriculture and food chains; (2) reduction of greenhouse gases from agriculture-related activities; (3) closing nutrient cycles/loops and valorisation of agricultural waste biomass and food waste into cost-effective feeds and fertilisers; and (11) building farmers' and food production personnel's knowledge base and developing their capacity are prioritised by the top five scores.

Amongst the medium-long-term strategies, (1) Improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (3) closing nutrient cycles/loops and valorisation of agricultural waste biomass and food wastes into cost-effective feeds and fertilisers; (4) collaboration along the agriculture and food chains; (7) promoting the use of smart and precision agriculture systems in sustainable food production; and (14) aligning ASEAN agricultural standards and those of our major export markets are the top five prioritised strategies.

Improving overall soil health (1) is ranked as the most prioritised strategy in the short and medium to long term. Furthermore, Figure 4.2 shows that the enhancement of soil health has been highly applied by the respondents. Those are in line with the recent policy enactment of 'Land Degradation Neutrality Targets', aimed at improving soil health (Ministry of Agriculture, Forestry, and Fisheries of Cambodia, 2018).

Figure 4.2. Key Priority Strategies of the Guidelines: Short- and Mid- to Long-term in Cambodia



Source: Authors.

4.2.3. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 and Q4 of the Questionnaire)

As the challenge to implement the Guidelines suggests, finance and market access shows the highest ratios (Table 4.1), followed by technology and infrastructure and resources (human and agricultural inputs). Compared with the average of all ASEAN countries (Figure 2.5 in Chapter 2), it is notable that environmental impacts are highly recognised as a challenge, whilst policy and institutional issues are less acknowledged.

Table 4.2 shows that the ratio of education and its application is the highest at the farm level, whilst financial and market support is most prominent at the provincial and national levels. This trend mirrors that of ASEAN, where governmental bodies provide financial support to address the most prioritised challenge. Additionally, capacity building is necessary to resolve human resource issues at the farm and provincial levels.

Table 4.1. Challenges Mapping the Implementation of the Guidelines in Cambodia

Categories	Challenges	Ratios (%)
Environmental impacts	Climate change and its impacts; pests and diseases; soil degradation; and pollution	14.1
Education and capacity building	Unskilled human resources, limited knowledge and training	12.4
Technology and infrastructure	Limited facilities, infrastructures, and laboratories; difficulties in adopting agriculture irrigation techs; lack of techniques, knowledge, and capacities for post-harvest	21.1
Finance and market access	Limited R&D finance from government or external sources; unequal distribution of farmers' funds; low prices; and lack of market support	31.9
Resources (human and agricultural inputs)	Lack of skilled human resources; difficulties in collaborating amongst stakeholders; excessive use and expensive agrochemicals	20.0
Policy and institutional framework	Difficulties in creating new agriculture regulations	0.5

Source: Authors.

Table 4.2. Solution Mapping at the Farm, Provincial, and National Levels, Including Ratios for the Implementation of the Guidelines in Cambodia

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	Training programmes and technical training, awareness advancement on sustainable agriculture, capacity building development, farmer field schools, and education and extension	Finding good cassava varieties, providing agricultural technologies	Production on more agriculture yields, promotion of food value chain, agriculture cycle, and food production	-
	93.8%	4.2%	2.1%	0.0%
Province	Training and technical support	Availability of cassava varieties, seeds, and irrigation system support	Search of markets, budget, negotiation on the price with collectors	Amendment of policies, cooperation with any stakeholders, creation of farmers group to increase cassava yield, private sector engagement
	32.3%	9.7%	54.8%	3.2%
National	Research on agricultural value chain	Modern cultivation equipment, improvement of rice quality, modern agriculture engineering equipment and digital	Market opportunities, working with banks to obtain loans, lending money with a low-interest rate of 5%, facilitating cassava price,	Development of more projects, creation of agriculture regulations and amendment of policies, creation of farmers associations, coordination with

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
		agriculture, development of integrated irrigation system	planning strategic and budget measures, increasing the price of rice, finance support	buyers and farmers directly, establishment of policy and roadmap, arranging priority tasks, engaging private sectors
	9.6%	15.4%	69.2%	5.8%

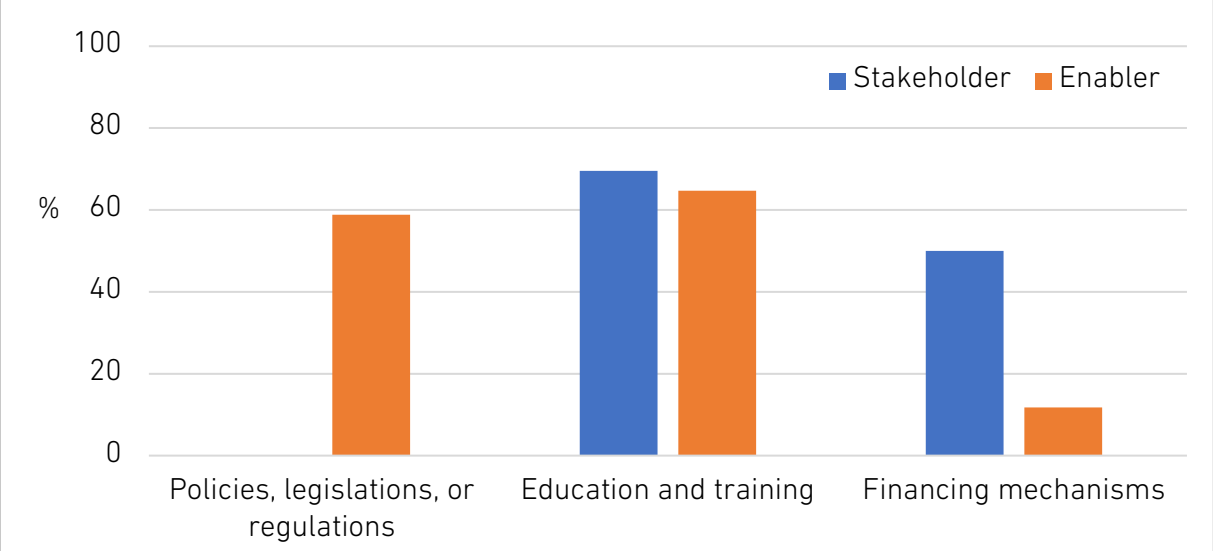
Source: Authors.

4.2.4. Enabling Environment for the Guidelines

4.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

The respondents address policies related to crop seeds and breeders' control, fertiliser, the Triangle Strategy of government, fisheries, plant quarantine, rice production, national strategic development plan, and the rectangular strategy in the country. No stakeholders recognise the policy for sustainable agriculture and food systems, whereas 58.8% of enablers acknowledge it (Figure 4.3). Even if the interviews may not have been conducted appropriately with the stakeholders, it indicates a need for increased promotion of the policy amongst them. In this regard, the low ratio of the policy and institutional framework shown in Table 3.3 is likely due to the challenge arising from insufficient attention to policy concerns amongst stakeholders.

Figure 4.3. Percentage of Respondents' Understanding of Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to Support the Sustainable Agriculture and Food Systems in Cambodia

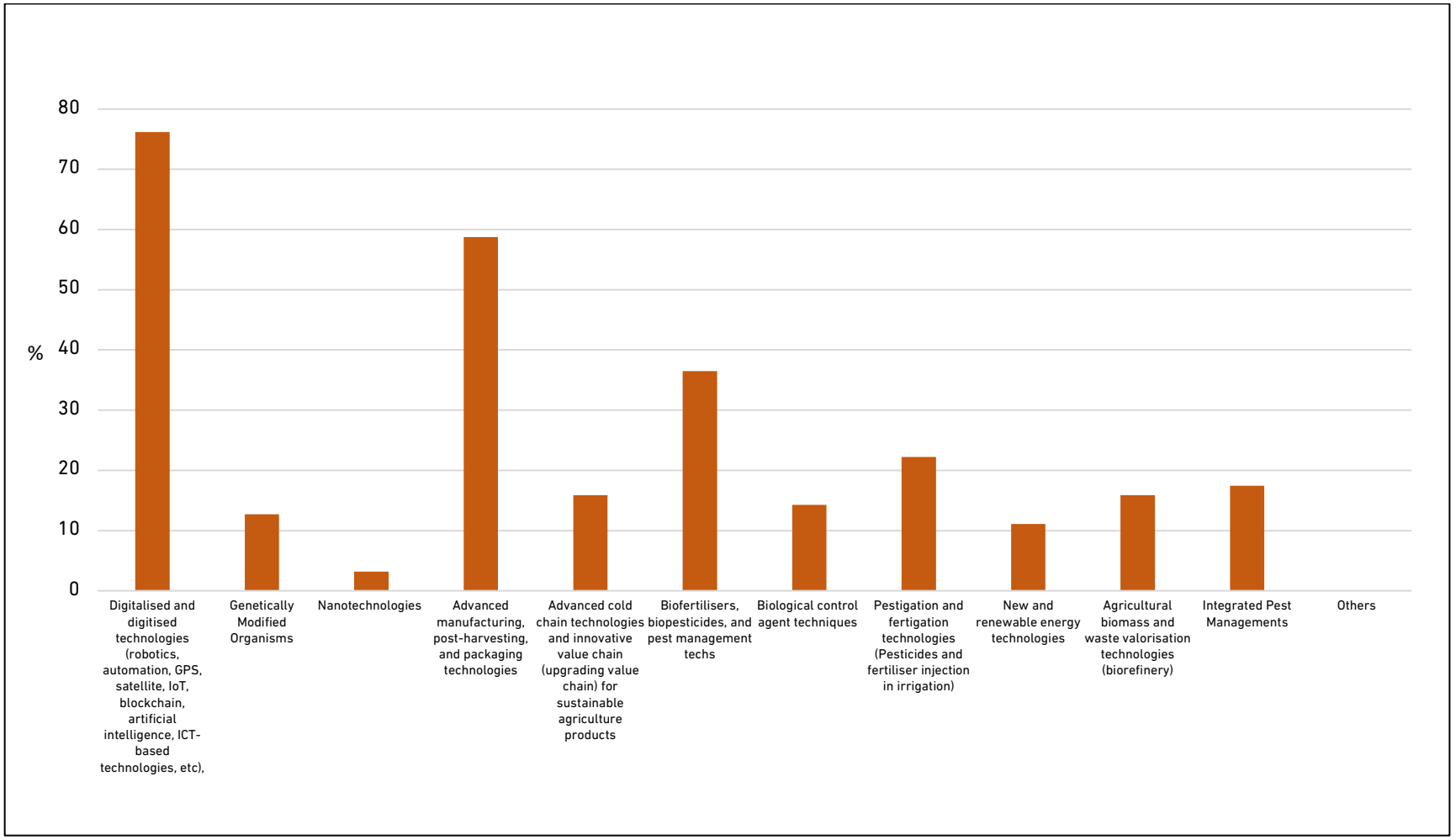


Source: Authors.

4.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

Figure 4.4 shows that digitalised and digitised technologies (76.2%) and advanced manufacturing, post-harvesting, and packaging technologies (58.8%) have been highly adopted whilst other technologies indicate relatively low ratios compared with other ASEAN countries. Referring to Figure 4.4, however, Cambodia is considered to have a low percentage of digital agriculture and the use of disruptive technologies. Considering that digital agriculture has a narrower meaning than digitalised and digitised technology, this may be at least partially due to respondents' misinterpretation that they use digital technologies in their lives, but do not apply them effectively to agricultural techniques. It could be interpreted that advanced manufacturing, post-harvesting, and packaging technologies are the most applied innovative technologies in Cambodia.

Figure 4.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in Cambodia



Source: Authors.

4.2.4.3. Education and Capacity Building (Q7 of the Questionnaire)

Different specific educational subjects on sustainable agriculture are delivered from the respondents, such as financial management, crop planting management, use of agricultural inputs, plant varieties, animal feeding, fishery, climate change, poultry raising, post-harvest technology, integrated pest management, good agricultural practices, and food safety.

Figure 4.3 shows the relatively high ratios of stakeholders and enablers, which are 69.6% and 64.7% respectively. Education and capacity building are less emphasised as challenges (Table 4.1), aligning with the interpretation that opportunities for education have been effectively addressed. Additionally, building farmers' and food production personnel knowledge base and developing their capacity rank as the fifth key strategy in the short term (Figure 4.2). That might indicate that education will continue to be required.

4.2.4.4. Financing Mechanism (Q8 of the Questionnaire)

Cambodia has utilised financial mechanisms sourced from loans, grants, and microfinance. This support is mainly from farmers' associations, banks, and projects. Fifty percent of stakeholders understand the financing mechanisms whereas only 11.8% of enablers understand the mechanisms (Figure 4.3).

The financial issue is the primary focus amongst the challenges (Table 4.1), and enhancing financial support at the national level is proposed as the solution (Table 4.2). This likely indicates that the financing mechanisms implemented by enablers may be more necessary.

4.3. Conclusion

Agroecology, CSA, and the enhancement of soil health have been implemented by both the respondents and others in Cambodia. In contrast, sustainable crop production and intensification have been widely applied by others in Cambodia but less applied so by the respondents. In addition, improvement of overall soil health will be the most prioritised strategy for sustainable agriculture and food systems. Environmental impact, including climate change and soil degradation, is one of the challenges, but has received less focus compared to other issues. The reduction of GHG gas is well prioritised only in the short term, whereas CSA has been less adopted. Thus, CSA might be noted in the context of the prevention of soil degradation.

Capacity building for sustainable agriculture and food systems has been well conducted whilst policies and financial support by enablers are not familiar to stakeholders. Financial and market access is recognised most as the challenge amongst the respondents. Enactments by the enablers are needed to address the issues.

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Chapter 5

Indonesia Country Report

Ma'mun Sarma, Dedy Cahyadi Sutarman, Kentaro Yamada, Siti Mustaqimatud Diyanah

5.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

The Government of Indonesia has shown its concern to policy initiatives for sustainable agriculture and food systems. In 2009, the government enacted Law No 41/2009 concerning the Protection of Sustainable Food Agricultural Land (BPK, 2009). Government Regulation (PP) Number 25 of 2012 on Sustainable Food Agricultural Land Information Systems was produced to support the previous initiatives (BPK, 2012). As one of the national initiatives, Regulation of the Minister of Agriculture of the Republic of Indonesia on balanced fertilisation (Permentan No. 13/2022) was conducted (BPK, 2022). It supports the Organic Fertiliser Processing Unit programme, which enables farmers to produce their own organic fertiliser. This initiative increases productivity and land sustainability, whilst also improving the income and welfare of the farmer group (FFTC-AP, 2019).

Educational systems have also been strengthened. For example, there are technical guidance programmes, Polytechnic of Agricultural Engineering Indonesia, and schools of agricultural vocational studies, amongst others (Ministry of Agriculture of Indonesia, 2021). The Early Warning Systems and Management of Climate Change Impacts in the Agricultural Sector (No.39/PERMENTAN/HM.130/8/2018) was also produced to support sustainability in the agriculture sector (BPK, 2018). An adaptation action programme has been implemented to anticipate the El Niño impact, which exacerbates drought (Directorate General of Food Crops of Indonesia, 2023).

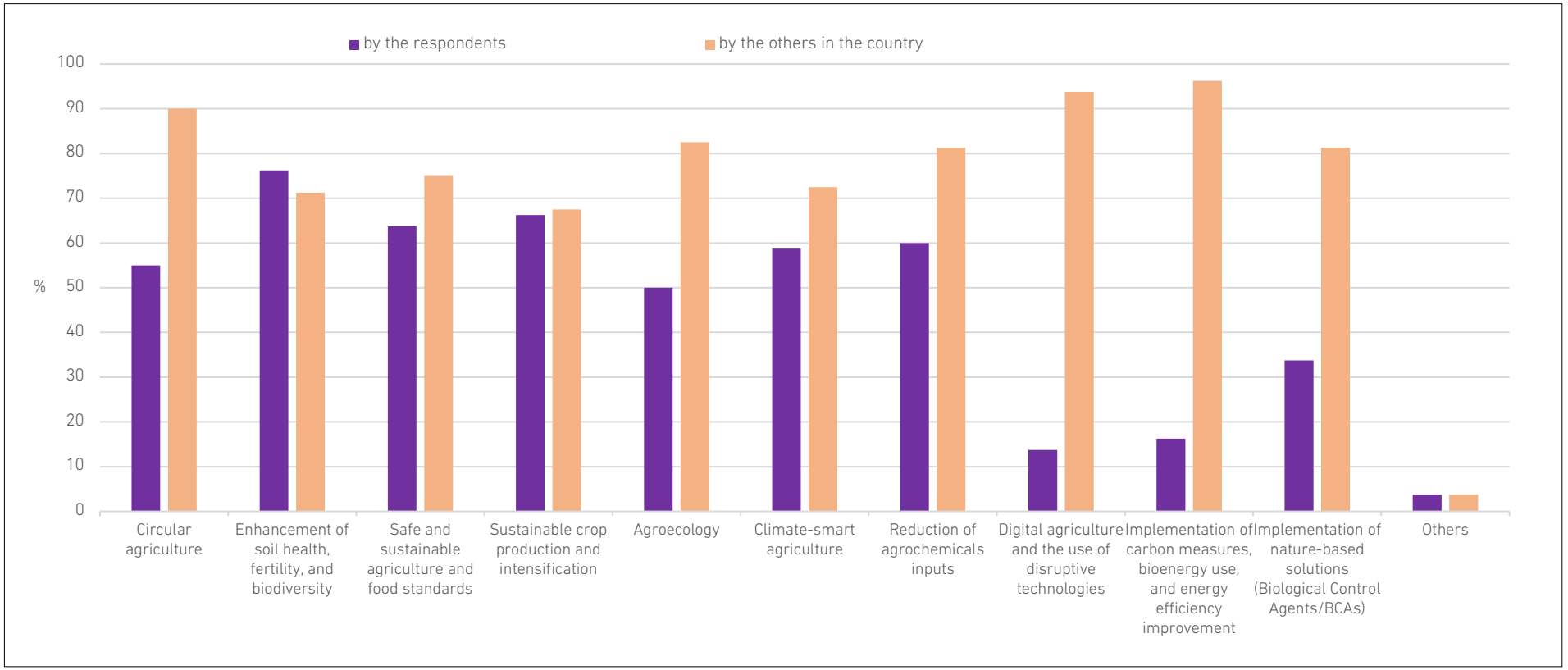
5.2. Result of the Questionnaire Survey and Discussion

5.2.1. Sustainable Key Actions or Initiatives Applied in Indonesia (Q1 of the Questionnaire)

Figure 5.1 shows that respondents have highly implemented the enhancement of soil health, fertility, and biodiversity (76.3%); sustainable crop production and intensification (66.3%); and safe and sustainable agriculture and food standards (63.8%). The implementation of carbon measures, bioenergy use, and energy efficiency improvements (96.3%); digital agriculture and the use of disruptive technologies (93.8%); and circular agriculture (90.0%) applied amongst others in the country demonstrate ratios exceeding 90%. However, respondents did not effectively implement these initiatives, as indicated by the low response ratio to the question.

Based on the data, there are distinct preferences of agri-food value actors regarding the implementation of initiatives for sustainable agriculture and food systems at both the site and country levels. At the site level, most actors have implemented initiatives for soil conservation, crop production and intensification, and agriculture and food standards, with the possible intention to increase agricultural and food productivity at the farm level to meet the demand and fulfil the needs of Indonesia. Meanwhile, at the country level, the government has started to complement farmers' needs in attaining the above goals by equipping them with technologies on bioenergy and energy efficiency, circularity, and digitalisation. These initiatives were highly strengthened with strong commitments of the G20 Leaders under the presidency of Indonesia as stipulated in the G20 Bali Leaders' Declaration (Government of Indonesia, 2022).

Figure 5.1. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in Indonesia Applied (a) by the Respondents and (b) by Others in the Country



Source: Authors.

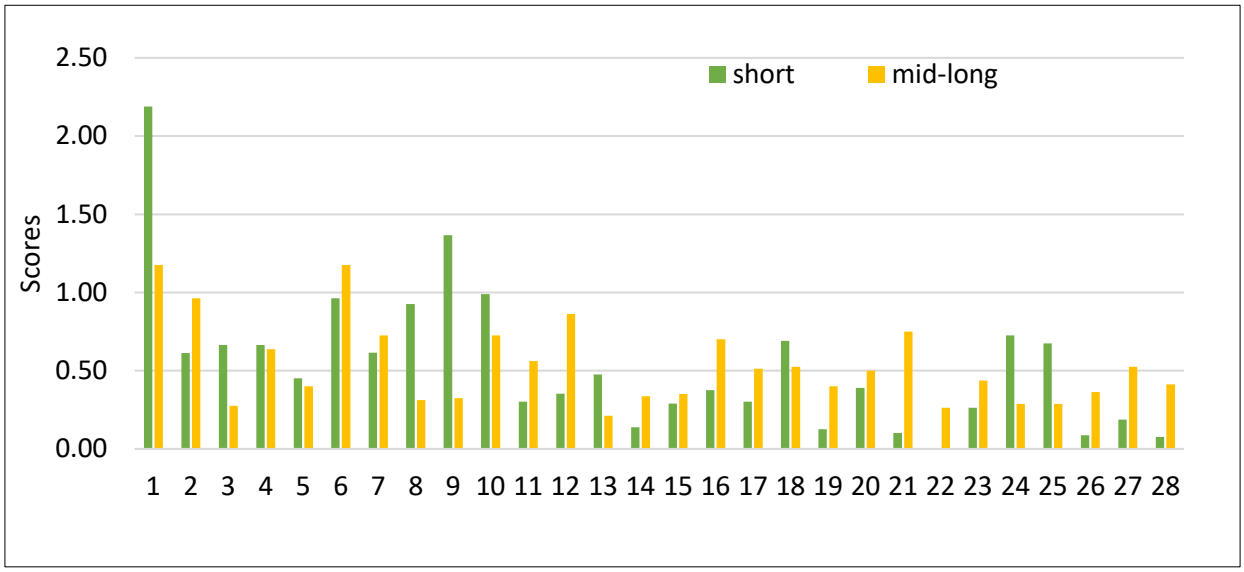
5.2.2. Prioritised Short- and Medium- to Long-term Strategies on the Guidelines in Indonesia (Q2 of the Questionnaire)

Figure 5.2 shows that amongst the short-term strategies, (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (9) connecting smallholders to markets; (10) encouraging diversification of production and income; (6) ensuring food security; and (8) facilitating funding with productive resources, finance, and services, are top five prioritised strategies.

Amongst the medium- to long-term strategies, the top five prioritised strategies are follows: (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (6) ensuring food security; (2) reduction of greenhouse gases from agriculture-related activities; (12) encouraging more research and development on sustainable and circular agriculture and food production; and (21) improving the participation of women and youth in sustainable smart systems.

As shown in Section 5.1, the Government of Indonesia has promoted the use of organic fertilisers in recent years. That is in line with the most prioritised strategy in the short and mid- to long term, which includes the application of organic fertilisers.

Figure 5.2. Key Priority Strategies of the Guidelines: Short and Mid- to Long Term in Indonesia



Source: Authors.

5.2.3. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 and Q4 of the Questionnaire)

Resources (human and agricultural inputs) show the highest ratio (41.3%) amongst the challenges (Table 5.1). The issues are mainly related to agricultural input and limited capital. Other challenges have similar ratios of approximately 10%. Facilitating funding with productive resources, finance, and services is proposed as one of the most prioritised strategies in the short term (see Section 5.2.2).

Table 5.2 shows that technology and infrastructure have the highest ratio at the farm level, whilst financial and market support has the highest ratios at the provincial and national levels. Financial and market support at the national level includes improving the distribution of fertilisers. The government initiative promoting the use of organic fertilisers (BPK, 2022; see Section 5.1) is underway and is expected to address the need for adequate agricultural inputs.

Table 5.1. Challenges Mapping the Implementation of the Guidelines in Indonesia

Categories	Challenges	Ratios (%)
Environmental impacts	Pest and diseases, climate change and its effects, land conversion	11.7
Education and capacity building	Low education and knowledge of farmers, non-optimal agricultural research	11.7
Technology and infrastructure	Traditional facilities and infrastructure, low tech at the farmer level and non-optimal use of post-harvest handling, low renewable tech adoption	14.2
Finance and market access	Limited market access to agricultural products	12.5
Resources (human and agricultural inputs)	Lack of skilled farmers and ageing farmers, high and volatile prices of agricultural inputs and crops, limited agricultural business capital	41.3
Policy and institutional framework	How to improve ineffectiveness of implementation and socialisation of policies, security of land and agricultural products, standardisation amongst various cultures, how to decrease differences in programmes by central and local governments	8.8

Source: Authors.

Table 5.2. Solution Mapping at the Farm, Provincial, and National Levels, Including Ratios for the Implementation of the Guidelines in Indonesia

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	Training on human resources, conducting training on sustainable farming, providing technical assistance and knowledge sharing	Control of plant pests and diseases; manufacture of organic fertiliser; balancing of fertiliser programmes; adoption of practical, economical, and applicable technology; and search for agriculture cultivation techniques	Increase in productivity of the agricultural business, facilitation on market, search for capital assistance	Development of agriculture land policy, enactment of regulation and protection on agricultural commodities, networking with private sector involvement
	17.5%	65.0%	12.5%	5.0%
Province	Knowledge sharing, human resources training, and improvement	Prioritisation of climate-smart agriculture	Increase in productivity of the agricultural business, increased budget support for the agricultural sector, facilitating capital assistance for agricultural business, controlling price and fertiliser distribution, facilitating the market process	Development of synergies between government, private, and community; plan in policies on sustainable agriculture; development of comprehensive sustainable programmes from upstream and downstream; networking with the private sectors; development of agriculture land policies; facilitation of agricultural cooperatives

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
	20.0%	17.5%	35.0%	27.5%
National	Research on agriculture product development	Post-harvest handling, development of agriculture production infrastructure, development of applicative agriculture technologies	Improvement of agricultural products supply chain, control in price and fertiliser distribution, support for budget in the agriculture sector, guarantees in the market of agriculture products, support for the budget on agriculture development, search in agribusiness capital assistance and scheme	Monitoring and evaluation of sustainable agriculture policies, development of agricultural cooperatives, development of policies on the conversion of agricultural land, dissemination and synchronisation of agricultural policies
	6.0%	19.0%	42.9%	32.1%

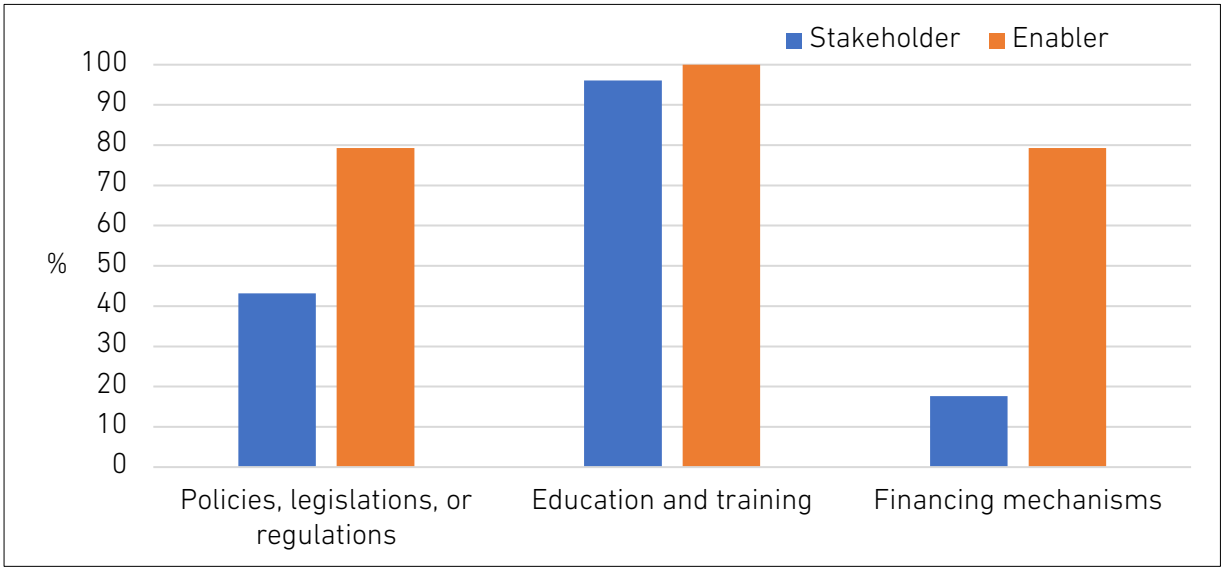
Source: Authors.

5.2.4. Enabling Environment for the Guidelines

5.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

Policies, legislations, or regulations for the sustainable agriculture and food systems are well recognised by the enablers rather than the stakeholders (Figure 5.3). Moreover, respondents also have a good knowledge of specific practices, such as food security and nutrition, sustainable food agriculture land, early warning system of climate change in agriculture, village government, sustainable cultivation system, and sustainable food agriculture land information system.

Figure 5.3. Percentage of Respondents' Understanding of Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to Support the Sustainable Agriculture and Food Systems in Indonesia

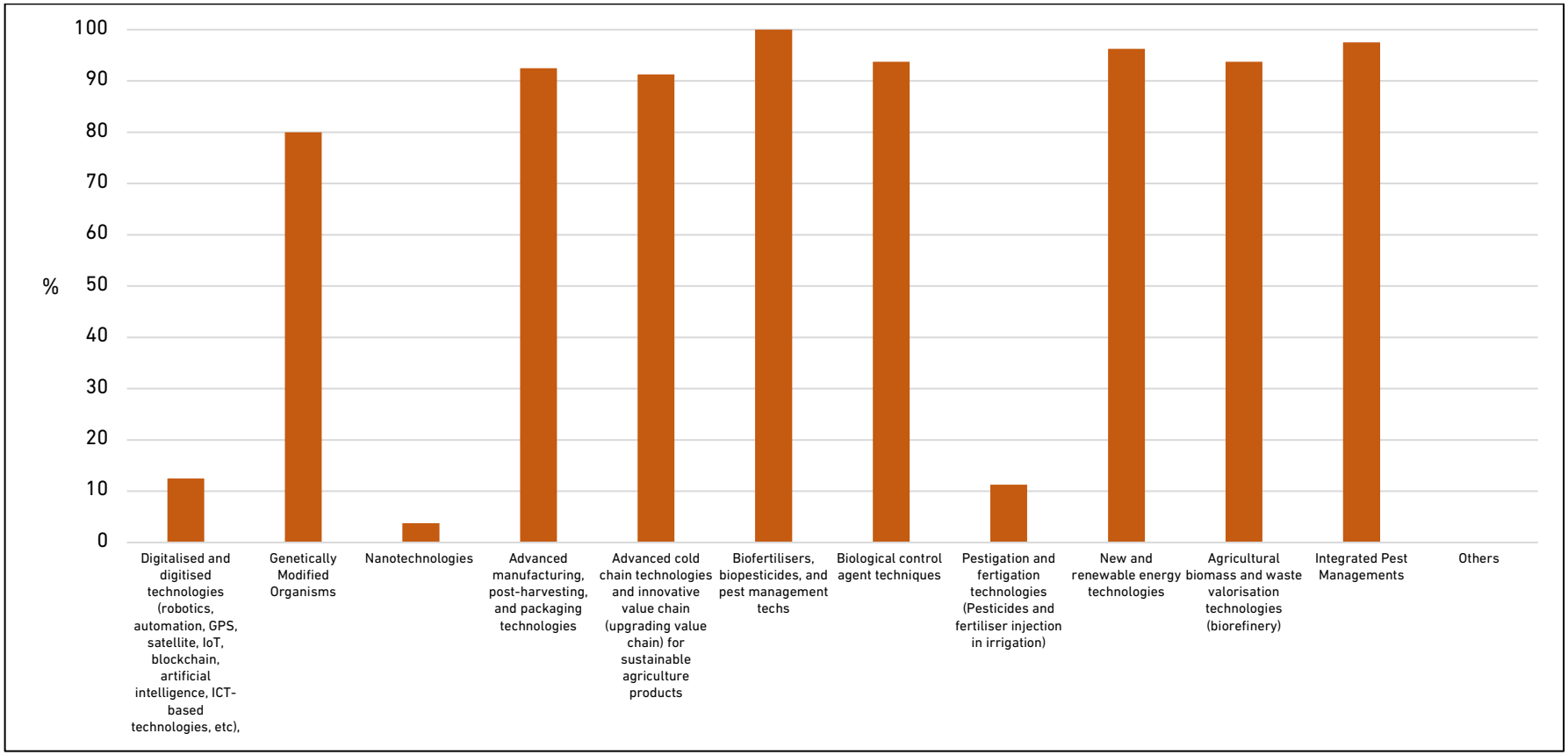


Source: Authors.

5.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

Figure 5.4 shows that innovative technologies, except for Digitalised and digitised technologies, nanotechnologies, including pestigation and fertigation technologies, have been well adopted. The low ratio of digitalised and digitised technologies is in line with the low implementation of digital agriculture (Figure 5.4). Respondents were aware that biofertilisers, biopesticides, and pest management techs have been adopted in Indonesia, which might be related to the recent initiatives by the government to promote organic fertilisers (BPK, 2022).

Figure 5.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in Indonesia



Source: Authors.

5.2.4.3. Education and Capacity Building (Q7 of the Questionnaire)

Education and capacity building for sustainable agriculture and food systems is well recognised by the stakeholders and enablers (Figure 5.3). This initiative is mostly related to food value chain actors with different subject matters, such as agriculture cultivation, biofertiliser, agricultural productivity, halal products, food technology, sustainable farming, organic farming, millennial agriculturist, good agriculture practices, good animal husbandry practices, climate-smart agriculture (CSA), and post-harvest.

For the challenge of implementing the guideline (Table 5.1), the ratio of education to capacity building is low. Supporting policies (see Section 5.1) have strengthened the educational system in Indonesia, which may lead to a better understanding of the initiative amongst stakeholders and enablers.

5.2.4.4. Financing Mechanism (Q8 of the Questionnaire)

Varied sources and types of financial support for sustainable agriculture are identified in Indonesia, such as agricultural business capital loans, people's business credit, subsidies, grants, financial support for sustainable agricultural land, Sustainable Development Goals and carbon finance support, financial cooperation, and carbon economic value. These sources and types of financial support are recognised by the enablers with a high ratio whereas only 17.6% of the stakeholders recognise them.

Finance and market access is not highly recognised as the challenge to implement the guideline (Table 5.1).However, it is important to note that addressing the challenge of finance and market access is more crucial at the province and national levels than at the farm level (Table 5.2). A higher ratio of the recognition of financing mechanisms by the enablers indicates that their initiatives will likely meet the demand. However, the issue of market access, which is one of the prioritised strategies in the short term, would still be an issue, especially for small farmers.

5.3. Conclusion

To implement the Guidelines, resources including agricultural input is the main issue. Implementation of a biofertiliser initiative has been well adopted in Indonesia but might be still insufficient. The government initiative for organic fertilisers has been promoted in recent years, and it may be the solution. Capacity building is well recognised both by stakeholders and enablers. Financial mechanisms are also well recognised only by the enablers but should be recognised more by the stakeholders, which will lead to the enhancement of the market access by small farmers.

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Chapter 6

Lao PDR Country Report

Sayvisene Boulom, Kentaro Yamada, Siti Mustaqimatud Diyanah

6.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

Government initiative for green development in the 9th Five-Year National Socio-Economic Development Plan (2021–2025) has been conducted (Lao PDR Peace Independence Democracy Unity Prosperity, 2021). The more specific and recent policies – the Agriculture Development Strategy to 2025 and Vision to 2030 (Ministry of Agriculture and Forestry of Lao PDR, 2015) and Green and Sustainable Agriculture Framework for Lao PDR to 2030 (Department of Policy and Legal Affairs, Ministry of Agriculture and Forestry of Lao PDR, 2021) with the slogan 'modernisation, clean, safety, quality, stability, sustainability, and commercialisation' – were published. In addition, the National Green Growth Strategy (2018–2030) is being undertaken. Under the initiatives above, related policies such as clean agriculture, organic agriculture, and good agriculture practices (GAP) have been prioritised (Secretariat for Formulation of National Green Growth Strategy of the Lao PDR, 2018).

The Lao PDR government, through the Department of Agriculture, has two main actions to support clean agriculture development initiatives, namely, The Clean Agriculture Development Center and The Promotion of Organic Farming and Marketing Project (Hirokawa, 2013). This action will promote practices for sustainable agriculture including organic farming, integrated pest management, GAP, an integrated farming system, a system of rice intensification, conservation agriculture, agro-forestry, diversified agriculture, and utilisation of animal products for self-sufficient nutrients, food and nutrition, as well as capacity building including the utilisation of digital application (LICA, 2018).

6.2. Result of the Questionnaire Survey and Discussion

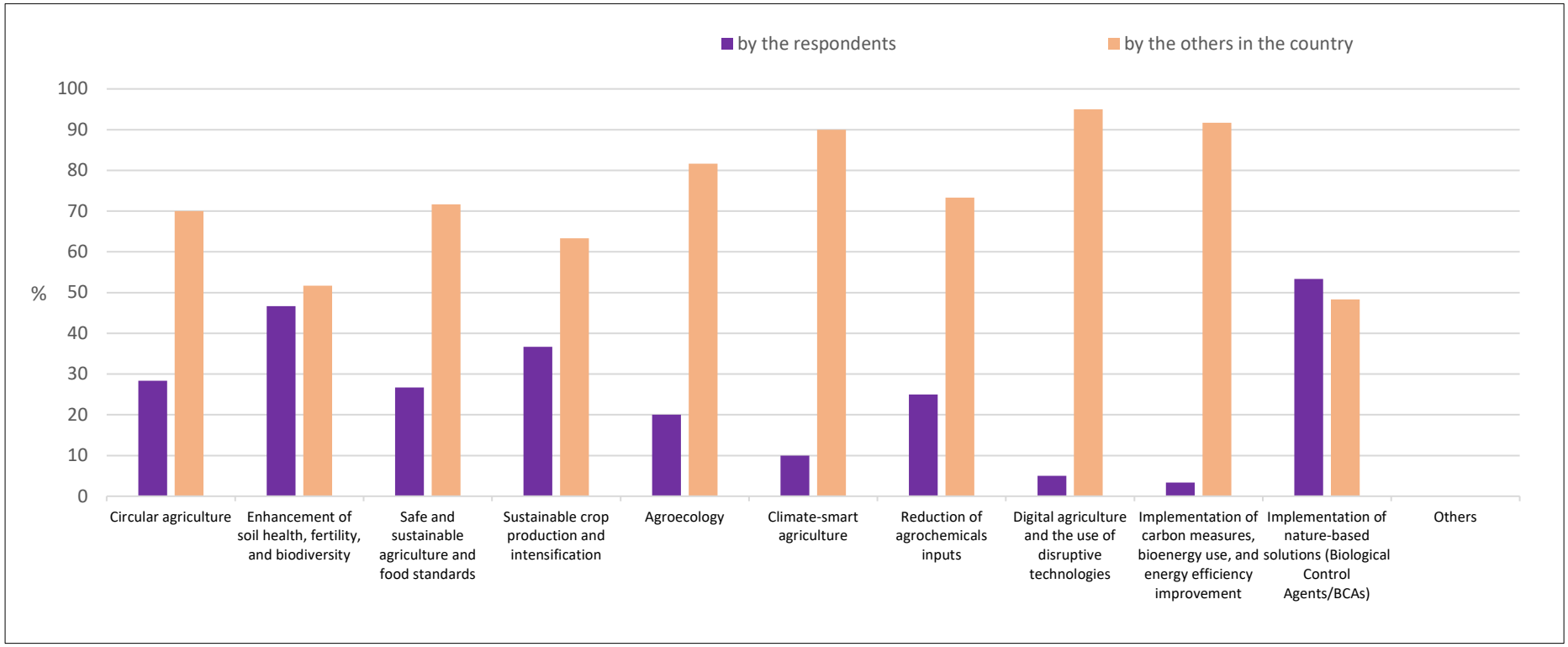
6.2.1. Sustainable Key Actions or Initiatives Applied in the Lao PDR (Q1 of the Questionnaire)

Figure 6.1 shows that the implementation of nature-based solutions (53.3%) and the enhancement of soil health, fertility, and biodiversity (46.7%) have been applied relatively well by the respondents and indicate almost the same ratios in the case of the applications by others in the country. Digital agriculture and the use of disruptive technologies (95.0%); implementation of carbon measures, bioenergy use, and energy efficiency improvement (91.7%); and climate-smart agriculture (CSA) (90.0%) are the top three actions that have

been applied by others in the country. In contrast, these are the three lowest actions that have been applied by the respondents.

According to the result, from the respondents' view, sustainable agriculture and food systems are favoured with nature solutions, soil conservation, and continuous crop production and intensification, whereas digital transformation, energy security, and CSA are demanded at the country level with a more systemic and integrated implementation based on national development ambitions and the metabolic profile of the country. For instance, the Lao PDR government has promoted productivity improvements through a digital transformation through the Digital Economy Strategy (2021–2030) and the National Digital Economy Development Plan (2021–2025), and the agriculture sector is one of the sectors that is digitised (World Bank, 2022). Such initiatives might be well recognised by the respondents; however, they are less frequently applied by them respondents.

Figure 6.1. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in the Lao PDR Applied (a) by the Respondents and (b) by Others in the Country



Source: Authors.

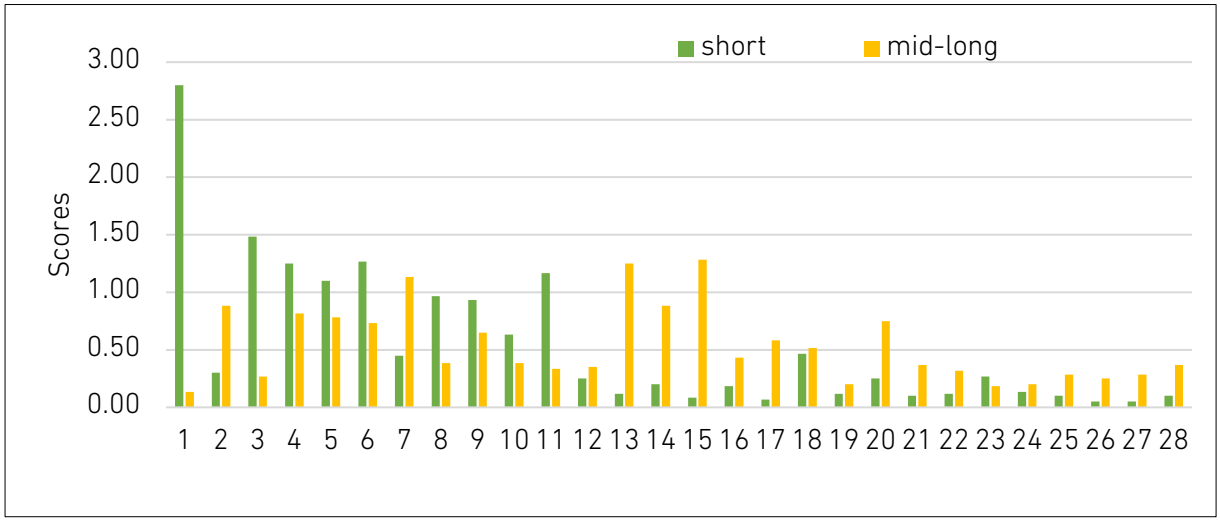
6.2.2. Prioritised short- and mid- to long-term strategies on the Guidelines in the Lao PDR (Q2 of the questionnaire)

Figure 6.2 shows that amongst the short-term strategies, (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (3) closing nutrient cycles/loops and valorisation of agricultural waste biomass and food waste into cost-effective feeds and fertilisers; (6) ensuring food security; (4) collaboration along the agriculture and food chains, and (11) building farmers and food production personnel knowledge base and developing their capacity are the top five priority strategies.

Amongst the medium- to long-term strategies, the top five priority strategies are as follows: (15) strategising to replace highly hazardous pesticides (HHPs), broad-spectrum pesticides, and neonicotinoids in ASEAN agriculture; (13) promoting the set-up of new sustainable and circular initiatives; (7) promoting the use of smart and precision agriculture systems in sustainable food production; (2) reduction of greenhouse gases from agriculture-related activities; and (14) aligning ASEAN agricultural standards and those of our major export markets.

Notably, the strategies related to production are prioritised in the short and mid- to long term. These practices have been implemented as shown in Section 6.2.1. Strategies that are not directly related to production techniques, such as food security, capacity building, and new initiatives are also prioritised. Some initiatives and practices have been recently conducted, but further enhancements for them might be required.

Figure 6.2. Key Priority Strategies of the Guidelines: Short and Mid- to Long Term in the Lao PDR



Source: Authors.

6.2.3. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 and Q4 of the Questionnaire)

Table 6.1 shows that education and capacity building (31.6%) is highly recognised as the challenges amongst the respondents, followed by finance and market access (23.9%), and policy and institutional framework (21.3%).

According to Table 6.2, solutions to the challenges in education and capacity building are required at the farm level, whilst solutions for finance and market access are focused at the provincial and national levels.

Those are in line with the results of Q2 (see Section 6.2.2), which indicates that education and capacity building are related to strategy no. 11, and finance and market access is related to strategy no. 4, shown as the prioritised strategies in the short term. Policy and institutional framework might be related to strategy no. 13, which is prioritised in the mid to long term and might be less required as the solution.

Table 6.1. Challenges Mapping the Implementation of the Guidelines in the Lao PDR

Categories	Challenges	Ratios (%)
Environmental impacts	Environmental impacts of food production	3.9
Education and capacity building	No extensive and limited knowledge, underdeveloped education, persistence to use agrochemicals	31.6
Technology and infrastructure	Unavailable and low techniques and innovation, limited modern technologies	9.7
Finance and market access	Lack of funding and access to loans, difficulties in accessing finance, high cost of trading	23.9
Resources (human and agricultural inputs)	Not enough labour, high cost of production, unwell-rounded knowledgeable farmers in technology	9.7
Policy and institutional framework	Deficient market access policies, insufficient supporting policies, how to increase limited policy responses, unreached policies understanding to the farmers level	21.3

Source: Authors.

Table 6.2. Solution Mapping at the Farm, Provincial, and National Levels, Including Ratios for the Implementation of the Guidelines in the Lao PDR

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	Training in production techniques and sustainable agriculture, learning on sustainable agriculture production techniques, support to following up and providing knowledge, researching on product expansion and new techniques for farmers	Modern technologies in the production system, data collection to analyse the problems	Search for sources of funding and co-financing fund	-
	58.8%	7.8%	33.3%	0.0%
Province	Training on agriculture techniques, development of technical training in various fields, expansion and dissemination of sustainable agriculture information	Promotion of sustainable agricultural production techniques	Search in markets and funding sources to help support the provision of various equipment and techniques, securing capital	Determination of strategies to create an implementation plan based on government funding, dissemination of the rules, creation of projects, farmers' support to obtain more earnings, improvement of the sustainable agriculture policy

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
				following the actual situation, development of public–private projects
	27.3%	3.6%	61.8%	7.3%
National	Expansion of information about sustainable agriculture, discussion arrangement to find solutions, and research scholarship	Strengthened equipment and production techniques	Looking for domestic and foreign sources of funding support capital, modern technology, and production know-how, looking for cooperative funds	Strengthened legal regulations, sustainable agriculture policy support, development of legal regulations on the prohibition of the use of chemicals
	20.3%	13.0%	58.0%	8.7%

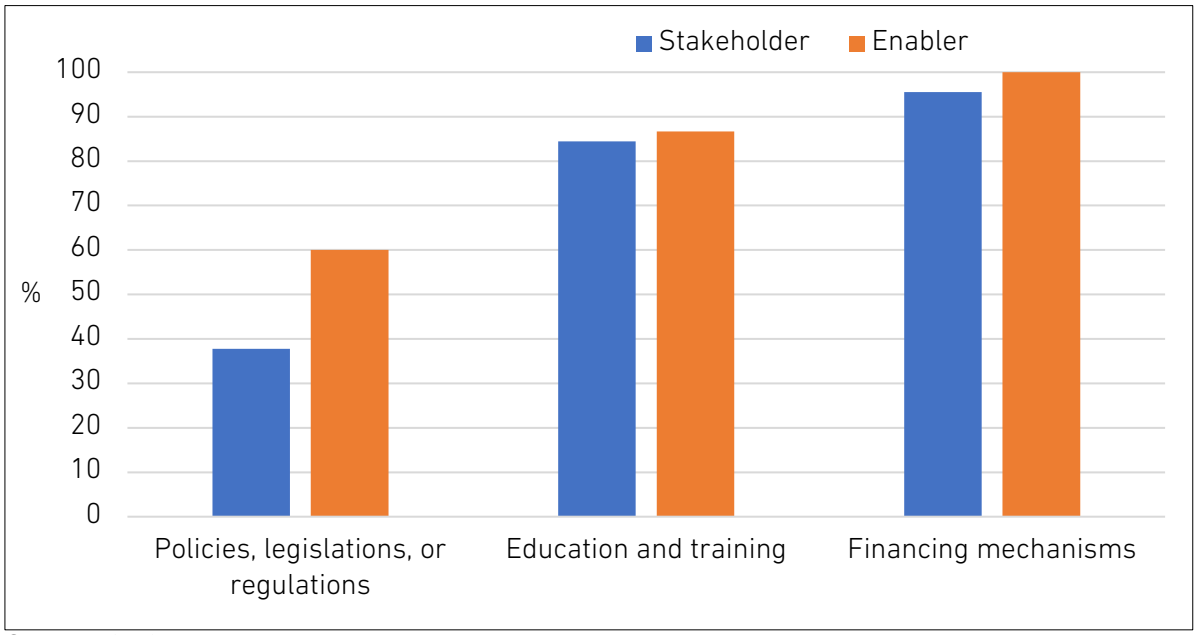
Source: Authors.

6.2.4. Enabling Environment for the Guidelines

6.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

Figure 6.3 shows that policies, legislations, or regulations for the sustainable agriculture and food systems are well recognised by the enablers rather than the stakeholders. The respondents have a better understanding in specific practices, such as policies on chemical fertiliser, organic farming, and organic vegetable cultivation.

Figure 6.3. Percentage of Respondents' Understanding of Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to Support the Sustainable Agriculture and Food Systems in the Lao PDR

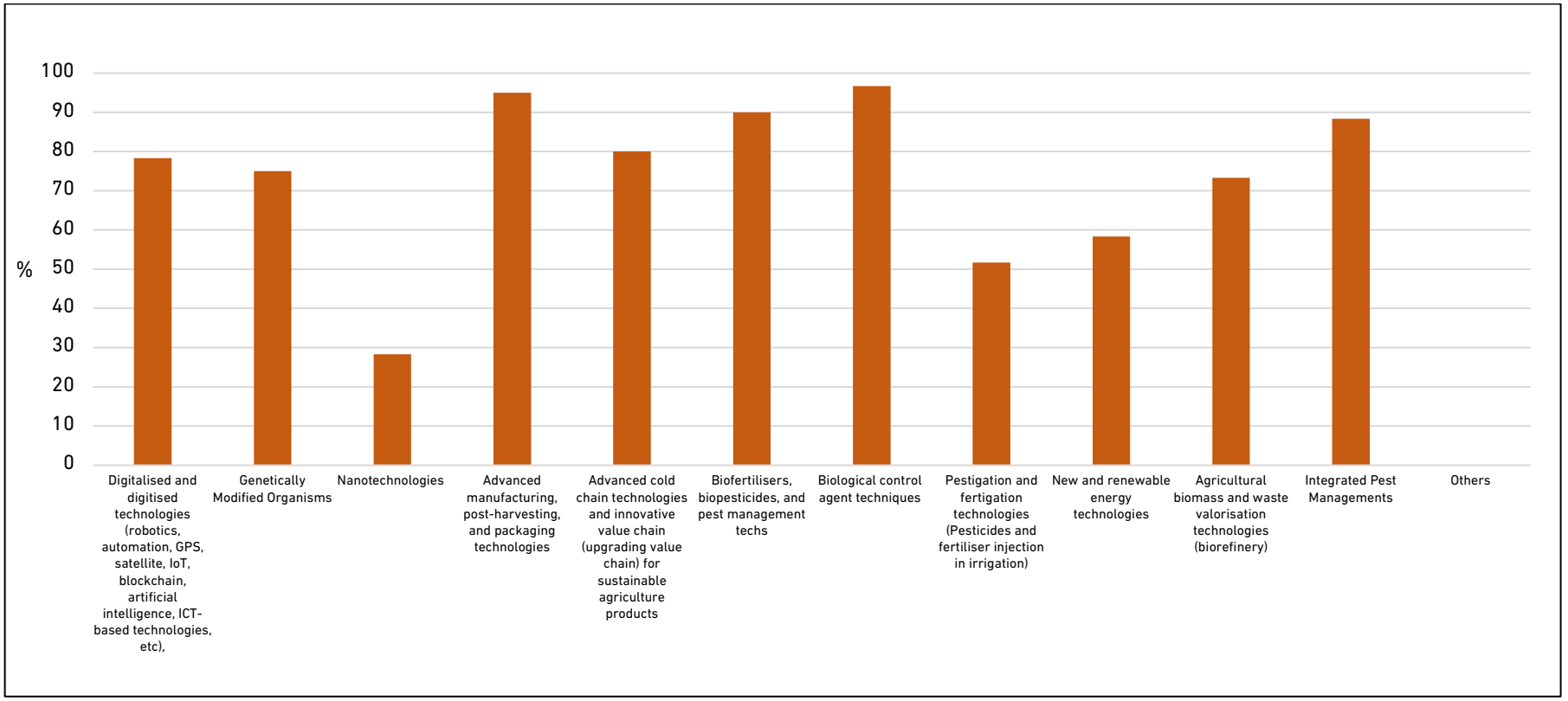


Source: Authors.

6.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

More than 50% of the respondents adopted innovative technologies except nanotechnologies (Figure 6.4). Biological control agent techniques, advanced manufacturing, post-harvesting, and packaging technologies, and Biofertilisers, biopesticides, and pest management techs are highly adopted with more than 90% ratios. The ratio of digital and digitised technologies is relatively high and is in line with the result of Figure 6.4, whereas the implementation of nature-based solutions including biological control agents shows the lowest ratio in the case of the application by others in the country in Figure 6.1. Although it might be controversial, it can be interpreted that the implementation of biological control agent techniques is in the initial stages in the Lao PDR.

Figure 6.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in the Lao PDR



Source: Authors.

6.2.4.3. Education and Capacity Building (Q7 of the Questionnaire)

Both stakeholders and enablers highly recognise the importance of education and capacity building for sustainable agriculture and food systems (Figure 6.3). A range of educational topics related to sustainable agriculture and food systems are covered in both field training and higher education programmes. The subjects are controlled use of agrichemicals inputs (pesticides, fertiliser, herbicides); sustainable agriculture production; food safety; compositing; biomass valorisation; land use management; food waste and its use for biofertiliser; and sustainable agriculture.

However, education and capacity building are still the highest challenges to the implementation of the Guidelines (Table 6.1). It possibly indicates that the opportunity for education and capacity building is insufficiently provided.

6.2.4.4. Financing Mechanism (Q8 of the Questionnaire)

Finance mechanisms are well recognised both by stakeholders and enablers (Figure 6.3). Many types and sources of financial support are provided to support sustainable agriculture, including group funds, village funds, government projects funds and support, farmers' network funds, cooperative funds, and promotional banks. The funds are in the form of grants, loans, credit, and general funds. However, finance and market access is the second highest challenge for implementing the Guidelines (Table 6.1), and is recognised as the most important solution at the provincial and national levels (Table 6.2). Financial mechanisms are necessary to make new initiatives more accessible to stakeholders.

6.3. Conclusion

Initiatives for sustainable agriculture have been implemented in the Lao PDR including the adoption of innovative technologies. However, issues related to finance and capacity building persist.

Smallholder farmers faced challenges in applying sustainable agriculture. Multidiscipline involvement and sustainable agriculture interventions could aim to produce an evidence base for both farmers and policymakers to consider these approaches. Technology, human resources, and funding could push sustainable agriculture and food systems in the Lao PDR.

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Chapter 7
Malaysia Country Report

Chubashini Suntharalingam, Kentaro Yamada, Siti Mustaqimatud Diyanah

7.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

The National Agrofood Policy (NAP) provides the direction of the agriculture and food sector in Malaysia. The current policy (2021–2030) emphasises the importance of climate-smart agriculture (CSA) towards the adoption of sustainable and climate-resilient practices (Ministry of Agriculture and Food Industries of Malaysia, 2021).

'Advance towards sustainable agricultural practices and food systems' is one of the policy thrusts of NAP, which includes the reduction of food loss and wastage along the value chain, driving greater adoption of sustainable farming practices with the utilisation of bioresources, the promotion of conservation and preservation of biodiversity and natural resources, and the development of health and sustainable food systems (Ministry of Agriculture and Food Industries of Malaysia, 2021).

Agro-based initiatives in 2013 such as the Malaysia Good Agricultural Practices (MyGAP), initiated in 2002 and officially launched by the Ministry of Agriculture and Agro-based Industry in 2013 (Department of Agriculture of Malaysia, 2023), and organic certification scheme (MyOrganic, launched by the Department of Agriculture of Malaysia in 2015) (Ministry of Agriculture and Food Security, 2024) are promoted in Malaysia to address concerns and greater transparency in food production (Rathakrishnan et al., 2022), improve the well-being of workers, and provide better livelihood opportunities for farmers and rural communities (Altieri and Nicholls, 2012). MyGAP certification encompasses all aspects of the agricultural supply chain from production to final products. This initiative is a comprehensive approach to address food-related risks along the supply chain (Ministry of Agriculture and Agro-based Industry, 2018).

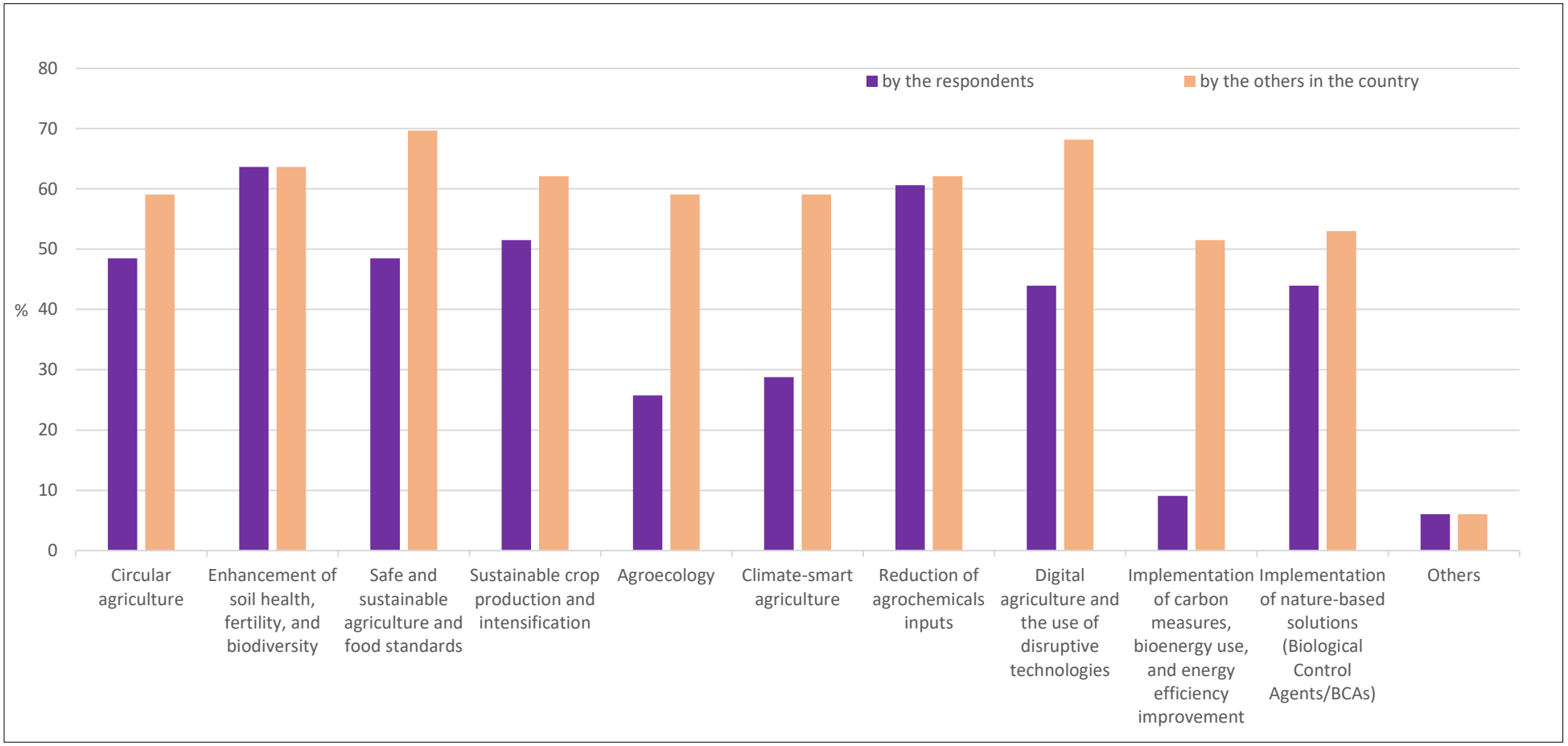
7.2. Result of the Questionnaire Survey and Discussion

7.2.1. Sustainable Key Actions or Initiatives Applied in Malaysia (Q1 of the Questionnaire)

Majority of the respondents prioritised the following actions and initiatives concerning sustainable agriculture and food systems (Figure 7.1): (i) enhancement of soil health, fertility, and biodiversity (63.6%); (ii) reduction of agrochemical inputs (60.6%); and (iii) Sustainable crop production and intensification (51.5%). These responses are aligned with previous studies carried out in Malaysia concerning soil fertility, health, and biodiversity

through the application of green practices, i.e. biofertiliser, agro-biomass biochar, and mycorrhiza (Abu Bakar et al., 2015; Nordin, Redza, and Saad, 2017; Lindang et al. 2021). These three prioritised actions in Malaysia are also priorities in other ASEAN countries, i.e. with a more than 60% response rate. The two highest actions adopted by the other ASEAN countries are safe and sustainable agriculture and food standards (69.7%) and digital agriculture and the use of disruptive technologies (68.2%).

Figure 7.1. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in Malaysia Applied (a) by the Respondents and (b) by Others in the Country



Source: Authors.

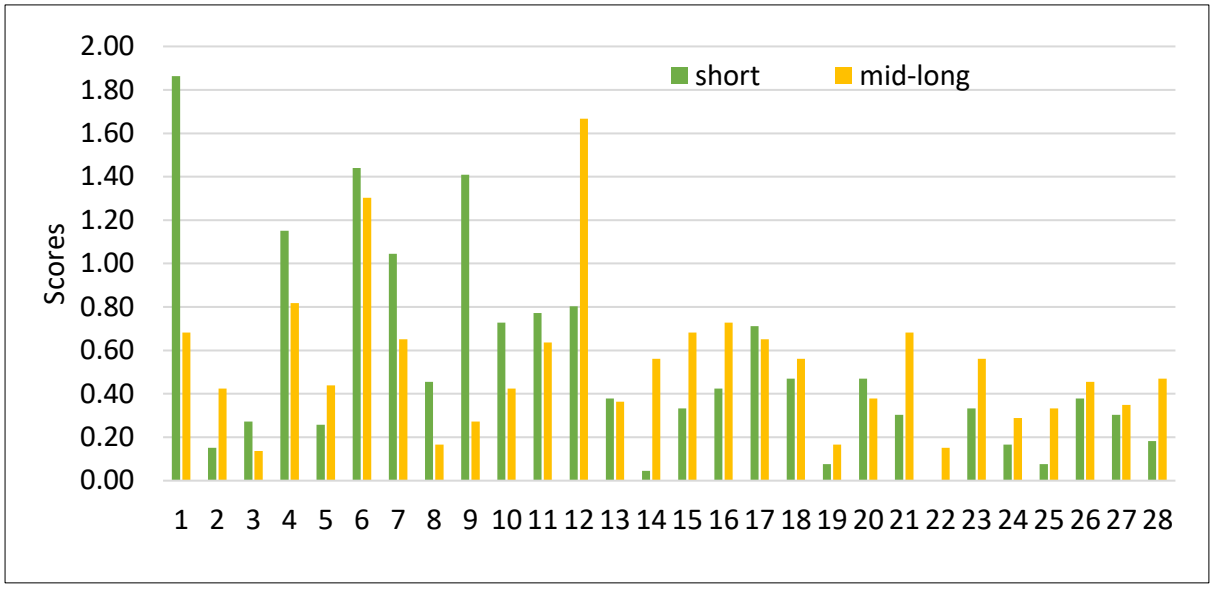
7.2.2. Prioritised Short- and Mid- to Long-term Strategies on the Guidelines in Malaysia (Q2 of the Questionnaire)

Figure 7.2 shows that amongst the short-term strategies, (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (6) ensuring food security; (9) connecting smallholders to markets; (4) collaboration along the agriculture and food chains; and (7) promoting the use of smart and precision agriculture systems in sustainable food production, are selected as the top five priorities.

Amongst the medium- to long-term strategies, (12) encouraging more research and development on sustainable and circular agriculture and food production, (6) ensuring food security, (4) collaboration along the agriculture and food chains, and (16) encouraging private sector research participation in new, modern, and smart technologies in sustainable food production are selected as the top four priorities. In addition, three strategies – (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (15) strategising to replace highly hazardous pesticides (HHPs), broad-spectrum pesticides, and neonicotinoids in ASEAN agriculture; and (21) improving the participation of women and youth in sustainable smart systems – have a similar number of responses, positioned as the fifth priority.

Most of the prioritised short-term strategies are related to the enhancement of productivity and the improvement of farmers whereas the strategies that aim to enhance the R&D activities are more prioritised in the mid- to long term. That is in line with the recent policies introduced in Section 7.1.

Figure 7.2. Key Priority Strategies of the Guidelines: Short and Mid- to Long-term in Malaysia



Source: Authors.

7.2.3. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 and Q4 of the Questionnaire)

Education and capacity building and resources (human and agricultural inputs) demonstrated the highest percentage (29.9%) amongst the challenges, followed by finance and market access (20.3%) (Table 7.1). This could be interpreted as meaning that human resources are most needed to implement the Guidelines through training. The trend in Malaysia slightly differs from the majority of ASEAN countries, where finance and market access show the highest ratio whilst in Malaysia, that challenge is in the third place.

Table 7.2 shows that education and its application have the highest ratio at the farm level, and financial and market support has the highest ratios at the provincial and national levels. This trend is similar to the ratios of ASEAN (Table 2.4 in Chapter 2).

Market access for small farmers is the prioritised strategy in the short term as shown in Figure 7.2. In addition, ageing farmers are proposed as one of the challenges in resources (Table 7.1), and the participation of young farmers is very much required in the mid- to long-term strategy (see Section 7.2.2). Ensuring young farmers in the local area and improving market access for farmers with provincial and national enactments are crucial. In line with this, the Government of Malaysia prioritised youth engagement in the development of the agriculture sector that is depicted in the 12th Malaysia Plan (2021–2025) (Ministry of Economy of Malaysia, 2021).

Table 7.1. Challenges Mapping the Implementation of the Guidelines in Malaysia

Categories	Challenges	Ratios (%)
Environmental impacts	Climate variabilities	3.0
Education and capacity building	Different research systems and their data sharing; inability to change actors' and farmers' mindsets; lack of skills, training, awareness, and management of agricultural input	29.9
Technology and infrastructure	Challenges in technology transfer, adoption, and costs; exposure to modern and smart farming	12.7
Finance and market access	Difficulty in accessing loans; monopoly in the supply chain; inefficient financial support, incentives, and subsidies	20.3
Resources (human and agricultural inputs)	Ageing farmers and lack of labour, cooperation, and government support; fluctuated prices; high cost of agricultural inputs, technologies, farmers' living standards	29.9
Policy and institutional framework	Inefficient process, no fixed policy on sustainable agriculture, and inaccessibility on agriculture guidelines	4.1

Source: Authors.

Table 7.2. Solutions Mapping at the Farm, Provincial, and National Levels, Including Ratios for the Implementation of the Guidelines in Malaysia

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	Training and course, easy access to foreign labourers, enhancement of expertise, providing technical support, transferring and sharing knowledge to young people, hiring more extension officers	Technical training, modern technologies transfer, better seed quality	Financial support, price reduction on agriculture inputs	Promotion of private sector engagement, promotion of private sector involvement
	60.3%	12.8%	25.6%	1.3%

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Provincial	Training, hiring more extension staff, technical knowledge and skills, and creation of awareness for youth	Improvement of extension system, facilities support, and improved system of agri-food	Financial support, expanding subsidies, reducing middleman	Coordinating with state government, project executions that are in line with the government, and reduction in bureaucracy
	28.0%	6.0%	56.0%	10.0%
National	Strengthened studies, promotion of sustainable agriculture through social media, enticing youth to enter farming	Improvement of facilities, controlled unregistered paddy seeds, and the latest seed technologies offer	Financial support, offering rice subsidies, financial research	Development of collaborations and enactment of new policies, stable government, and enactment of policies on food waste
	10.5%	8.8%	50.9%	29.8%

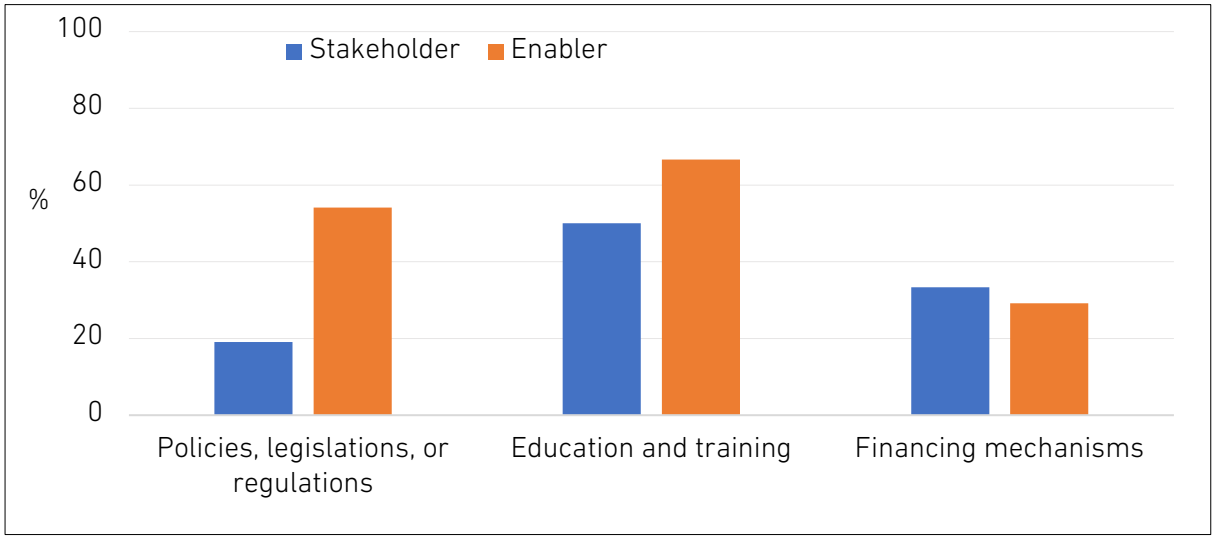
Source: Authors.

7.2.4. Enabling Environment for the Guidelines

7.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

In Malaysia, stakeholders have less awareness of the policies, legislations, or regulations pertaining to sustainable agriculture and food systems (Figure 7.3). These policies include national agri-food, good agricultural practices (GAP) and organic farming.

Figure 7.3. Percentage of Respondents' Understanding of Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to support the Sustainable Agriculture and Food Systems in Malaysia

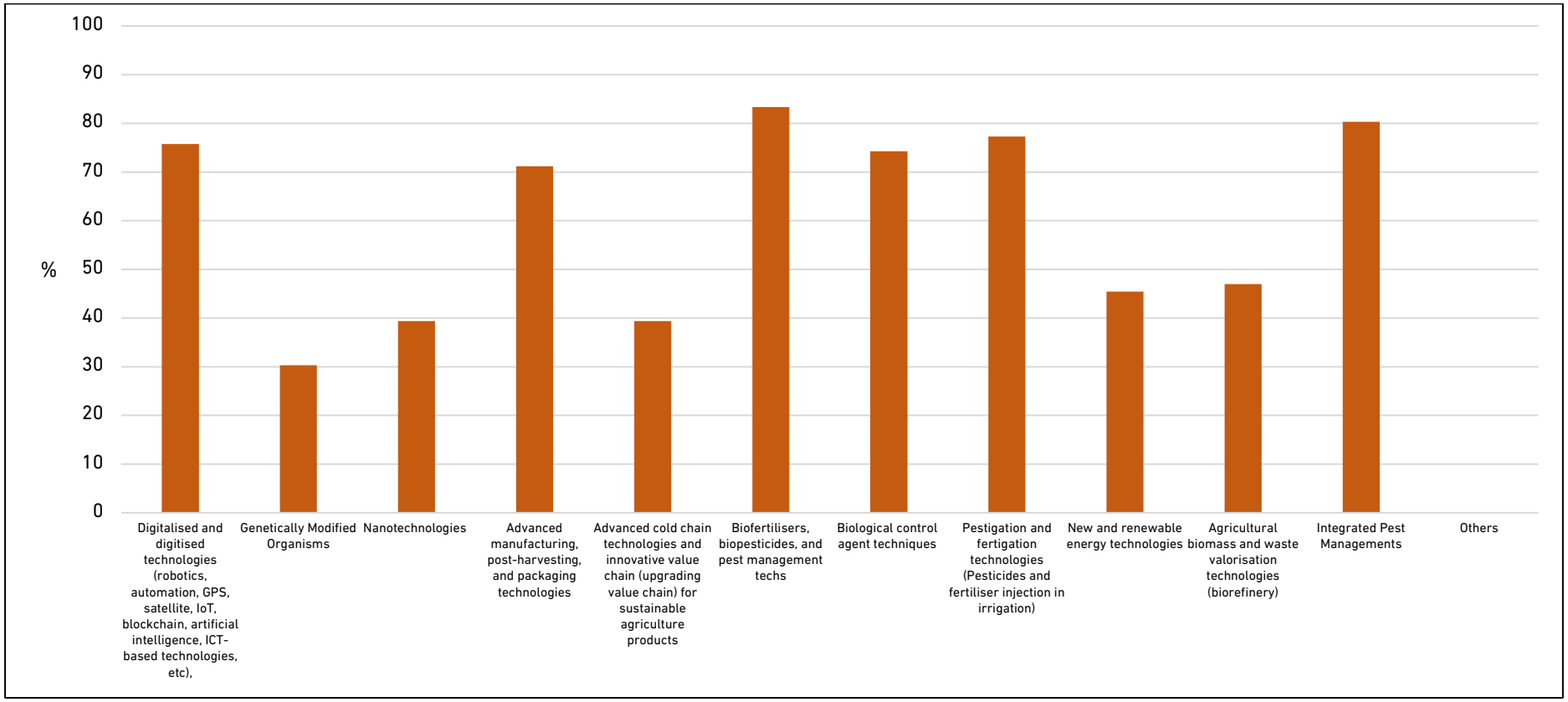


Source: Authors.

7.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

The high rate of responses (more than 70%) to (i) digitalised and digitised technologies; (ii) advanced manufacturing, post-harvesting, and packaging technologies; (iii) biofertilisers, biopesticides, and pest management techs; (iv) biological control agent techniques; (v) pestigation and fertigation technologies; and (vi) integrated pest management indicates that all these technologies are well adopted in Malaysia (Figure 7.4). However, other technologies show only less than 50% adoption rate. R&D projects focused on these technologies could boost adoption rates in the future (see Section 7.1).

Figure 7.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in Malaysia



Source: Authors.

7.2.4.3. Education and Capacity Building (Q7 of the Questionnaire)

Compared with the average of ASEAN countries (Figure 2.7 in Chapter 2), Malaysia is amongst the countries with the lowest levels of information and knowledge received from educational institutions and capacity building programmes (Figure 7.3). Respondents indicate that public and private universities, governmental agencies, and agriculture institutes offered education for sustainable agriculture and food systems to farmers and enabling actors. The programmes were mainly focused on specific topics such as GAP and pest and disease control. Since the topics were narrowly focused, implying that only a limited number of actors in the value chain had an interest, there is a need for broader agricultural topics to be covered for a wider audience. This highlights the need for education and capacity building in Malaysia as an enabling factor for implementing the Guidelines.

7.2.4.4. Financing Mechanism (Q8 of the Questionnaire)

The responses of approximately 30% of stakeholders and enablers (Figure 7.3) indicate that both groups require more information on financing mechanisms. Various channels are available to obtain financial support for sustainable agriculture, such as Agrobank microcredit, governmental loans, bank loans, and young entrepreneurs grants.

Financial and market support is an important solution that should be enacted by provincial and national initiatives (see Section 7.2.3). Thus, it should be noted that the financing mechanism needs greater recognition and utilisation, necessitating efforts to raise awareness.

7.3. Conclusion

In Malaysia, key sustainable initiatives or actions on sustainable agriculture and food systems are well adopted. According to the prioritised strategies, enhancing production is required in the short term, whereas R&D is essential in the mid-long term. The challenges to implementing the Guidelines are related to resources and education followed by finance and market, which need the framework of solutions for the resource and education at the farm level, and for finance at the provincial and national levels. Respondents require better awareness of the policies, education, and finance mechanisms in Malaysia. Hence, ensuring the resources, including providing the opportunity of capacity building and improving the financial literacy, as well as proceeding with the initiatives for R&D, are necessary.

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Chapter 8

Myanmar Country Report

Than Than Soe, Kentaro Yamada, Siti Mustaqimatud Diyanah

8.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

To promote sustainable agriculture and enhance food security, Myanmar developed several initiatives that are included in Myanmar Agenda 21 (MA21). The initiatives encompass a range of priorities, including public education and participation, food and nutrition, food production, essential consumption items, production methods, research and institution building. The action programme of MA21 in the agriculture sector is National Adaptation Programs of Action (NAPA). Proposed priority projects include the use of climate-resilient rice varieties, crop diversification, and climate-smart agriculture approaches to reduce the vulnerability of subsistence farmers to climate change (Hom et al., 2015). As outlined in the recent policy, the Myanmar Sustainable Development Plan (2018–2030) recognises that Myanmar's social, cultural, and economic development can be sustained on the foundation of its natural environment (Ministry of Planning and Finance of Myanmar, 2018). In addition, the Government of Myanmar also developed the 'Family Farming Knowledge Platform' to boost sustainable agriculture development in the country (FAO, 2023).

Rice Bio-Park has been established as a practice of circular agriculture for rice-based farming, utilising the byproducts of rice (MSRFF, 2018). The Rice Bio-Park aims to increase farmers' income, enhance value-added products, and create job opportunities. The bio-park is focused on converting rice biomass into marketable value-added products (MSRFF, 2018).

8.2. Result of the Questionnaire Survey and Discussion

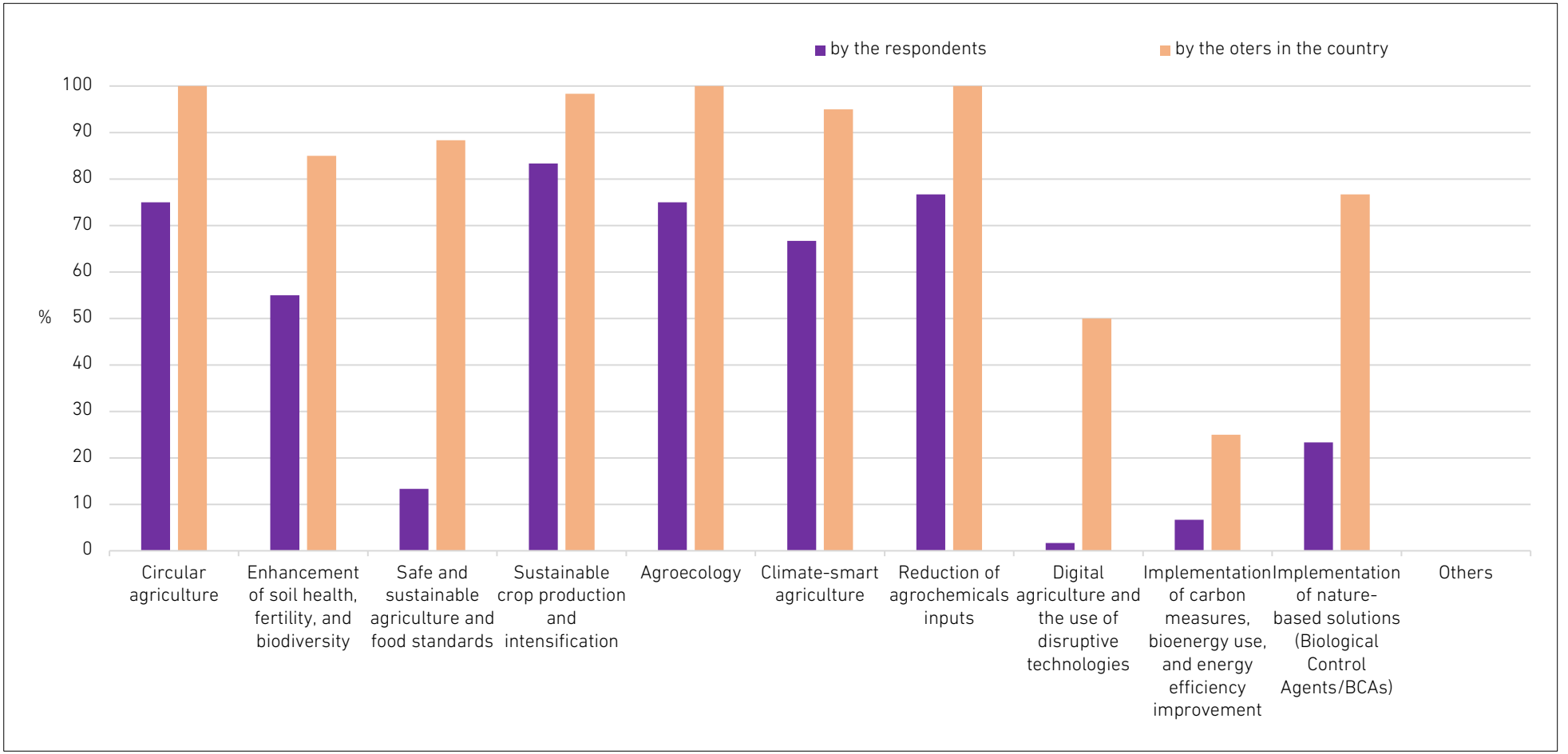
The answers are collected solely from the stakeholders in Myanmar. All results in the following section are based on their responses.

8.2.1. Sustainable Key Actions or Initiatives Applied in Myanmar (Q1 of the Questionnaire)

Figure 8.1 shows that sustainable crop production and intensification (83.3%), reduction of agrochemicals inputs (76.7%), circular agriculture (75.0%), and agroecology (75.0%) have been highly applied by respondents. These four actions and initiatives show ratios of 98.3%–100% ratios. This indicates that these initiatives have been effectively

implemented in the country. In addition, the similarity of the trends for these four actions and initiatives suggests that country-level ambitions or development plans regarding sustainable crop production and intensification, circular agriculture, agroecology, and the reduction of agrochemicals may align with personal initiatives taken by agri-food value chain actors in their farms or institutions. Some of the notable actions taken by the country included the establishment of farmers' field schools to support a system of rice intensification (Kabir, 2006; Din and Morisson, 2003)as well as diversification practices such as polyculture and pond-dike cropping, along with improved management practices for the sustainable intensification of small-scale aquaculture production (Wang et al., 2023). For instance, a new agroecology project, 'Co-designing Myanmar's Pathways for Agroecological Transition towards Sustainable Food System (CoMPASS)', initiated in 2019 by the Swiss Agency for Development and Cooperation, International Rice Research Institute, and Ministry of Agriculture, Livestock, and Irrigation has helped the country to enhance the agriculture sector's contribution to its economic growth (IRRI 2019).

Figure 8.1. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in Myanmar Applied (a) by the Respondents and (b) by Others in the Country



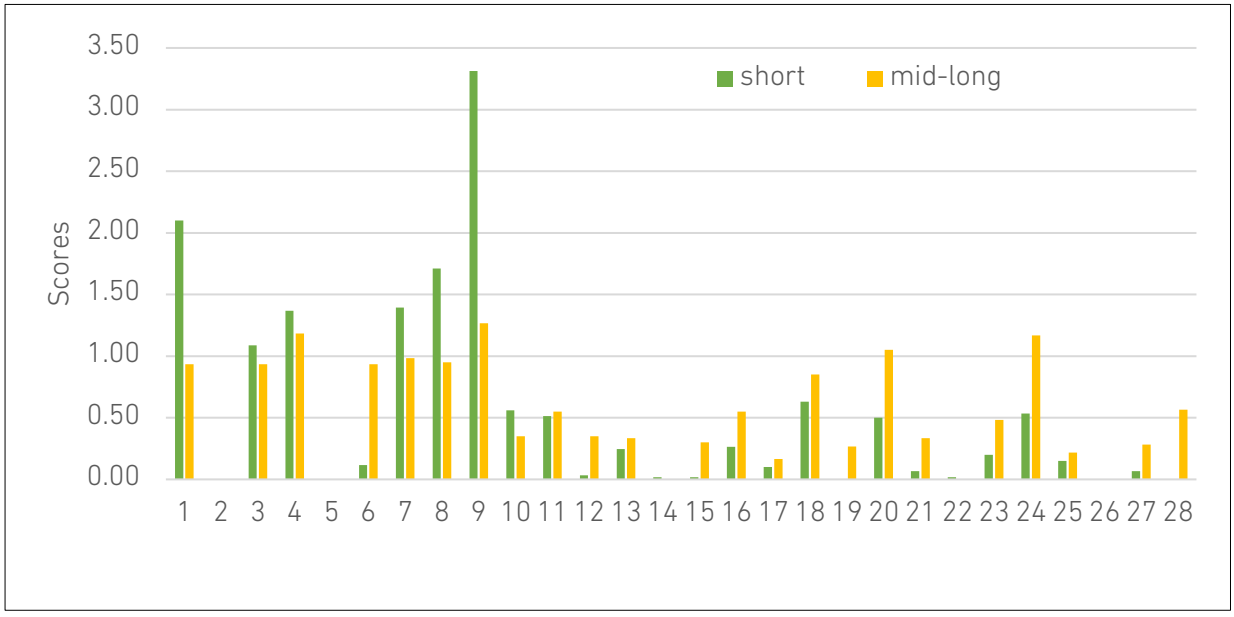
Source: Authors.

8.2.2. Prioritised Short- and Mid- to Long-term Strategies in Myanmar (Q2 of the Questionnaire)

Figure 8.2 shows that amongst the short-term strategies, (9) connecting smallholders to markets; (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (8) facilitating funding with productive resources, finance, and services; (7) promoting the use of smart and precision agriculture systems in sustainable food production; and (4) collaboration along the agriculture and food chains are the top five prioritised strategies.

Amongst the medium- to long-term strategies, (9) connecting smallholders to markets, (4) collaboration along the agriculture and food chains, (24) improving the health and well-being of the farming community in ASEAN, (20) encouraging the participation and training of targeted marginalised communities to be involved in sustainable agriculture systems, and (7) promoting the use of smart and precision agriculture systems in sustainable food production are the top five prioritised strategies.

Figure 8.2. Key Priority Strategies of the Guidelines: Short and Mid- to Long-term in Myanmar



Source: Authors.

8.2.3. Challenges and solutions of sustainable agriculture and food systems (Q3 and Q4 of the Questionnaire)

Technology and infrastructure show the highest ratio (36.1%) amongst the challenges, followed by policy and institutional framework (25.6%) and finance and market access (25.0%) (Table 8.1). Organic farming technology is proposed as the challenge for

sustainable agriculture, whereas related actions and initiatives such as agroecology and the reduction of agrochemical inputs have been well applied in the country (Figure 8.1). These initiatives might be continuously required.

For the solutions, Table 8.2 shows that financial and market support has the highest ratio at the farm level whilst education and its application have the highest at the provincial and national levels. That is different from the average trend of ASEAN countries (Table 2.4 in Chapter 2). This could be interpreted to mean that the market, driven by farm-level initiatives, may not be substantial enough to significantly influence broader market issues due to limited size. In addition, the framework at the provincial and national levels may aim to support farmers by providing extension staff, farming machinery, and capacity building for farmers.

Table 8.1. Challenges Mapping the Implementation of the Guidelines in Myanmar

Categories	Challenges	Ratios (%)
Environmental impacts	N/A	0.0
Education and capacity building	Lack of understanding and socialisation	13.3
Technology and infrastructure	Organic farming technologies	36.1
Finance and market access	Issues in unstable market and market opportunities	25.0
Resources (human and agricultural inputs)	high cost and unstable agricultural inputs	24.0
Policy and institutional framework	Challenges in the establishment of farmer organisations, ineffective implementation of national and international standards, understanding and socialisation of relevant policies	25.6

N/A = not available
Source: Authors.

Table 8.2. Solution Mapping at the Farm, Provincial, and National Levels, Including Ratios for the Implementation of the Guidelines in Myanmar

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	GAP and ASEAN Guidelines application (agrochemicals reduction), creation of job opportunities, extension, and training on good agricultural practices to reduce agrochemical application and cultural practices	Technology for organic fertiliser production and supporting technology development	Establishment of market opportunities and creation of a stable market for agricultural inputs (seed and agrochemicals), the proper price for agriculture produces	Establishment of farmers' organisations and groups, and specifying standard weighing/measuring systems for crop products
	23.1%	4.6%	60.0%	12.3%
Province	Dispatch of extension staff, hiring farm machinery, and training for farmers to reduce agrochemical application and cultural practices	Timely and enough provision of irrigated water to demonstrate farmers' field day, investment in infrastructure, farm machinery and equipment	Stable market for crops by linking farmers or via farmer groups, and agri-inputs (seed and agrochemicals) with low prices, financial support for collaborative agricultural research	Formulation of policies on public–private partnership, establishing farmer organisations in regionally, developing guide lines
	45.1%	8.5%	35.4%	11.0%
National	Dispatch of extension staff, hiring farm machinery, and	Timely and enough provision of irrigated	Stable market for crops by linking farmers or via farmer	Formulation of policies on public-private partnership

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
	training for farmers to reduce agrochemical application and cultural practices	water to demonstrate farmers' field day	groups, and providing agri-inputs (seed and agrochemicals) with low prices, financial support for collaborative agricultural research	
	34.5%	12.7%	30.9%	21.8%

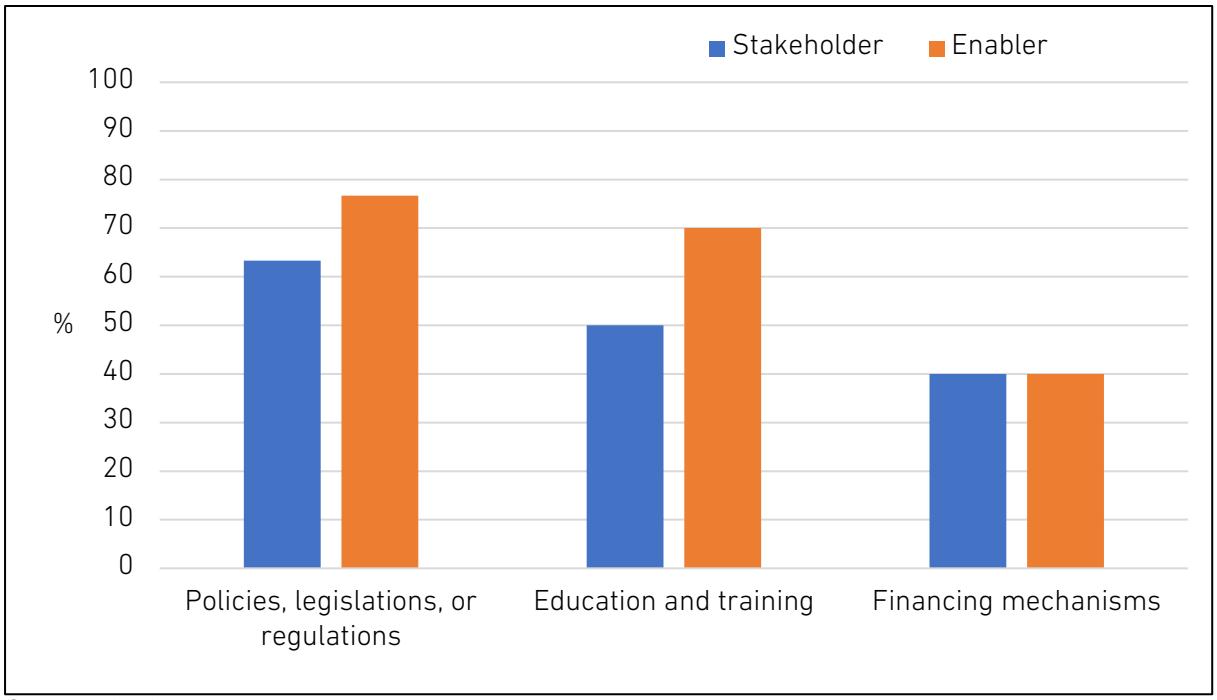
Source: Authors.

8.2.4. Enabling Environment for the Guidelines

8.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

Around 63.3% of stakeholders in Myanmar have a good understanding related to policies, legislations, or regulations for the sustainable agriculture and food systems (Figure 8.3). This result is relatively higher amongst ASEAN countries. The respondents were aware of specific initiatives such as policies on land law, agri-inputs, seeds, fertilisers, pesticides, good agricultural practices, organic farming, loans and investment, and biodiversity conservation.

Figure 8.3. Percentage of Respondents' Understanding of Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to Support Sustainable Agriculture and Food Systems in Myanmar

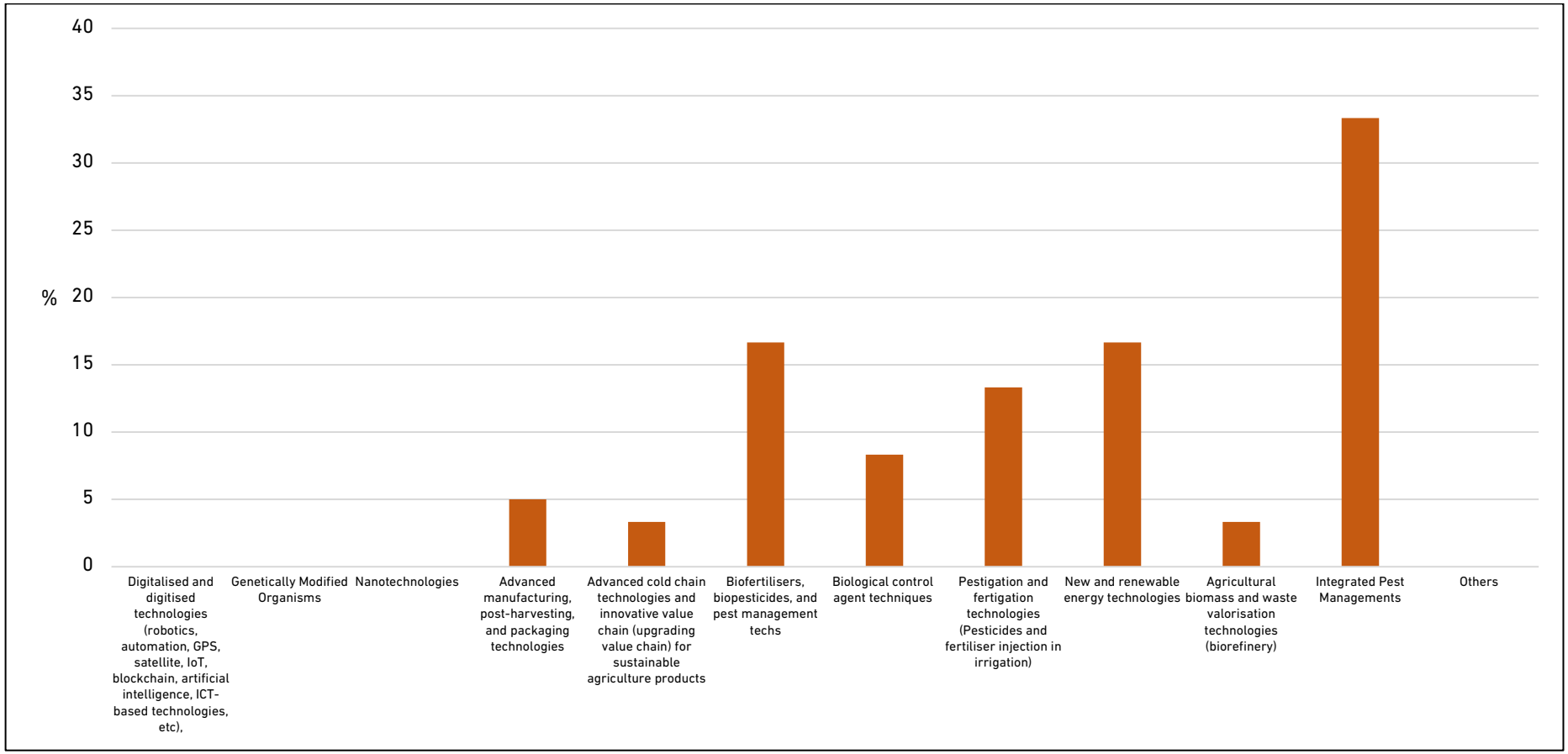


Source: Authors.

8.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

The respondents might choose one technology amongst the choices so that the bias amongst the technologies is larger compared with the results of other countries. As shown in Figure 8.4, integrated pest management has the highest ratio, followed by biofertilisers, biopesticides, and pest management techs, and new and renewable energy technologies. It is in line with the highly adopted initiative for reducing agrochemical inputs (Figure 8.1).

Figure 8.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in Myanmar



Source: Authors.

8.2.4.3. Education and capacity building (Q7 of the questionnaire)

Education and capacity building for sustainable agriculture and food systems is recognised by 51.7% of the stakeholders (Figure 8.3) as the enabling factor to boost the implementation of the guidelines in the country. The results showed that the vocational training and educational programme on food processing for rural development, as well as cultural practices and low-interest rate subsidies, was implemented by the Saemaul Undong Project in accordance with the Myanmar–Korea Agriculture Project (Snel and Brouwer, 2021). Education and training enacted at the provincial and national levels are the key solutions for promoting the sustainable agriculture and food systems (Table 8.2), which implies requiring such packaged education.

8.2.4.4. Financing mechanism (Q8 of the questionnaire)

According to Figure 8.3, 40% of the stakeholders are aware of the financing mechanism. As per the respondents, the primary sources of funding for sustainable agriculture in Myanmar are the Myanmar Agricultural Development Bank, which offers loans ranging from 150,000 kyat (K) to K1,500,000 with an interest rate of 0.0005 within a period of 6–8 months for repayment. Additionally, Saemaul Undong, funded by the Korea International Cooperation Agency, and Mya Sein Yaung cooperative, supported by the Ministry of Cooperatives and Rural Development, constitute the State Fund for village development projects located in Myanmar. Private microfinance is another source of funding available to vegetable growers, in contrast to the many options available to rice farmers who manage large areas of land.

In Myanmar, finance and market support are the key solutions to address the challenges of implementing sustainable agriculture and food systems at the farm level (Table 8.1). Considering that connecting smallholders to the market is most prioritised as the strategy in the short and mid- to long term, improving market support and raising farmers' awareness for this initiative would be crucial.

8.3. Conclusion

Sustainable crop production and intensification, reduction of agrochemical inputs, circular agriculture, and agroecology have been well applied in the country. Amongst the 28 key strategies, connecting smallholders to markets is prioritised most in the short and mid- to long term. To implement a sustainable agriculture and food systems, technology and infrastructure pose the biggest challenges, whilst education and its application, along with finance and market support, are highly proposed as key solutions. The awareness of the policy, education, and financing mechanism for sustainable agriculture and food systems is relatively low amongst the stakeholders. Amongstthe innovative technologies, Integrated Pesticide Management is well adopted in the country.

Technology, financing, and policy should be facilitated with the help of the public and private sectors as well as international partners. The study showed that respondents knew only the names of the laws or regulations. Thus, farmers should be encouraged, facilitated, or educated via different platforms such as forums (extension programmes), capacity-building programmes, discussion series, seminars, demonstrations, and others.

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Chapter 9

Philippines Country Report

Lynette C. Cimafranca, Antonio P. Abamo, Shantan E. Bayarcal, Kentaro Yamada, Siti Mustaqimatud Diyanah

9.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

Many initiatives for sustainable agriculture have been implemented in the Philippines. These include the Organic Agriculture Act of 2010 of the 18th Congress of the Philippines (Senate Office of the Secretary of Philippines, 2022); the Food Safety Act of 2013 of the 15th Congress of the Philippines (Congress of Philippines, 2013); the Gender and Development Program (Philippine Commission on Women, 2022); Good Agricultural Practice (Bureau of Agriculture and Fisheries Standards, 2021); Agriculture and Fisheries Modernization Act (Congress of the Philippines, 1997); and Free Irrigation Act for Rice and Corn (National Irrigation Administration of Philippines, 2018).

As a recent initiative, the Bureau of Agricultural Research – Department of Agriculture coordinates, integrates, funds, and manages the research for development in agriculture and fisheries. Through scaling agricultural technologies, institutional programmes including human resources development, and policy support program, enhanced productivity, improved competitiveness, and climate resiliency and natural resources management will be achieved (High Value Crops Development Program, 2023).

More specifically, the utilisation of renewable energy, balanced fertilisation and promotion of biofertilisers, soil health management, precision and digital agriculture technologies, Philippine Rice Information System handles variability in optimal fertilisation, Site-Specific Nutrient Management have been promoted (Buresh et al., 2019).

9.2. Result of the Questionnaire Survey and Discussion

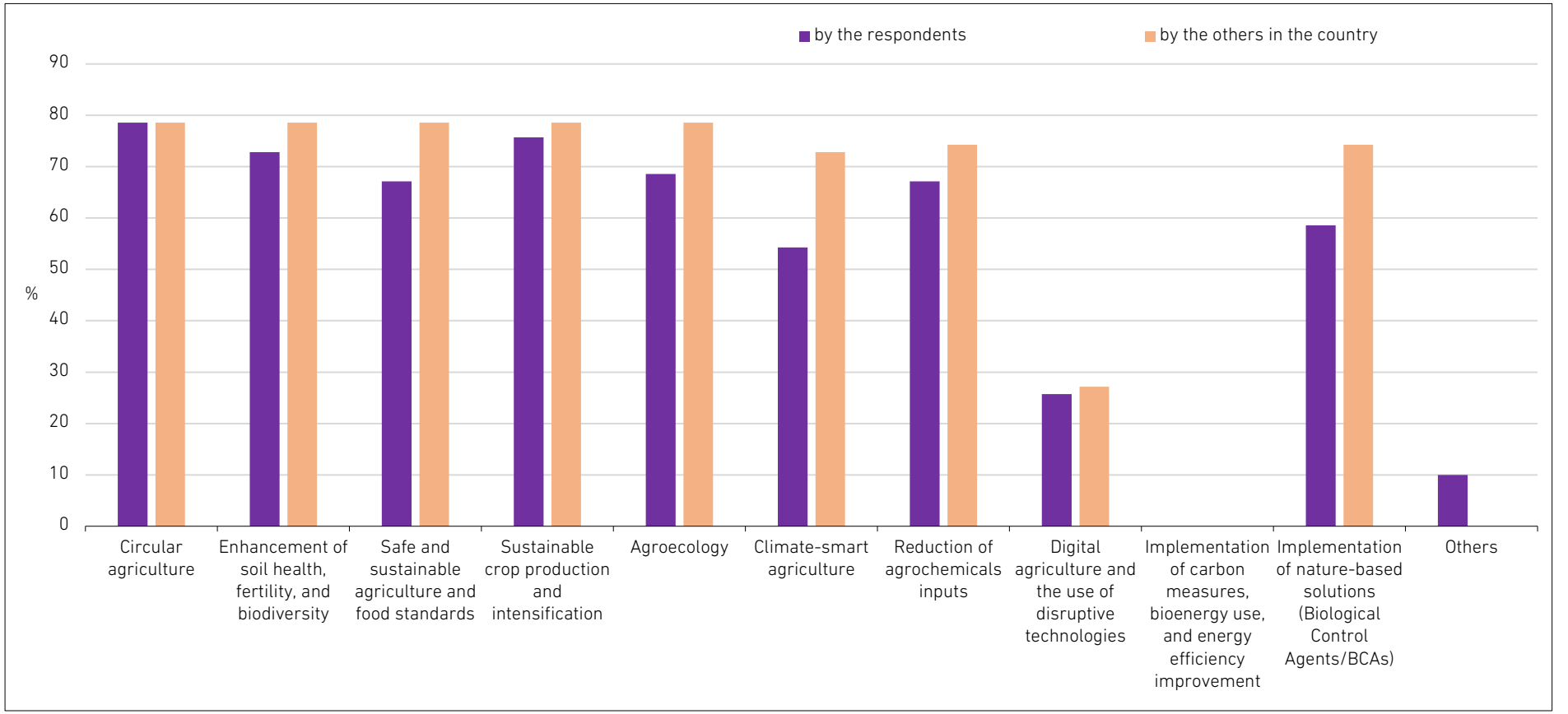
9.2.1. Sustainable Key Actions or Initiatives Applied in the Philippines (Q1 of the Questionnaire)

Figure 9.1 shows that circular agriculture (78.6%); sustainable crop production and intensification (75.7%); and enhancement of soil health, fertility, and biodiversity (72.9%) are being highly applied initiatives by the respondents. Aside from (i) digital agriculture and the use of disruptive technologies and (ii) implementation of carbon measures, bioenergy use, and energy efficiency improvement have been applied by more than half of the respondents. Those highly applied initiatives are also widely recognised in the

country, as over 70% of respondents indicate that those initiatives have been adopted by others, demonstrating widespread acceptance and implementation at a national level.

All country-level initiatives are aligned with the initiatives of the respondents, indicating that both sets of initiatives complement and support each other in advancing national development commitments related to agri-food systems enhancement. In the Philippines, according to Meijer et al. (2021), the Philippines is the highest ocean plastic waste polluter, contributing 356,371 metric tonnes per year. As a result, a new law enacted on the circular economy –the 'Extended Producer Responsibility' – obligates plastic packaging producers to prevent, clean up, and recover waste. With the abundance of waste issues, such as food packaging plastics littering the ocean, both personal and country initiatives have been taken seriously. An institutional initiative, such as the 'Food Rescue Program by Scholars of Sustenance Philippines, is also undertaken to address food loss and waste (Scholar Sustenance Philippines, 2023).

Figure 9.1. Key Actions or Initiatives On Sustainable Agriculture and Food Systems in the Philippines Applied (a) by the Respondents and (b) by Others in the Country



Source: Authors (2023).

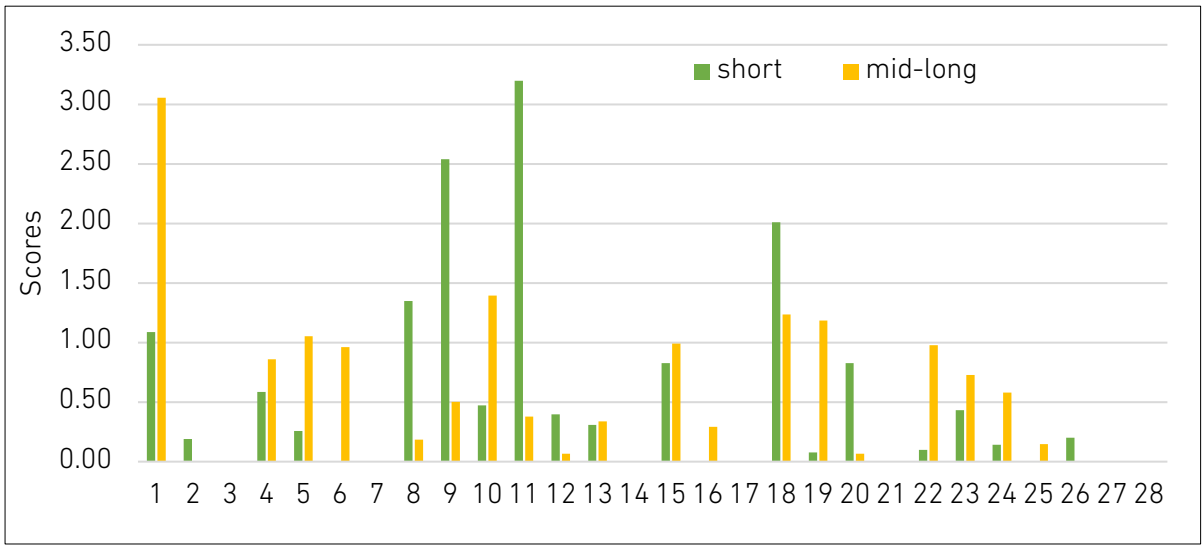
9.2.2. Prioritised Short- and Mid- to Long-term Strategies on the Guidelines in the Philippines (Q2 of the Questionnaire)

Figure 9.2 shows that amongst the short-term strategies, (11) building farmers and food production personnel knowledge base and developing their capacity; (9) connecting smallholders to markets; (18) reducing the reliance on the use of agrochemicals in agriculture, balancing the use of organic and chemical fertilisers; (8) facilitating funding with productive resources, finance, and services; and (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity are prioritised as the top five short-term strategies.

Amongst the medium- to long-term strategies, (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (10) encouraging diversification of production and income; (18) reducing the reliance on the use of agrochemicals in agriculture, balancing the use of organic and chemical fertilisers; (19) encouraging the development of sustainable, environmentally friendly farming input alternatives within ASEAN; and (5) improving biodiversity are prioritised in Philippines.

Compared with other ASEAN countries, the strategies that support farmers are prioritised in the short and mid- to long term.

Figure 9.2. Key Priority Strategies of the Guidelines: Short and Mid- to Long-term in the Philippines



Source: Authors (2023).

9.2.3. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 and Q4 of the Questionnaire)

Table 9.1 highlights that environmental Impacts are considered the biggest challenges (30.0%) to sustainable agriculture and food systems, followed by resources (human and agricultural inputs) (23.6%), finance and market access (19.3%), and education and capacity building (18.6%). Notably, environmental impact has the highest ratio amongst the challenges only in the Philippines. The Philippines aims to decrease the impact of environmental change by transforming its agricultural sector through climate-resilient agriculture. Recent policies focus on climate change mitigation, digitalisation in agriculture, and integrated landscape approaches (Celeridad, 2019).

According to the solution mapping (Table 9.2), technology and infrastructure show the highest ratio at the farm level, whereas finance and market support are the highest at the provincial and national levels with a significant gap amongst the others. It is evident that farmers need technology to improve their production and require institutional support for financial and market-related issues. This aligns with the key strategies that prioritise connecting smallholders to the market and facilitating funding in the short term (Figure 9.2).

Table 9.1. Challenges Mapping the Implementation of the Guidelines in the Philippines

Categories	Challenges	Ratios (%)
Environmental impacts	Climate change and its impacts, pests and diseases, soil degradation	30.0
Education and capacity building	Lack of training and technique, knowledge	18.6
Technology and infrastructure	Infrastructure for agriculture and transportation, and its expensive costs	8.6
Finance and market access	Lack of financial support and marketing network	19.3
Resources (human and agricultural inputs)	High agricultural input cost and lack of capital, alternative sources of farmers' income; Inactive association and lack of coordination amongst associations	23.6
Policy and Institutional Framework	N/A	0.0

N/A = not available.
Source: Authors (2023).

Table 9.2. Solution Mapping at the Farm, Provincial, and National Levels, Including Ratios for the Implementation of the Guidelines in the Philippines

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	Training, workshop, and seminar on agriculture management	Fertiliser, pest and disease management, terrain selection and management, practical integrated farming, natural management of farming	Provisions for financial assistance	Monitoring and supporting agriculture associations, provisions for agriculture input, and development of ordinances to control thieves
	31.3%	56.3%	6.3%	6.3%
Provincial	Training, workshop, and seminar on agriculture management	Development of agriculture and food systems facilities	Connecting farmers to market, providing marketing strategies, and creating more stable market and market access	Monitoring agriculture products, and developing farmer networks and linkages
	15.0%	5.0%	75.0%	5.0%
National	-	-	Financial assistance and market access	Provision for agriculture inputs
	0.0%	0.0%	83.3%	16.7%

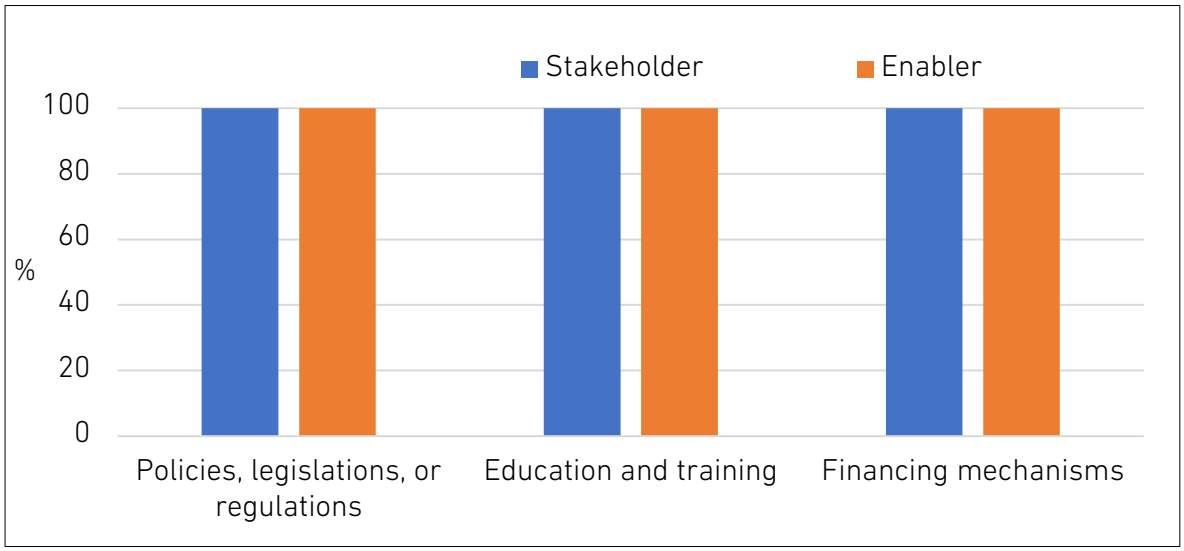
Source: Authors (2023).

9.2.4. Enabling Environment for the Guidelines

9.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

All respondents show their awareness to the policies, legislations, or regulations for the sustainable agriculture and food systems in the Philippines (Figure 9.3). Specifically, policies on organic agriculture, food safety, agriculture and fisheries modernisation, free irrigation, gender and development programmes, prohibition of burning rice straw, and certification of organic farmers are well known by the respondents.

Figure 9.3. Percentage of Respondents' Understanding of Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to Support Sustainable Agriculture and Food Systems in the Philippines

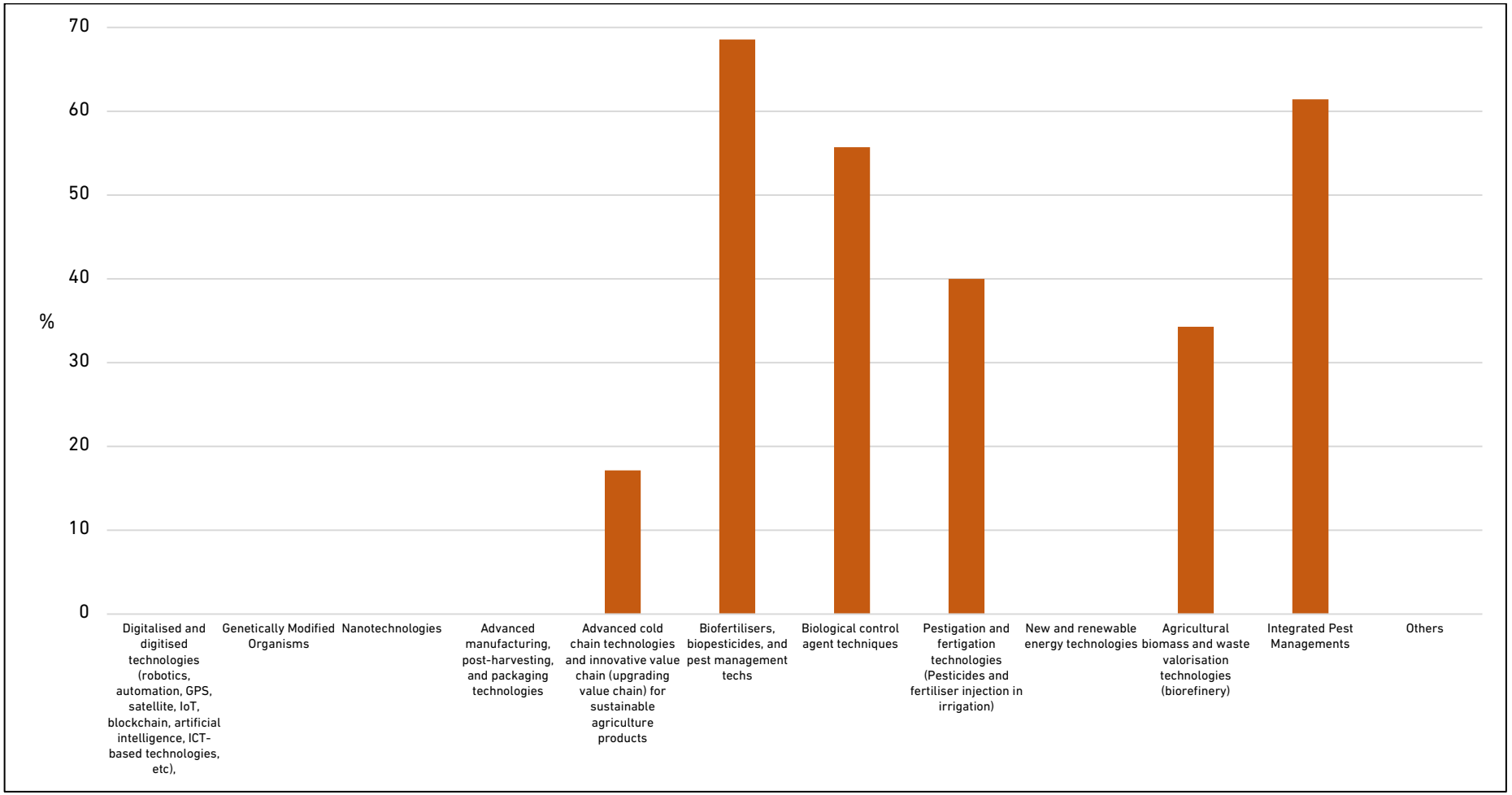


Source: Authors (2023).

9.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

Figure 9.4 shows that more than half of the respondents recognise iofertilisers, biopesticides, and pest management techs; integrated pest management; and biological control agent technologies and that these have been adopted in the Philippines. The Philippines has limited adoption of innovative technologies in the food and agriculture sector. It is identified that technology and infrastructure are the most significant solutions needed at the farm level (Table 9.2). However, there would be more data on digital technology adoption according to Figure 9.4. That is possibly due to the respondents' understanding of interpreting disruptive technologies generally defined in question on key sustainable initiatives. In Q1, respondents in the Philippines benefited from information and communication technology–based platforms, such as a marketplace to market their agri-products. The other four technologies, though not mentioned by the respondents, might be implemented in the Philippines but have yet to achieve widespread adoption amongst the farmers.

Figure 9.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in the Philippines



Source: Authors.

9.2.4.3. Education and capacity building (Q7 of the questionnaire)

Education and capacity building for sustainable agriculture and food systems are also recognised as solutions for implementing sustainable agriculture guidelines by all respondents (Figure 9.3). According to respondents, education in the Philippines is conveyed to target participants through GAP, organic farming, natural farming, apiculture, climate change, gender, climate-smart agriculture, and an integrated farming system. These subjects covered in lectures for targeted food value chain actors are diverse.
On the other hand, a capacity building programme for farmers is the most prioritised strategy in the short term (Figure 9.2) and is recognised as the key solution for advancing sustainable agriculture and food systems (Table 9.2). It is necessary not only to enhance awareness of education and capacity building but also to ensure that farmers have access to these resources.

9.2.4.4. Financing mechanism (Q8 of the questionnaire)

According to Figure 9.3, all respondents recognise the importance of the financing mechanism. There are limited sources and types of financing available to support sustainable agriculture in the Philippines, including association funds and loans. More financial sources as institutional enactments at the provincial and national levels (see Section 9.2.3) are required for implementing sustainable agriculture and food systems.

9.3. Conclusion

The Philippines has applied various sustainable actions and initiatives. However, innovative technologies are still partially adopted. Technology and infrastructure are recognised as one of the key solutions to the challenges of implementing sustainable agriculture at the farm level. Finance and market support are the key solutions at the provincial and national levels, indicating that the institutional enactment for providing the financial schemes is required. Whilst policies, education, and financing mechanisms are well recognised in the Philippines, the strategies related to the financial issue are proposed as the prioritised strategies in the short term. It would be interpreted that the initiatives for sustainable agriculture are well recognised in the country, and more opportunities to utilise them are required.

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Chapter 10

Singapore Country Report

Dharish David, Kentaro Yamada, Siti Mustaqimatud Diyanah

10.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

Singapore's initiative called '30 by 30', which aims to enhance the capacity to produce 30% of the nutritional needs by 2030, has been initiated (Singapore Food Agency, 2020a). It includes local production, which buffers the impact of food supply disruptions from abroad, mitigates the effects of climate change and resource constraints, and aims to close the production loop in the long run.

In addition, the development of the land and sea space for agriculture and aquaculture has been conducted. For instance, building facilities and infrastructure for long-term agriculture and aquaculture plans that stated in the Lim Chu Kang Masterplan (Singapore Food Agency, 2020), policies and plans for development of industrial space for farming and Agri-Food Innovation Park (Ministry of Trade and Industry of Singapore, 2019), and food production in alternative and unutilised spaces such as rooftops, upgrown farms, etc. (Teng et al., 2019), have been implemented. Singapore also focused on bolstering food security by encouraging further innovation through Singapore Food Story 2.0 research and development (R&D) (Singapore Food Agency, 2023a) and novel food. Furthermore, Singapore building facilities to strengthen the R&D in food (Singapore Food Agency, 2022).

R&D for sustainable urban food production are also encouraged, as well as good agricultural practices (GAP) initiatives and the standards for Singapore Clean and Green Urban Farms (Teng et al., 2019; Singapore Food Agency, 2021a). In collaboration with agri-tech industry players (farm operators, technology providers and buyers), academic and research institutes, and government agencies, two specific standards have also been developed for vegetables and seafood farms (Singapore Food Agency, 2023b).

The SS 661 Standards for Clean and Sustainable Farms in Singapore is a new standard introduced by the Singapore Food Agency, Enterprise Singapore, the Singapore Manufacturing Federation – Standards Development Organisation, and Republic Polytechnic. The standard, known as 'Specification for Clean and Green Urban Farms – Agriculture', plays a crucial role in supporting Singapore's '30 by 30' goal. This standard outlines best practices and a farm management system for local farms, specifically urban vegetable farms, to ensure the production of clean, sustainable, and environment-friendly farm produce.

Table 10.1 provides an overview of the key components addressed by SS 661, outlining the scope, standards, and best practices for clean and green urban farms in Singapore.

Table 10.1. Key Components of SS 661 Standards for Clean and Sustainable Farms in Singapore

Component	Description
Criteria for Farm Management	Outlines the standards and best practices related to farm management, covering aspects such as employee competency requirements, responsible resource management, and green procurement practices
Techniques and Practices	Defines the recommended techniques and practices that urban vegetable farms should adopt to achieve a clean and green production system. Includes guidelines for farm operations, crop protection, harvesting, packaging, and the storage and distribution of farm products
Handling of Customer Complaints	Establishes procedures for addressing customer complaints in the context of farm produce, ensuring a systematic and effective approach to handling consumer feedback
Farm Product Recalls	Sets guidelines for the process of recalling farm products, ensuring that such procedures are in place and effectively implemented when necessary
Internal Audits	Defines the procedures and criteria for conducting internal audits within urban vegetable farms to assess compliance with SS 661 standards
Adoption of Smart Farming Techniques	Encourages the adoption of smart farming technologies to enhance efficiency, reduce resource wastage, and contribute to the sustainability of agricultural practices
Circularity in Resource Management	Emphasises recycling of farm waste and minimising the impact on the environment and ecosystem
Optimisation of Operational Efficiency	Guides farms in optimising operational efficiency, ensuring that resources are used efficiently in the production of clean and green farm produce
Training and Professional Development Opportunities	Indicating support for local farmers in adopting and adhering to SS 661 through initiatives such as training courses and collaboration with educational institutions

Source: Singapore Food Agency (2021a).

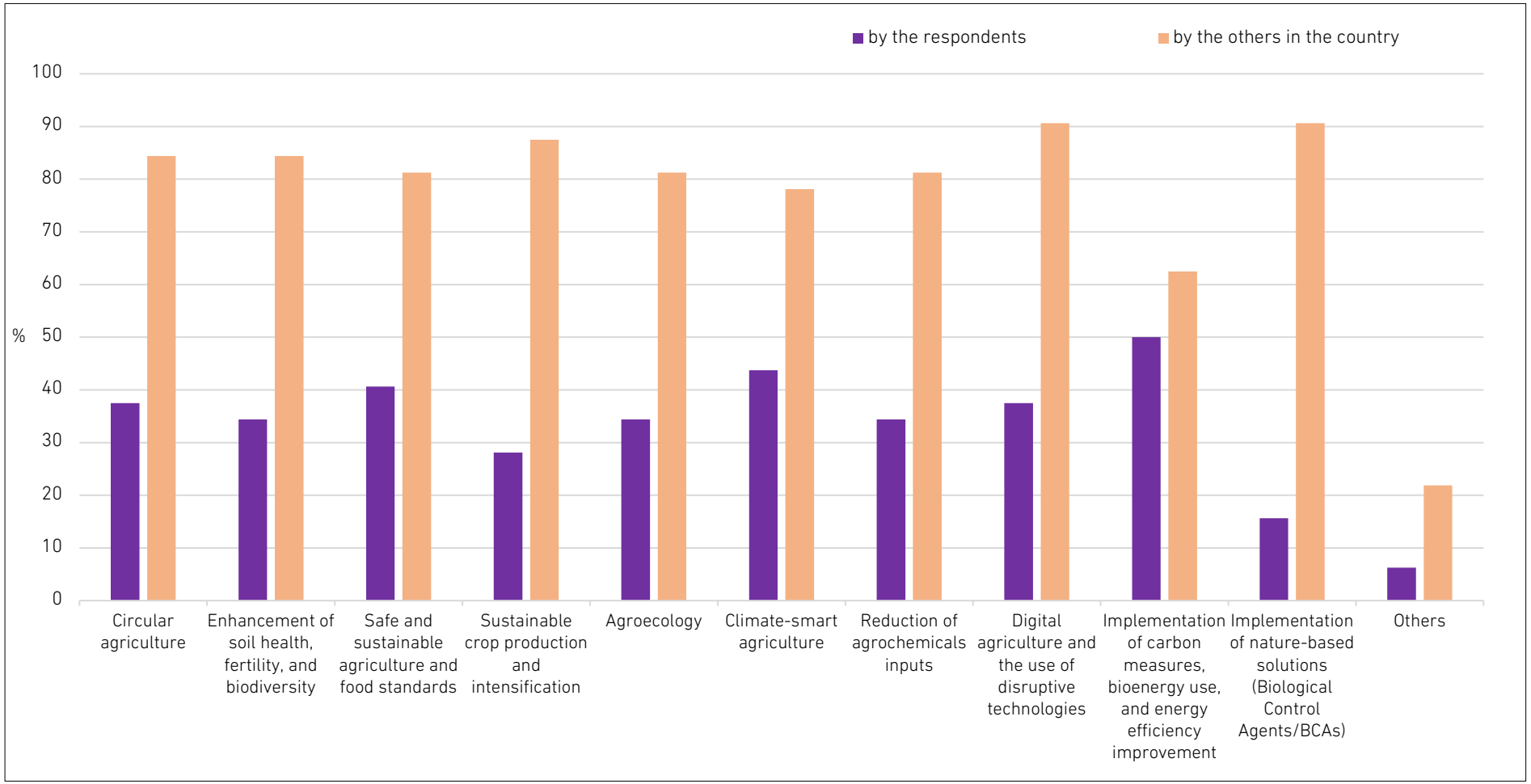
10.2. Result of the Questionnaire Survey and Discussion

10.2.1. Sustainable Key Actions or Initiatives Applied in Singapore (Q1 of the Questionnaire)

This question indicates that Singaporean personal actions and country development programmes are varied in supporting the advancement of sustainable agriculture and food systems. Figure 10.1 highlights that implementation of carbon measures, bioenergy use, and energy efficiency improvement (50.0%) has the highest ratio followed, by climate-smart agriculture (43.8%), and safe and sustainable agriculture and food standards (40.6%). The initiatives are less adopted by the respondents, although approximately 80%–90% of respondents acknowledge that all initiatives except the implementation of carbon measures, bioenergy use, and energy efficiency improvement have been applied in the country.

With the country's growing demand and limited land, it is clear that Singapore has modernised its agriculture sector with digital technologies to meet the city's food needs. Additionally, Singapore aims to become a regional agri-tech hub, providing financial support for agri-tech and serving as a base for food-tech incubators and accelerators (Voutier and Woo, 2021).

Figure 10.1. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in Singapore Applied (a) by the Respondents and (b) by Others in the Country



Source: Authors.

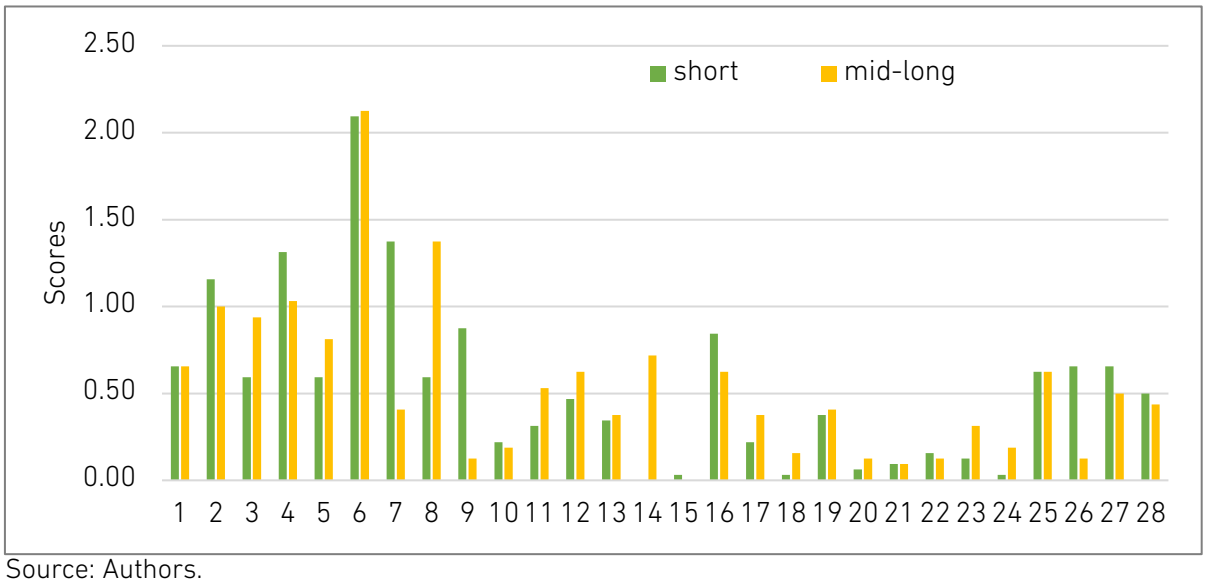
10.2.2. Prioritised Short- and Mid- to Long-term Strategies on the Guidelines in Singapore (Q2 of the Questionnaire)

Figure 10.2 shows that amongst the short-term strategies, (6) ensuring food security, (7) promoting the use of smart and precision agriculture systems in sustainable food production, (4) collaboration along the agriculture and food chains, (2) reduction of greenhouse gases from agriculture-related activities, and (9) connecting smallholders to markets are the top five priorities in Singapore.

Amongst the medium-long-term strategies, the top five priorities are as follows: (6) ensuring food security, (8) facilitating funding with productive resources, finance, and services; (4) collaboration along the agriculture and food chains; (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; and (3) closing nutrient cycles/loops and valorisation of agricultural waste biomass and food wastes into cost-effective feeds and fertilisers.

Ensuring food security is proposed as the most prioritised strategy, which is in line with the recent '30 by 30' policy in Singapore that aims to improve the self-sufficiency rate of nutrition (Singapore Food Agency, 2020) as Singapore imports more than 90% of its food (Singapore Food Agency, 2021b). Therefore, though local production cannot be scaled up, local farms are important to the nation's food security by serving as a buffer to reducing dependence on imports during supply disruptions. Other prioritised strategies are also not as prominent in other countries, making the requirements for sustainable agriculture and food systems in Singapore unique amongst ASEAN countries.

Figure 10.2. Key Priority Strategies of the Guidelines: Short and Mid- to Long-term in Singapore



Source: Authors.

10.2.3. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 and Q4 of the Questionnaire)

According to Table 10.2, finance and market access were identified by 28.1% of respondents as the most important challenges for implementing the Guidelines in Singapore. Policy and institutional framework (20.8%) and technology and infrastructure (19.8%) also show higher ratios, followed by resources (15.6%) and education and capacity building (14.6%).

Thus, broader categories of challenges are recognised in Singapore.

Table 10.3 shows that education and its application, and financial and market support are well proposed as the solutions at the farm level, whereas policy enactment is well proposed at the provincial and national levels. The ratio of policy enactment is by far the highest at the provincial and national levels. This contrasts with the general trend observed in ASEAN countries, as Singapore is the smallest in terms of land size and most economically developed. The development of the platform at the regional and national levels to engage public–private partnership will affect the effectiveness of the policy implementation by government. In addition, institutional policy framework, local and institutional education, and investment as well as subsidies for local stakeholders are necessary to boost the effectiveness of the policy implementation.

Table 10.2. Challenges Mapping the Implementation of the Guidelines in Singapore

Categories	Challenges	Ratios (%)
Environmental impacts	Forest degradation and land issues	1.0
Education and capacity building	Lack of education, awareness, and capacity building, disregarding indigenous knowledge	14.6
Technology and infrastructure	Technical innovation and techs, user-centricity in agritech and digital agriculture, lack of digital infrastructures	19.8
Finance and market access	Lack of funding for education, technology, investment, adoption of sustainable agri-food systems, homogenisation of funding within the region	28.1
Resources (human and agricultural inputs)	Lack of skilled and knowledgeable farmers, increased cost in sustainable practices, high-cost requirements for agroinputs	15.6
Policy and institutional framework	Homogenisation and harmonisation of regulation, inconsistency of the implementation of the guidelines, changeable laws and	20.8

Categories	Challenges	Ratios (%)
	regulations, economic factors domination, and urgency on transformation	

Source: Authors.

Table 10.3. Solution Mapping at the Farm, Provincial, and National Levels, Including Ratios for Implementing the Guidelines in Singapore

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	Training, knowledge, and awareness building, best practices implementation, active workshop engagement, building farmers capacity and education, and providing digital literacy	Promotion of innovation from private sectors, promotion of digital technologies	Unlocking financial and grant support from the government, investment matching, providing incentives and subsidies	Bottom-up partnership transformation through partnership, development of projects, and applying laws
	38.9%	13.9%	36.1%	11.1%
City	Awareness advancement training, capacity building, and education	Basic and digital infrastructure	Financial support and access to agricultural inputs	Engagement of policymakers on effective solutions
	33.3%	10.0%	20.0%	36.7%
National	Research and development, raising public awareness, institutional capcity, documentation and information sharing	Promotion of regenerative techniques and technologies	Access to agriculture inputs and finance	Development of national and regional platforms for multistakeholder collaboration, setting pro-farmers guidelines and regulatory framework, implementing policies effectively, and promoting private

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
				sector involvement
	5.6%	11.1%	27.8%	55.6%

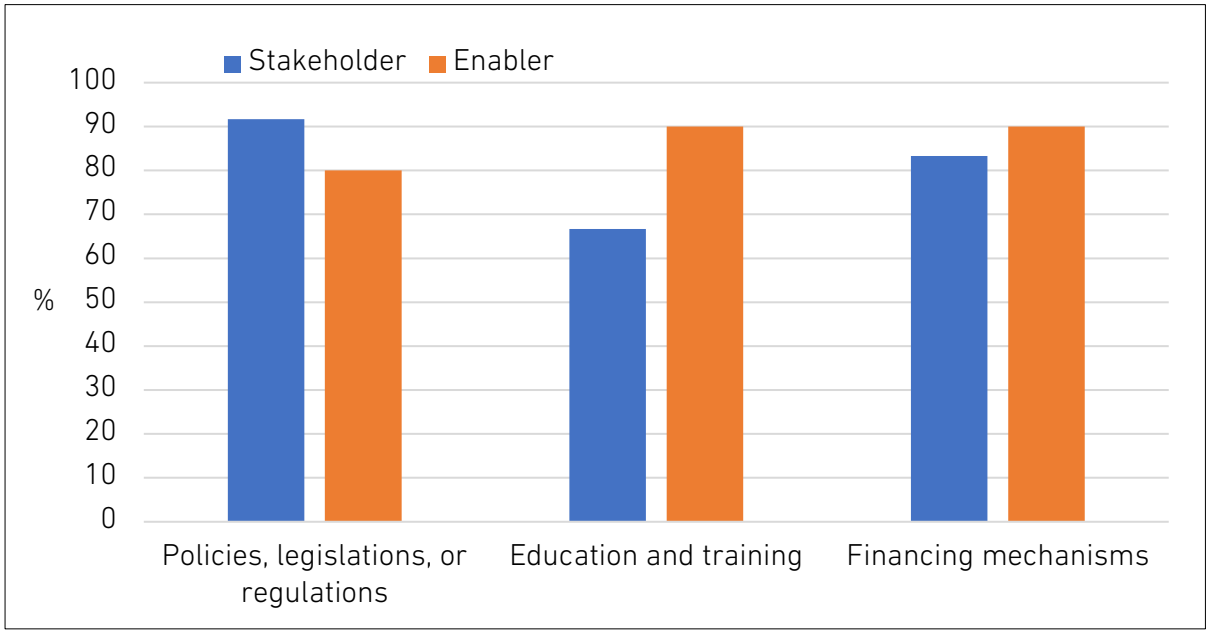
Source: Authors.

10.2.4. Enabling environment for the Guidelines

10.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

Policies, legislations, or regulations for the sustainable agriculture and food systems are well recognised by the stakeholders, slightly more than the enablers (Figure 10.3). It might be interpreted that the promotion of those initiatives for stakeholders has been well conducted. Respondents mentioned policies on '30 by 30', national mission for sustainable agriculture, cultured meat, Singapore Green Plan, Zero Waste Masterplan, GAP, Clean and Green Urban Farms, Agri-food Cluster Transformation, and Agri-food and Veterinary, as successful.

Figure 10.3. Percentage of Respondents' Understanding of Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to Support Sustainable Agriculture and Food Systems in Singapore

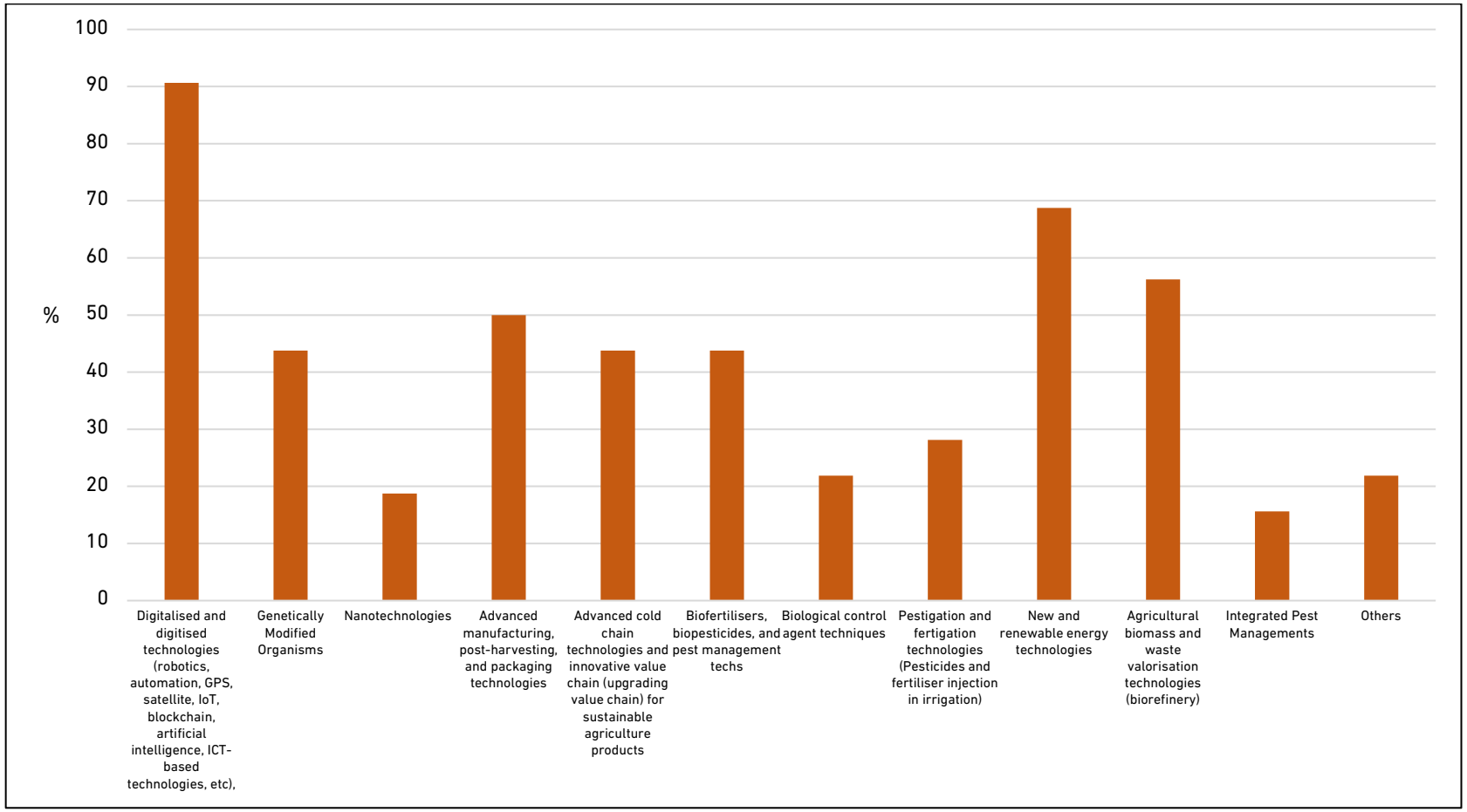


Source: Authors.

10.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

Singapore has effectively adopted digitalised and digitised technologies, followed by new and renewable energy technologies, and agricultural biomass and waste valorisation technologies (Figure 10.4). The high adaptation of these three technologies is in line with the high applications of the initiatives for sustainable agriculture (Figure 10.1) and prioritised strategies might be accompanied by innovative technologies (e.g. the reduction of greenhouse gas emission, precision agriculture, etc.) (Figure 10.2).

Figure 10.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in Singapore



Source: Authors.

10.2.4.3. Education and Capacity Building (Q7 of the Questionnaire)

Education and capacity building for sustainable agriculture and food systems is well recognised by the stakeholders and enablers to boost the implementation of the guidelines (Figure 10.3). Training and educational activities have been conducted to support the implementation of sustainable agri-food systems in Singapore. The beneficiaries are students in higher education, mostly with subjects taught, including horticulture, good farming, agrotechnology, sustainable food system, urban agriculture technologies, vertical and urban farming, sensors and instrumentations, plant diagnostics, nutrient management, crop scheduling, food alternatives, farmers field school, permaculture, regenerative agriculture, and agriculture extension. All these subjects have been included in local global-ranking universities, institutes, and polytechnics (including the National University of Singapore, Nanyang Technological University, Singapore Institute of Technology, Singapore Polytechnic, Singapore Management University). Moreover, public campaigns by the Singapore Food Agency as government representatives could bolster support for enhancing education and capacity building programmes in the agriculture sector.

Education and its applications are one of the key solutions at the farm and national levels (Table 10.3). The high awareness amongst both the stakeholders and enablers and coupled with numerous opportunities for education and capacity building are crucial for effectively implementing the Guidelines.

10.2.4.4. Financing Mechanism (Q8 of the Questionnaire)

Approximately 80%–90% of respondents recognise the financing mechanisms (Figure 10.3) as an enabling factor for enhancing the implementation of the guidelines. Unlike other countries, Singapore has urban and modern agriculture policies set in place, and this is coupled with the necessary sustainable agriculture financial and government funds. The funds range from government grants, green bonds, green finance, various grants with equities and tax schemes, agri-tech funds, SEEDS Capital, blended finance, innovative finance, carbon market funds, and voluntary carbon credit.

Financial and market support is one of the key solutions at the farm level (Table 10.3). In addition, connecting smallholders to the market and facilitating the funds are the prioritised strategies in the short and mid- to long term (Figure 10.2). Addressing financial issues for farmers for the long term would be required to scale up smart and green agriculture sector initiatives in the country.

10.3. Conclusion

The initiatives for sustainable agriculture have been effectively implemented, and innovative technologies for sustainable agriculture have been adopted. Policies, education, and financing mechanisms are highly recognised amongst the stakeholders and the enablers. Despite challenges in finance and market access, Singapore has

introduced several types of financing mechanisms for sustainable agriculture. The challenge can be addressed through farm level initiatives, which means farmers will need to make greater use of the available financial support, considering agriculture contributes less than 1% of GDP and uses 1% of land (Department of Statistics Singapore, 2023). That will lead to the accomplishment of the prioritised strategies related to financial and market access issues. Moreover, the implementation of standards and best practices, as outlined in SS 661, not only ensures the production of clean and sustainable farm produce but also contributes to consumer confidence, promotes environmental responsibility, and supports Singapore's overarching goal of achieving a resilient and efficient local food production system.

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Chapter 11

Thailand Country Report

Orachos Napasintuwong, Parthana Parthanadee, Ravipim Chaveesuk,

Kentaro Yamada, Siti Mustaqimatud Diyanah

11.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

Thailand launched its first long-term comprehensive strategic plan (2018–2037) aimed at sustainable development (National Strategy Secretariat Office, 2018). This national strategic plan is a framework towards the vision of Thailand becoming 'a developed country with security, prosperity, and sustainability following the Sufficiency Economy Philosophy (SEP)' (National Strategy Secretariat Office, 2018). In addition, Thailand launched strategies to drive economic development with BCG economy model in 2021. The BCG economic model is a driving mechanism for 'quality growth' focusing on science, technology, and innovation to create economic value whilst balancing between the conservation and use of the natural resources base and biodiversity.

In addition, the BCG model was activated for sustainable recovery from COVID-19 (Ministry of Foreign Affairs of Thailand, 2021).

Thailand put significant initiatives into biotechnology. In 2012, Thailand developed its National Biotechnology Policy Framework (2012–2021) that aimed to strengthen comprehensive issues, including the sustainable agri-food systems (Ministry of Science and Technology of Thailand, 2012). It is also proposed that agricultural biotechnology is important in addressing sustainability issues, including restoring agricultural resources to the normal state (Chanikornpradit, 2022).

Food and agriculture are one of the targeted sectors in 2021–2025, and advanced technologies, such as smart farming, precision agriculture, and decision-making system based on market and area, are implemented (Thailand Board of Investment, 2020). Such digital and internet of things technologies are applied in the BCG value chain, contributing to economic development within the BCG Model (NXPO, 2023).

Specific to the rice sector, Thailand has joined the Sustainable Rice Platform (SRP), a multi-stakeholder platform convened by United Nations Environment Programme and the international Rice Research Institute to embrace a voluntary sustainable rice practice. Thailand approved Thai Agricultural Standard for Sustainable Rice in May 2022. The SRP Standard provides a framework for sustainable rice farming practices.

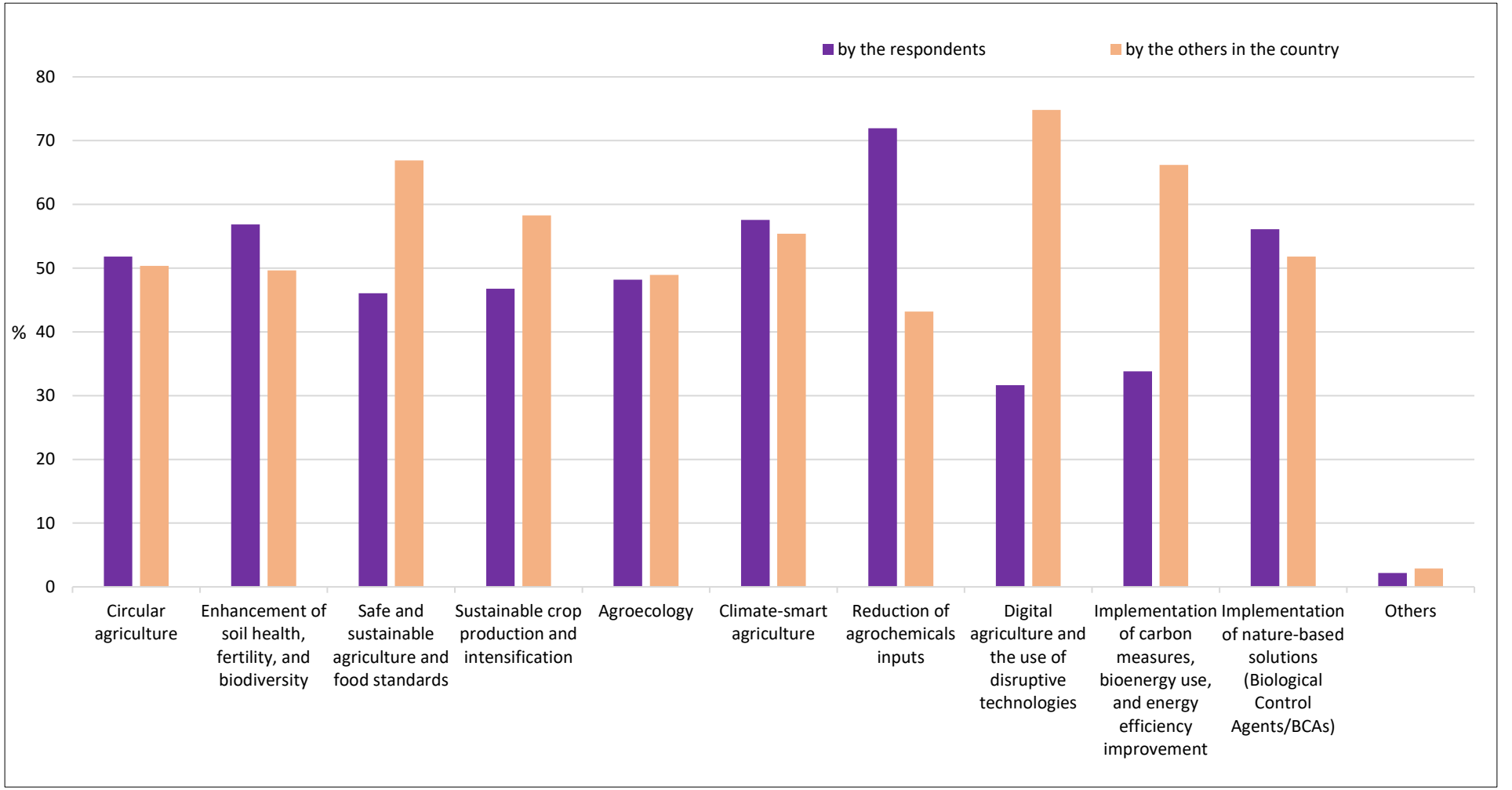
11.2. Result of the Questionnaire Survey and Discussion

11.2.1. Sustainable Key Actions or Initiatives Applied in Thailand (Q1 of the Questionnaire)

Figure 11.1 shows that reduction of agrochemicals input (71.9%) is well applied by the respondents, followed by climate-smart change (57.6%); enhancement of soil health, fertility, and biodiversity (56.8%); and implementation of nature-based solutions (56.1%). The ratios for the application by others in the country indicate that digital agriculture and the use of disruptive technologies (74.8%), safe and sustainable agriculture and food standards (66.9%), and implementation of carbon measures, bioenergy use, and energy efficiency improvement (66.2%) are well applied in Thailand.

At the site level, food value chain actors anticipate reducing agrochemical inputs in the agriculture and food sectors. At the country level, digital agriculture is being progressively applied to achieve sustainable agriculture and food systems. According to Global System for Mobile Communications (GSMA) (2022), micro, small, amd medium-sized enterprises of the rural agriculture and tourism sectors have been digitised to enhance their international competitiveness through Thailand's Fourth Small and Medium-sized Enterprises Promotion Plan (2017–2021) and the Digital Thailand Plan. That aligns with the observation that the ratios of applications for enhancing soil health and reducing agrochemicals by the respondents are higher than those of others in the country. This may suggest that the applications at the farm level are less recognised by the enablers.

Figure 11.1. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in Thailand Applied (a) by the Respondents and (b) by Others in the Country



Source: Authors.

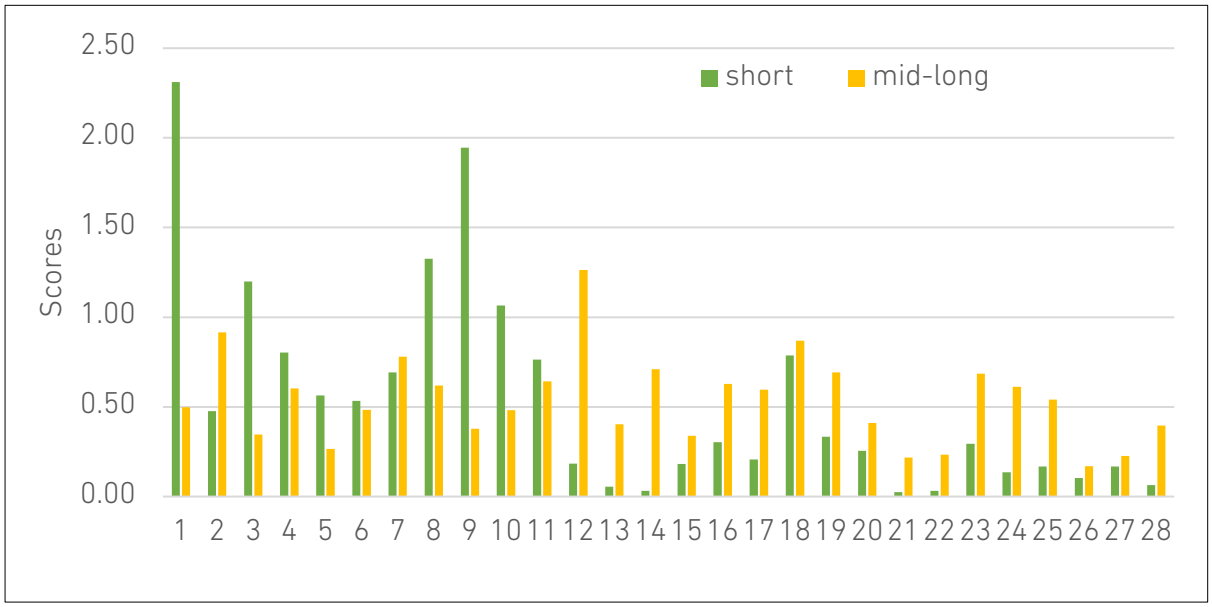
11.2.2. Prioritised Short- and Mid- to Long-term Strategies on the Guidelines in Thailand (Q2 of the Questionnaire)

Thailand prioritised the top five short-term strategies (Figure 11.2) as follows: (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (9) connecting smallholders to markets; (8) facilitating funding with productive resources, finance, and services; (3) closing nutrient cycles/loops and valorisation of agricultural waste biomass and food wastes into cost-effective feeds and fertilisers; and (10) encouraging diversification of production and income.

Amongst the medium- to long-term strategies, the most prioritised are: (12) encouraging more research and development on sustainable and circular agriculture and food production; (2) reduction of greenhouse gases from agriculture-related activities; (18) reducing the reliance on the use of agrochemicals in agriculture, balancing the use of organic and chemical fertilisers; (7) promoting the use of smart and precision agriculture systems in sustainable food production; and (14) aligning ASEAN agricultural standards and those of our major export markets.

The strategies that might improve the farmers' livelihood are prioritised in the short term, whereas the initiatives enacted by the institution or the government are prioritised in the mid- to long term.

Figure 11.2. Key Priority Strategies of the Guidelines: Short and Mid- to Long-term in Thailand



Source: Authors.

11.2.3. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 and Q4 of the Questionnaire)

Finance and market access (24.3%), policy and institutional framework (23.4%), education and capacity building (21.7%), and technology and infrastructure (19.4%) show approximately the same ratios as challenges in the implementation of the Guidelines in Thailand (Table 11.1).

Table 11.2 shows that education and its application would be the most important solution at the farm level, as well as financial and market support at the provincial level, and policy enactment at the national level. Considering that strategies related to financial issues are prioritised in the short term, whilst strategies related to the institutional framework are prioritised in the mid- to long term (Figure 11.2), solutions implemented in broader areas are expected to require a longer time frame.

Table 11.1. Challenges Mapping the Implementation of the Guidelines in Thailand

Categories	Challenges	Ratios (%)
Environmental impacts	Climate change and its impacts	4.3
Education and capacity building	Lack of education, understanding, and training	21.7
Technology and infrastructure	Access and funding to digital technology, expensive and inaccessible technology, technologies for product quality	19.4
Finance and market access	Lack of finance and credibility for the end market with production standards, limitation of farmers in bargaining powers, challenges in the marketing system, networks, and communication	24.3
Resources (human and agricultural inputs)	Lack of collaboration, lack of capital support, limited skilled and expertise human resources	6.9
Policy and institutional framework	Insufficiency of clear, conducive, and asynchronous policy for sustainable agriculture; deficient shared vision between policy departments and relevant practitioners	23.4

Source: Authors.

Table 11.2. Solution Mapping at the Farm, Provincial, and National Levels, Including Ratios for the Implementation of the Guidelines in Thailand

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	Training on good agricultural practices, farmers' group strengthening and joint management, workshop and knowledge enhancement programs, field exchange between extension officers and researchers	Application of modern technology, helping small farmers to access machines and technology, introduction of new varieties and irrigation systems, support in pest and disease control	Financial support (incentive), control in the use of agricultural inputs, improved access to capital, resources, and justice, farmers' market development, reduction in production cost, business partners' matching	Promotion of public–private partnership, issuance of policy for sustainable agriculture, establishment of farmers' cooperatives
	60.7%	19.7%	14.5%	5.1%
Province	Promotion of research works, farmer education programmes, and events arrangements to promote sustainable agriculture	New technology adoption and access, innovation in plant varieties, water irrigation management	Marketing promotion programmes, financial support and its strategic planning, and decentralised budget distribution	Policy development (finance, purchased materials, rice insurance, price control), monitoring and evaluation, and its legal measures, public–private collaboration, organising activities to accelerate sustainable agriculture, setting development plans
	29.5%	15.2%	40.0%	15.2%

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
National	Advancement of awareness and public interests in sustainable agriculture, and information dissemination to the public	Technology support for agricultural development, research and development, cassava breeding studies	Promotion of low-interest loan and rice insurance, funding for agriculture development, budget planning mechanism for 5–10 years, crop price assurance, and tariff reduction for trade	Regulatory framework reformation, issuance of pro-farmers and exporters policies, promotion of guidelines for cultivation improvement, policy setting (reduced bank debt, crops price), and organic food plant policy development
	12.0%	6.8%	29.3%	51.9%

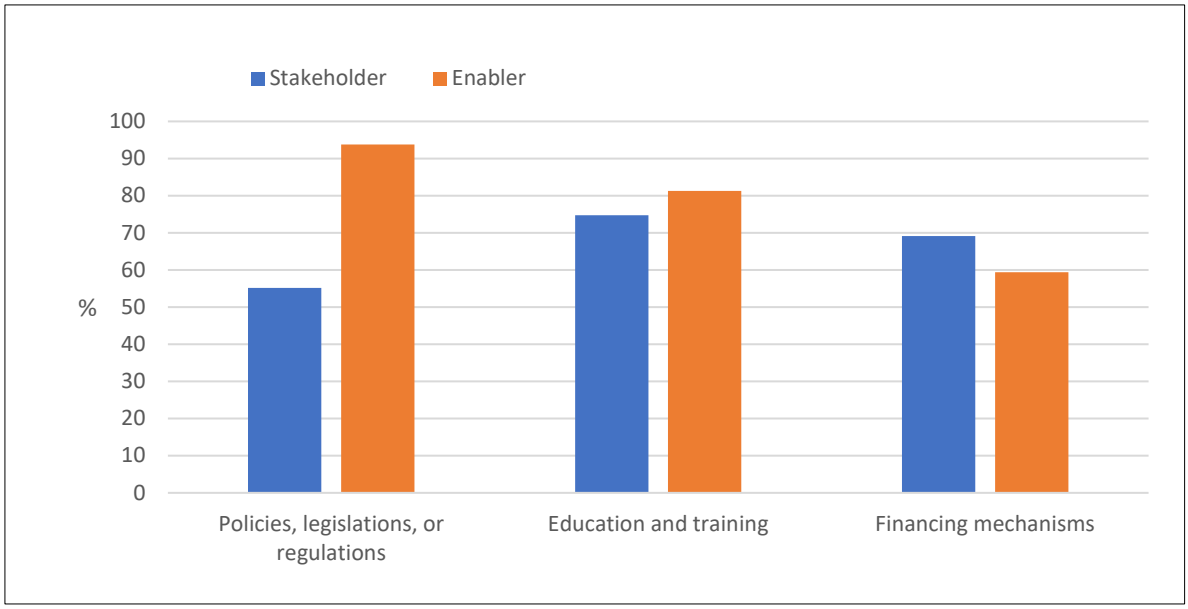
Source: Authors.

11.2.4. Enabling Environment for the Guidelines

11.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

Policies, legislations, or regulations for the sustainable agriculture and food systems are well recognised by the enablers rather than the stakeholders (Figure 11.3). The specific policies addressed by the respondents include the national strategic plan, BCG economy, agriculture development plan, climate change master plan, organic farming, sustainable rice production, digital technology, climate-smart farming, sustainable production and consumption, loans and investment, good agricultural practices (GAP), agriculture extension, crops insurance, and agriculture cooperatives

Figure 11.3. Percentage of Respondents' Understanding of Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to Support Sustainable Agriculture and Food Systems in Thailand

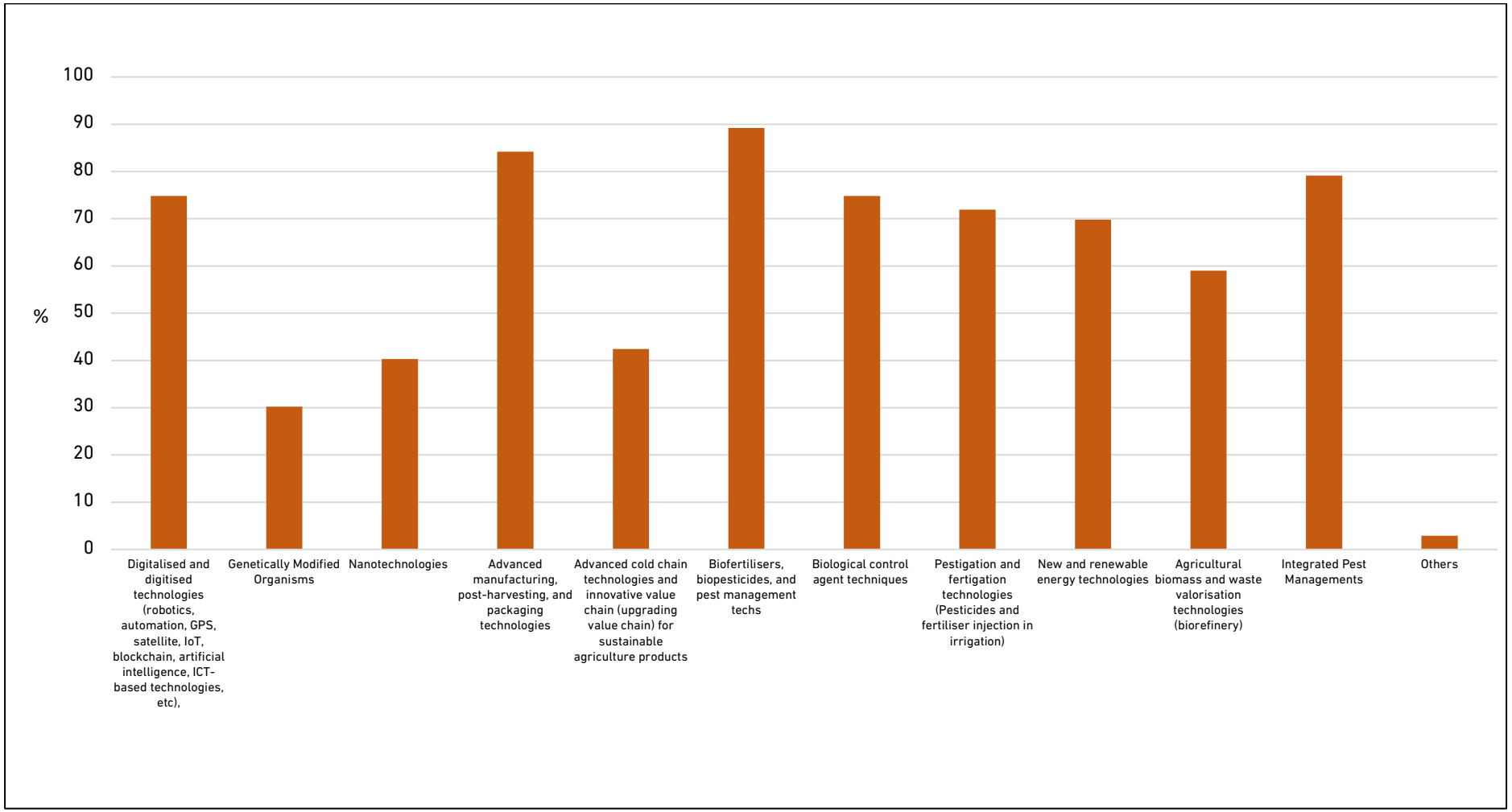


Source: Authors.

11.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

Approximately 80%–90% of the respondents recognise that biofertilisers, biopesticides, and pest management techs (89.2%); advanced manufacturing, post-harvesting, and packaging technologies (84.2%); and integrated pest management (79.1%) have been adopted in Thailand (Figure 11.4). High adaptation of the technology utilising bioresource is in line with the recent policy enactment of the BCG model (Royal Thai Embassy in Jakarta, 2021).

Figure 11.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in Thailand



Source: Authors.

11.2.4.3. Education and Capacity Building (Q7 of the Questionnaire)

Education and capacity building for sustainable agriculture and food systems are recognised by approximately 80% of the stakeholders and the enablers in Thailand as an enabling factor to bolster the implementation of the guidelines (Figure 11.3). Different subjects on sustainable agriculture are taken up at the farm level and higher education, such as a system of rice intensification, smart and precision farming, organic farming, biocontrol agents, land use, soil improvement, byproducts valorisation, pest and disease, advanced agriculture and biotechnology, reduction of burning in agriculture area, biofertiliser, and GAP. Notably, education for biotechnology has been conducted for sustainable agriculture, which is possibly promoted under the enactment of the BCG model. Some farmers answered that they were trained in global warming reduction, fermented fertiliser production, New Theory Agriculture, and organic plant cultivation, but there was no follow-up for them. In addition, according to the respondents, there are trainings, but still a small number of farmers implemented the practices. Considering that the lack of education is one of the challenges (Table 11.1), and that education and its application are solutions at the farm level (Table 11.2), it is essential to continuously provide opportunities for enhancing both formal and informal education for farmers.

11.2.4.4. Financing Mechanism (Q8 of the Questionnaire)

The awareness of financing mechanisms varied amongst ASEAN countries, and the respondents recognised this better than the average for ASEAN countries. According to the respondents, Thailand has numerous financing mechanisms to support sustainable agriculture, such as green credit, funds from the Board of Investment, bank loans, tree bank project funds, Bank for Agriculture and Cooperative funds and credits established by the government, rice-pledging scheme, climate fund, BCG Economy funds, project finance, government subsidies, and crop insurance funds. Institutions in Thailand also provide funding with industry participation, including both cash and in-kind contributions, for various programmes such as agriculture and food, digital technology and platforms, the development of future mobility, robotics and automation, and technology localisation

Such initiatives might be promoted more for mid- and long-term strategies for sustainable agriculture and food systems (see Section 11.2.3). In addition, financial and market support is required as the most important solution at the provincial level, as well as the second most important solution at the national level (Table 11.2), indicating that the institutional fund would remain required.

11.3. Conclusion

The reduction of agrochemicals and digital agriculture have been effectively implemented in Thailand. The strategy for improving soil health is prioritised in the short term, whilst the strategy for encouraging research and development is prioritised in the mid- to long term.

Finance, policy, education, and technology are identified as the major challenges in implementing the Guidelines. Education and its application, financial and market support, and policy enactment are the solutions at the farm, provincial, and national levels. Policies, education and training, and financial mechanisms are well recognised by the respondents, as well as the adaptation of innovative technologies, especially for utilising bioresource. The BCG model has been enacted in Thailand and has been well recognised by the respondents. Under the BCM model initiative, financial and educational activities will remain essential for promoting sustainable agriculture.

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Chapter 12

Viet Nam Country Report

Do Huy Thiep, Kentaro Yamada, Siti Mustaqimatud Diyanah

12.1. Recent Policy Initiatives for Sustainable Agriculture and Food Systems

The policy for agriculture shifts from focusing on 'agricultural production' to an 'agricultural economy', emphasising value improvement, efficiency, and diversification along the value chain in accordance with market requirements. In addition, a shift from monodisciplinary development to multidisciplinary and multi-sectoral integration is required, as along with the advancement of green and ecological development (Van Song et Al., 2020).

As the focal policy, Communist Party of Viet Nam issued 'On Agriculture, Farmers, and Rural Areas to 2030, Vision to 2045' (Resolution 19-NQ/TW) (FAO, 2022a). Related strategies are the 'National Green Growth Strategy 2021–2030 with a Vision to 2050' (Decision 1658/QD-TTg) (FAO, 2021); National Action Plan for Green Growth (Decision 882/QD-TTg) (FAO, 2022b); and the 'National Strategy for Climate Change until 2050' (Decision 896/QD-TTg) (Thu Vien Phap Luat, 2022a). Under the policy, the Ministry of Agricultural and Rural Development (MARD) approved its action plan to implement the National Green Growth Strategy 2021–2030 (Decision 3444/QD-BNN-KH) (Thu Vien Phap Luat, 2022b).

Decision No.150/QD-TTg of the Prime Minister, 'Approving the Strategy for Sustainable Agriculture and Rural Development for the period 2021–2030, with a Vision to 2050', indicates the policy framework on sustainable agriculture. This includes completing the structure of agricultural production along with competitiveness in the market, improving efficient and sustainable development in production, promoting cooperation along with value chain development, developing rural economy, and building the countryside with the urbanisation as well as preserving traditional culture (MARD, 2022).

The National Action Plan on Food Systems Transformation in Viet Nam towards Transparency, Responsibility, and Sustainability by 2030 refers to tasks for sustainable agriculture, such as the improvement of the protocols, the development of the input supply system, the development of agricultural production through agroecology transition, the development of the food processing and distribution system, and the promotion of sustainable food consumption practices. The action plan aims to contribute to achieving the Sustainable Development Goals by 2030 in Viet Nam, focusing on the transformation of food systems in the supply chain based on local advantages (Linh, 2023).

Agroecology is recognised as a means to implement the NAP. Linh (2023) indicated that Task 1 specifically identifies the review and development of agroecological and low-emission agriculture, the use of renewable energy, the development of regulations and guidelines for agroecology, policies to support green and safe traceable products, development of key agroforestry and fisheries value chains, and the establishment of partnerships as specific ways to achieve this. Similarly, Task 2 includes guidelines for adherence to production protocols and the use of organic fertilisers and biopesticides, research on variety- and technology-based measures (climate change, natural disasters, diseases, mechanisation); utilisation of land, water, and genetic resources; and promotion of local knowledge maintenance. Task 3 includes value chain-based tourism, One Health, and risk avoidance and resilience of food systems for vulnerable populations. Task 4 includes reducing food loss and waste and applying circular economy principles.

As the practical initiative, the Food Innovation Hub (FIHV) is planned to be established in Viet Nam, which is important in strengthening the regional innovation ecosystem, addressing climate change, and supporting the connection of global food and food systems in the direction of 'transparency, responsibility, and sustainability' (MARD and UNIDO, 2022). In addition, projects to promote the use of biomass are also underway, with biogas promotion efforts underway in Viet Nam, Lao PDR, and Malaysia (Anh et al., 2020).

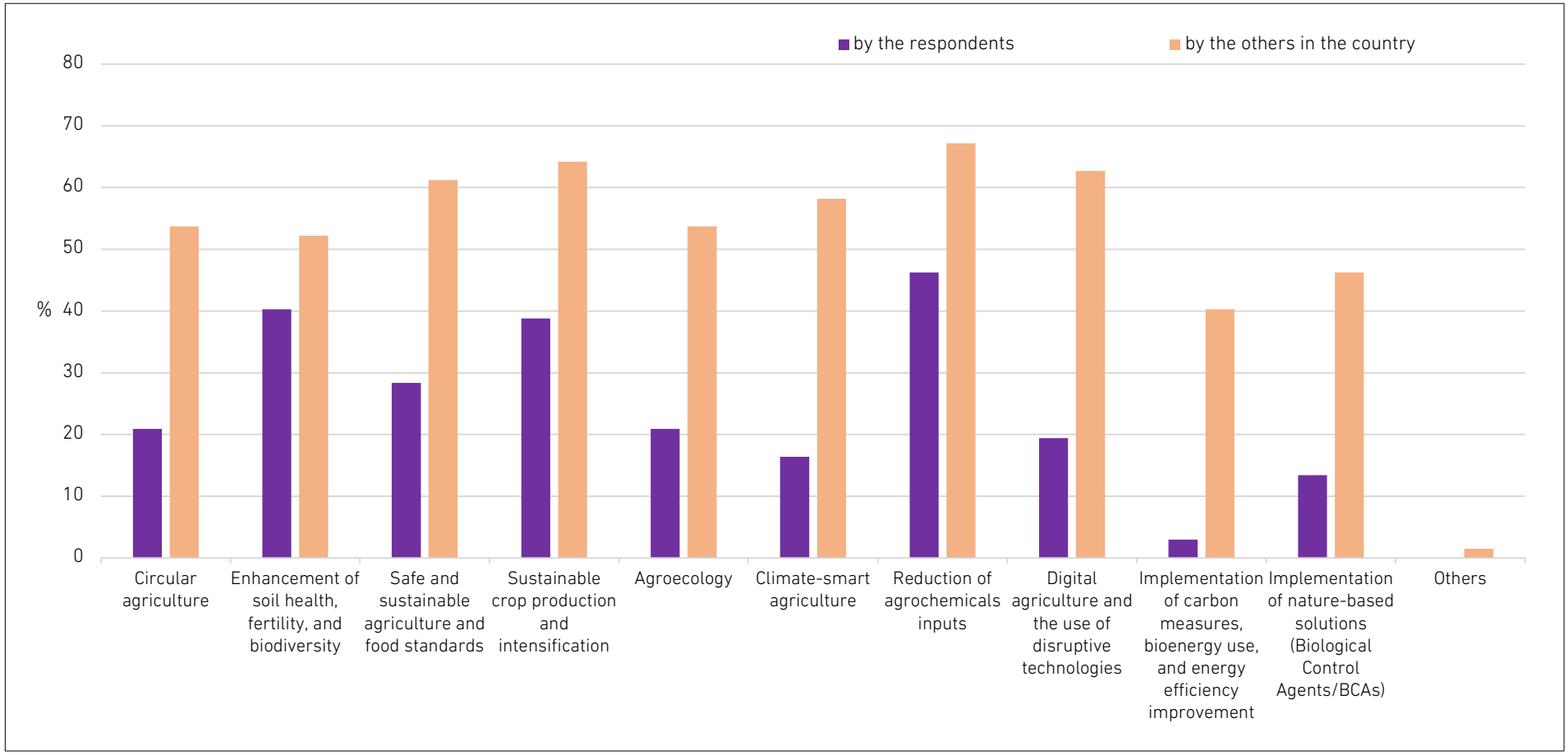
12.2. Result of the Questionnaire Survey and Discussion

12.2.1. Sustainable Key Actions or Initiatives Applied in Viet Nam (Q1 of the Questionnaire)

Figure 12.1 highlights that the top three applied key actions or initiatives in Viet Nam are the reduction of agrochemical inputs (46.3%); enhancement of soil health, fertility, and biodiversity (40.3%); and sustainable crop production and intensification (38.8%). The actions or initiatives implemented by others in the country have higher adoption rates compared to those implemented by the respondents as follows: reduction of agrochemical inputs (67.2%) is the highest, followed by sustainable crop production and intensification (64.2%), and digital agriculture and the use of disruptive technologies (62.7%). This shows that whilst these initiatives are widely adopted nationwide, respondents are less engaged with them. Reduction of agrochemical inputs and sustainable crop production and intensification are the most actualised initiatives on the ground by individuals and the country. It is apparent that these initiatives are looked forward by these actors to reduce production costs, reduce environmental pollution due to chemicals, and increase the productivity of agri-food products sustainably by intensifying the use of intelligent and pro-environmental technologies. Some previous studies addressed the reduction of agrochemicals used for fertilisers and pesticides (Morton, 2020; Thuong, Thinh, and Long, 2023), whilst research on sustainable crop production and intensification was conducted by Stuart et al. (2018) and Liem et al. (2022) to support national initiatives. In terms of country initiatives, projects and operationalised

committed actions have been and were taken to address the aforementioned issues, such as the Fertilize Right initiative (Nong Ngiep, 2023), Vietnam Sustainable Agriculture Transformation project (Ministry of Agriculture and Rural Development, 2014), and the Vietnam Sustainable Intensification Crop-Livestock Project (Gonda, Peters, and Douxchamps, 2019).

Figure 12.1. Key Actions or Initiatives on Sustainable Agriculture and Food Systems in Viet Nam Applied (a) by the Respondents and (b) by Others in the Country



Source: Authors.

12.2.2. Prioritised Short- and Mid- to Long-term Strategies on the Guidelines in Viet Nam (Q2 of the Questionnaire)

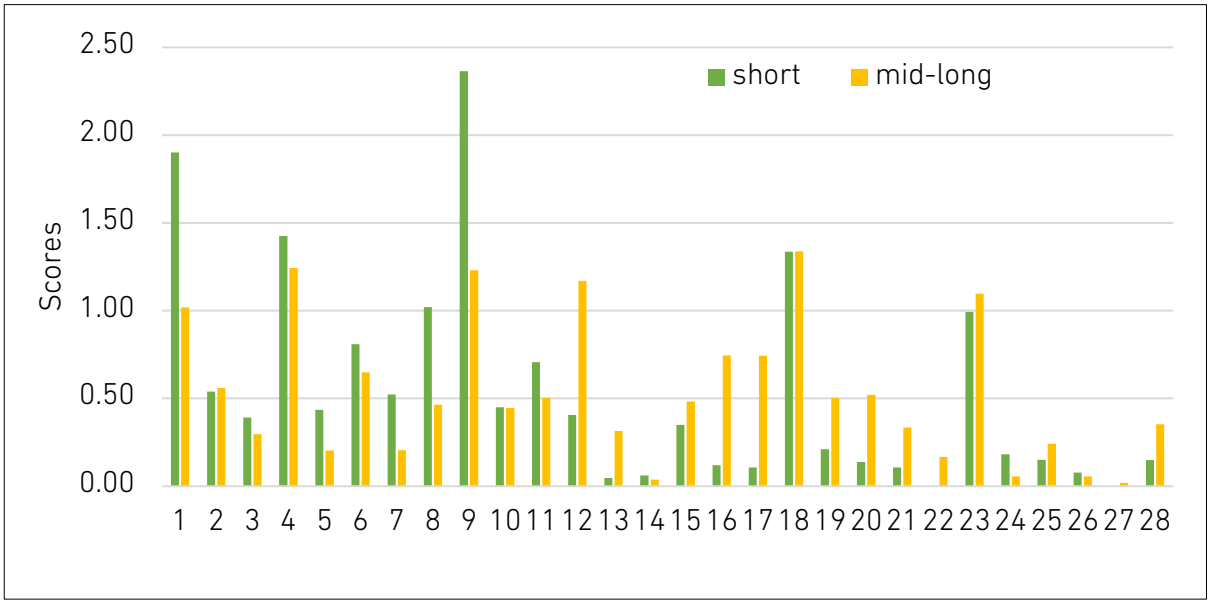
In Viet Nam, the top five key strategies prioritised in the short term (Figure 12.2) are (9) connecting smallholders to markets; (1) improving overall soil health: reducing overfertilisation of the soil base, applying of targeted organic fertilisers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity; (4) collaboration along the agriculture and food chains; (18) reducing the reliance on the use of agrochemicals in agriculture, balancing the use of organic and chemical fertilisers; and (8) facilitating funding with productive resources, finance, and services.

Amongst the medium- to long-term strategies, (18) reducing the reliance on the use of agrochemicals in agriculture, balancing the use of organic and chemical fertilisers; (4) collaboration along the agriculture and food chains; (9) connecting smallholders to markets; (12) encouraging more research and development on sustainable and circular agriculture and food production; and (23) reducing the environmental impact of agricultural and food production are highly prioritised as the top five strategies.

Three strategies are common amongst the prioritised strategies in the short and mid- to long term. Priority in reducing the use of agrochemicals is in line with the result of Figure 12.1. Connecting smallholders to markets and fostering collaboration along the agriculture and food chains will lead to an improvement in farmers' incomes.

These strategies imply that recent initiatives and requirements are thought to be extrapolated as mid- to long-term initiatives.

Figure 12.2. Key Priority Strategies of the Guidelines: Short and Mid- to Long-term in Viet Nam



Source: Authors.

12.2.3. Challenges and Solutions of Sustainable Agriculture and Food Systems (Q3 and Q4 of the Questionnaire)

Based on Table 12.1, finance and market access (33.1%), are considered the biggest challenges by respondents in Viet Nam, followed by resources (27.4%) and education and capacity building (16.0%). According to the specific challenges (Table 12.1), it can be summarised that skilled individuals and an improvement in the balance of income and expenditure are required.

Table 12.2 shows that education and its application as a solution have the highest ratio at the farm level, whilst finance and market support have the highest ratios at the provincial and national levels. Those enabling factors are expected to effectively address the challenges.

According to most respondents, an important role of government is required, which includes providing financial support, offering loans with favourable interest rates, facilitating technical training, and implementing technology and communication campaigns to raise awareness at all three levels.

Table 12.1. Challenges Mapping the Implementation of the Guidelines in Viet Nam

Categories	Challenges	Ratios (%)
Environmental impacts	Climate crisis and its impacts, energy crisis, new pandemics	1.1
Education and capacity building	Low education, training, and capacity building; limited knowledge, understanding, and awareness	16.0
Technology and infrastructure	Lack of technology investment, transfer, and adoption; limited advanced technologies and high installation; outdated infrastructures	10.9
Finance and market access	Lack of funding and its slow funding execution, no market information, organic markets available, low market price, and unstable market	33.1
Resources (human and agricultural inputs)	Lack of high-quality human resources and lack of resources; high cost and unstable agricultural inputs	27.4
Policy and institutional framework	How to improve effectiveness of policy support and implementation; insufficient policy and regulation on sustainable agriculture and contract farming; unsuitable legal regulation	11.4

Source: Authors.

Table 12.2. Solution Mapping at the Farm, Provincial, and National Levels, Including Ratios for the Implementation of the Guidelines in Viet Nam

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
Farm	Technical training, knowledge improvement, and capacity building in agriculture mechanisations	Technology transfer support, innovation, and quality improvements for agriculture produce	Financial support (loans, subsidies, investment, capital), and linking with markets	Development of national propaganda and guidelines
	54.4%	10.5%	31.6%	3.5%
Provincial	Training course support for farmers and multi-stakeholder dialogue	Investment in machinery, infrastructure, and mechanisation	Financial support (loans, tax reduction), agriculture inputs price control, promotion of contract farming, control of pesticides companies, production capital support, and creating linkage between farmers and traders or companies	Planning and monitoring specialised livestock production, developing guiding documents for policy support, and attracting the private sector
	17.6%	27.9%	45.6%	8.8%
National	Training high-quality human resources	Technology transfer support	Agriculture input and crop price control, financial support, and market channel enhancement	Project development with short-, medium-, and long-term goals; private sector engagement; policy development; and legal framework development for sustainable

	Education and Its Application	Technology and Infrastructure	Financial and Market Support	Policy Enactment
				agriculture transformation
	10.5%	15.8%	49.1%	24.6%

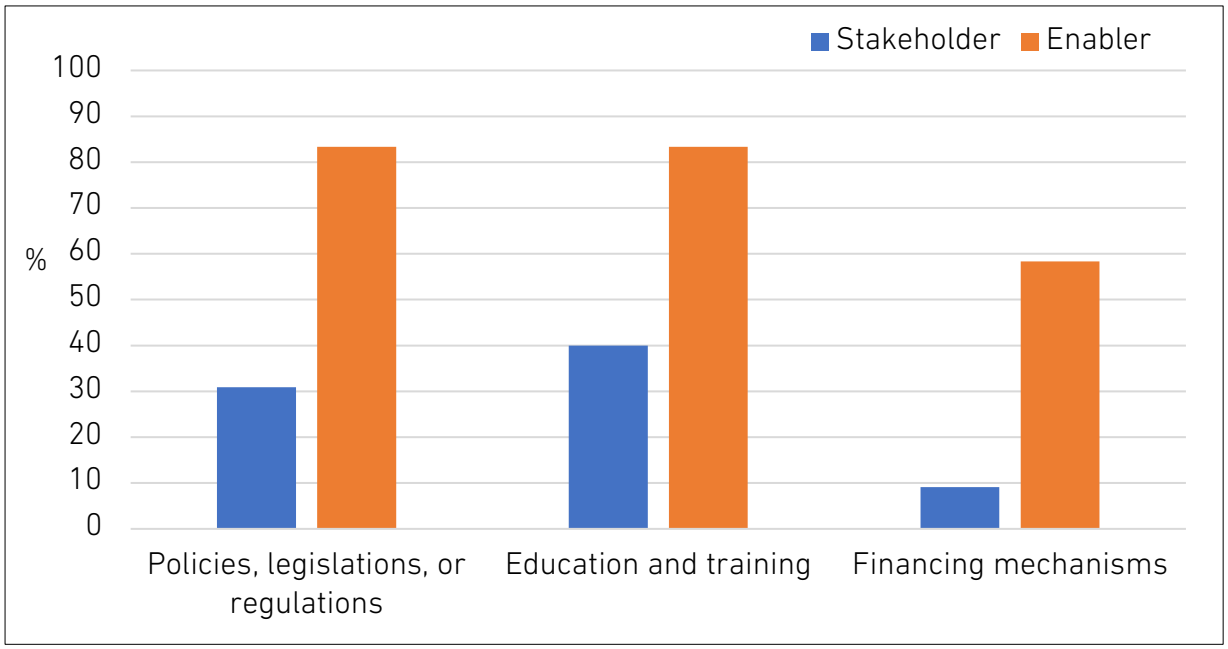
Source: Authors.

12.2.4. Enabling Environment for the Guidelines

12.2.4.1. Policies, Legislations, or Regulations (Q5 of the Questionnaire)

Policies, legislations, or regulations for the sustainable agriculture and food systems are well recognised as the enabling factors by the enablers rather than the stakeholders (Figure 12.3). Business and investment in agriculture, paddy land, crop restructure, food safety and hygiene, consumer protection, good agricultural practices, integrated pest management, fisheries, and strategies for green growth and sustainable agriculture were identified by the respondents as specific policies.

Figure 12.3. Percentage of Respondents' Understanding of Policies, Legislations, or Regulations; Education and Training; and Financing Mechanisms Applied to Support Sustainable Agriculture and Food Systems in Viet Nam

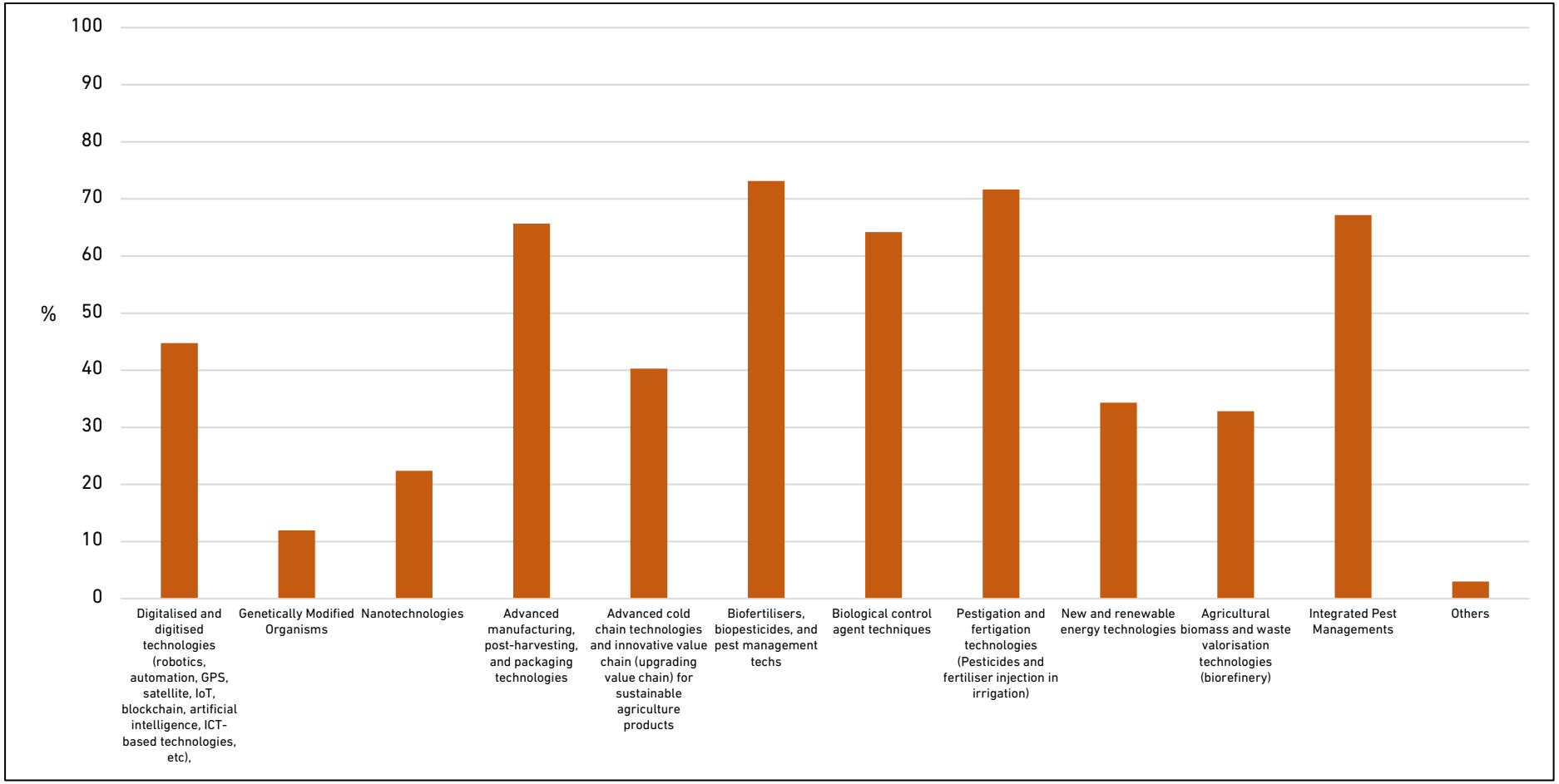


Source: Authors.

12.2.4.2. Innovative Technologies and Infrastructure (Q6 of the Questionnaire)

Figure 12.4 shows that biofertilisers, biopesticides, and pest management techs (73.1%) are recognised as the most adopted technologies, followed by pestigation and fertigation technologies (pesticides and fertiliser injection in irrigation) (71.6%); integrated pest management (67.2%); advanced manufacturing, post-harvesting, and packaging technologies (65.7%); and biological control agent techniques (64.2%). That is consistent with the active initiatives of reducing agrochemicals (Figures 12.1 and 12.2).

Figure 12.4. Percentage of Innovative Technologies Adopted or Introduced to Expedite the Implementation of Sustainable Agriculture and Food Systems in Viet Nam



Source: Authors.

12.2.4.3. Education and Capacity Building (Q7 of the Questionnaire)

Education and capacity building for sustainable agriculture and food systems are well recognised by stakeholders as well as enablers (Figure 12.3). In Viet Nam, subjects on sustainable agriculture education are safe rice and vegetable production, food hygiene and safety, controlled use of pesticides, pest and disease control, organic farming, and integrated marine systems. These subjects are integrated with agriculture education, training, capacity building, and courses at the farm and higher education institutes. However, awareness by stakeholders is low whereas education is the most important solution at the farm level (Table 12.2). Thus, more opportunities to provide education for farmers are essential to bolster the implementation of the Guidelines.

12.2.4.4. Financing Mechanism (Q8 of the Questionnaire)

Finance and market access is further less recognised by stakeholders than by enablers. Viet Nam applies several sources and types of financing mechanisms for sustainable agriculture. These mechanisms include bank loans, capital rents, R&D funds for plant varieties, tax policies aimed at promoting sustainable agricultural production, project support, and government assistance through credit policies, state budget expenditure policies, and tax incentives. However, their awareness is not well promoted. Finance and market access are the largest challenges, whilst the respondents from the farm to the national levels expect finance and market access will be key solutions in implementing the Guidelines (Table 12.1 and Table 12.2). In addition, market access for smallholder farmers is prioritised as the strategy (Figure 12.2). It is important to encourage the farmers to utilise the financial schemes.

12.3. Conclusion

The initiative to reduce agrochemicals has been implemented and will be further enhanced with the integration of new related technology. Awareness of education and financial support amongst the stakeholders is low, whereas these are key solutions for implementing the Guidelines. More institutional enactments for improving education and financial issues would be required. For instance, to improve the financial resources for farmers, increasing state budget allocation, public–private partnership by leveraging investment from the private sector and mobilising support from international organisations and partner countries are essential. Increasing state budget allocation leads to the improvement of credit access and insurance. as Also, mobilising financial support leads to a stable market for sustainable agricultural products, and sufficient infrastructure and technical support. These improvements will ensure economic benefits and will result in mobilising investment from the private sector.

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Appendices

A1. Method for Systematic Review

This method refers to Arksey et al. (2005), with modified procedures from Oxsrev/University of Oxford (2020) to bring together more reliable and robust information and evidence from various sources and disciplines to inform debates and decisions on specific issues. A proposed question for the study was: 'What are the key priority areas being concerned by and derived from national priority ASEAN countries to build and enhance a sustainable agri-food systems in the ASEAN region?'. From the question, a research framework is developed using the PICO/PECO (Population, Intervention, Counterfactual, Outcome/Population, Exposure, Counterfactual, Outcome) (Table 1), and the framework was utilised to search literature from Scopus using 'keywords and Boolean logic operators' with a timespan of 'all years' and in English.

After obtaining relevant literature from academic search engines, data were extracted based on parameters requested in the Data Extraction Sheet.

Table A1. PECO Framework and its Boolean Logic Operators for Searching Literature

	Population (P)	Exposure (E)/Intervention (I)	Counterfactual (C)	Outcome (O)
Question: A proposed question for this study is: 'What are the key priority areas being concerned by and derived from national priority ASEAN countries to build and enhance a sustainable agri-food systems in the ASEAN region?'				
PECO/PICO	ASEAN Countries	Sustainable policies, initiatives, institutional framework (most focused	Unsustainable activities, policies, initiatives, and institutional framework	Sustainable agri-food systems
Keywords	- Brunei Darussalam - Cambodia - Lao PDR - Indonesia - Malaysia - Myanmar - Philippines - Singapore - Thailand - Viet Nam	Dimensions of agri-food sustainability - good governance, - environmental integrity, - economic resilience, and - social well-being	Unsustainable activities, policies, initiatives, and institutional framework	• Sustainable agri-food • Sustainable agriculture • Sustainable food system • Sustainable food and agriculture
Search string	Example:			

	Population (P)	Exposure (E)/Intervention (I)	Counterfactual (C)	Outcome (O)
	Indonesia AND 'good governance' OR 'environmental integrity' OR 'economic resilience' OR 'social well-being' AND 'sustainable agriculture' OR 'sustainable food system' OR 'sustainable agri-food systems' If the quest cannot perform and show publications since the quest is too specific, the string is then changed into more general keywords: Indonesia AND 'Sustainable Agriculture' OR 'Sustainable Food System'			
Note: For population, please use a search string based on the country being studied, such as Brunei Darussalam, Cambodia, Lao PDR, Indonesia, Thailand, or Viet Nam, rather than generally putting ASEAN.				

Source: Authors.

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A2. The Questionnaire Form for the Survey

The finalised questionnaire is shown in Figure A1.

Figure A1. Finalised Questionnaire Form

Country	: .....
No. respondent	: .....
Enumerator name	: .....
Interview date	:.....

QUESTIONNAIRE

Building and Enhancing the Sustainable Agriculture and Food System in ASEAN Countries: A Preliminary Scoping Study
Conducted by

Economic Research Institute for ASEAN and East Asia

Background and Objective

The agriculture and food system is required to transform into more sustainable to address multiple challenges such as increasing productivity, reducing environmental load, improving biodiversity, promoting circular agriculture, and so forth. In this connection, ASEAN has developed 'ASEAN Regional Guidelines for Sustainable Agriculture in ASEAN' in October 2022. In the guidelines, 5 key principles and 28 key strategies are stressed. The guidelines are expected to facilitate transformation of ASEAN agriculture into highly productive, economically viable, and environmentally sound production system.

This questionnaire survey aims to obtain information from stakeholders in each ASEAN country on their awareness of sustainable agriculture and food system. The information obtained will be used for analysis to identify priority areas to be addressed for realizing sustainable agriculture and food systems.

Note: According to FAO, to be sustainable, agriculture must meet the needs of present and future generations, while ensuring profitability, environmental health, and social and economic equity.

RESPONDENT IDENTITY			
1. Name of respondent	:		
2. Occupation/job	:		
3. Category of Respondent	1. Value chain stakeholder: a. Farmers	b. Wholesaler	c. Processor
	d. Distributor	e. Cooperatives	f. Trade association
	g. E-commerce	h. Consumers (end-user, household, ordinary consumer)	i. Others_____
	2. Enabler:		
	a. Government officials	b. Academic/University	c. Finance Institution
	d. International Development Agencies	e. NGOs	f. Others_____
4. Main commodity (If Applicable)	:		
5. Address			
6. Gender/sex	: a. Male	b. Female	
7. Education	: a. Primary	b. Secondary	
	c. Vocational	d. Higher (Diploma, Bachelor, Master, Doctor)	
8. Email and Whatsapp	:		

PART 1

A. NATIONAL PRIORITIES ON SUSTAINABLE AGRICULTURE AND FOOD SYSTEMS (SAFS)

Q1. What are the ***key sustainable actions/initiatives*** that you and your country have applied for enhancing the sustainability of the agriculture and food system? **Please tick (✓) all that apply:**

By you	By others In your Country	
		Circular agriculture (using minimal amounts of external inputs, closing nutrients loops, and regenerative agriculture resources)
		Enhancement of soil health, fertility, and biodiversity
		Safe and sustainable agriculture and food standards (good agriculture, animal husbandry, and manufacturing practices, halal certification, and mutual recognition agreements)
		Sustainable crop production and intensification (appropriate cropping pattern and land use)
		Agroecology (regenerative agriculture, conservation agriculture, agroforestry, home gardens, agro-silvofishery, and reforestation)
		Climate-smart agriculture (drought tolerant, mewable enegy, soil and carbon sequestration, nutrient management, conservation tillage, etc.)
		Reduction of agrochemicals inputs - fertilizers, pesticides, antimicrobials, and veterinary drugs
		Digital agriculture (use of drone, precision farming) and the use of disruptive technologies
		Implementation of carbon measures, bioenergy use, and energy efficiency improvement
		Implementation of nature-based solutions (Biological Control Agents/BCAs)
		Others, specify _____

Q.2. The ASEAN Regional Guidelines for Sustainable Agriculture stated ***twenty-eight (28) key strategies***. From the strategies listed in this question, which strategies should be prioritized by your country in implementation for enhancing the sustainable agriculture and food system? Please, ***choose and rank the top-five priorities per short-term (in 5 years) and per mid-long term (more than 5 years) strategy***, respectively.

1. Improving overall soil health: reducing overfertilization of the soil base, applying of targeted organic fertilizers and amendments, and reducing the over-application of agrochemicals to meet optimum soil productivity
2. Reduction of greenhouse gases from agriculture-related activities
3. Closing nutrient cycles/loops and valorization of agricultural waste biomass and food wastes into cost-effective feeds and fertilizers
4. Collaboration along the agriculture and food chains
5. Improving biodiversity
6. Ensuring food security
7. Promoting the use of smart and precision agriculture systems in sustainable food production
8. Facilitating funding with productive resources, finance, and services
9. Connecting smallholders to markets
10. Encouraging diversification of production and income
11. Building farmer's and food production personnel knowledge base and developing their capacity
12. Encouraging more research and development on sustainable and circular agriculture and food production
13. Promoting the set-up of new sustainable and circular initiatives
14. Aligning ASEAN agricultural standards and those of our major export markets
15. Strategizing to replace highly hazardous pesticides (HHPs), broad-spectrum pesticides, and neonicotinoids in ASEAN agriculture

PART 2

(This part is applied to the respondent of enablers such as government officials, Academics, International Development Agencies, NGOs, etc.)

C. READINESS FOR SUSTAINABLE AGRICULTURE AND FOOD SYSTEM (SAFS)

To be sustainable, agriculture and food systems must meet the needs of present and future generations for their products and services while ensuring economic profitability, environmental health, and social-economic equity.

Q.9. In terms of economic dimensions, please tick/select (√) ***one applicable level of readiness*** for each indicator.

Economic Resilience Indicators	Readiness level			
	Level 1: Not yet considered	Level 2: Under consideration	Level 3: Implementation planned	Level 4: Implementation under way
Investment: Investing activities and investments: 1) to improve and monitor sustainability performance, 2) to meet community needs and generate profits in long-terms, and 3) to obtain earned revenue, considering the total cost of the product and a break-even point.				
Vulnerability: Having mechanisms 1) to reduce the negative impacts on production supply shortages, 2) to ensure a diversified income structure from products sales, 3) to access financial sources to withstand liquidity crises, and 4) to reduce risks that could threaten the business.				
Product Quality and Information: Having food hazards and safety control measures, total volume of production, and product labelling codes complying with regulations and standards.				
Local Economy: Hiring regional employees and local suppliers, and paying them applicable taxes similarly/equally as indicated by local regulations				

Q.10. In terms of environmental dimensions, please tick/select (√) ***one applicable level of readiness*** for each indicator.

Environmental Indicators	Readiness level			
	Level 1: Not yet considered	Level 2: Under consideration	Level 3: Implementation planned	Level 4: Implementation under way
Atmosphere: Setting and implementing practices for GHGs reduction and air pollution				
Water: Setting and implementing practices for water consumption reduction and water pollution value				
Land: Implementing practices and having a plan to improve soil quality and fertility				
Biodiversity: Setting and applying practices for conserving ecosystem, species, and genetic diversity				
Materials and Energy: Planning a target and operating circular agriculture, food loss and waste, nutrient balance activities, and renewable energy.				
Animal Welfare: Applying animal health practices, reducing antimicrobials and veterinary drugs use, and implementing good human animal handling practices				

Q.11. In terms of social well-being dimensions, please tick/select (√) ***one applicable level of readiness*** for each indicator.

Social Indicators	Readiness level			
	Level 1: Not yet considered	Level 2: Under consideration	Level 3: Implementation planned	Level 4: Implementation under way
Decent Livelihood: Having extratime for leisure and family activities; earning a living wage; having opportunities to increase skills and knowledge; and having access to the equipment, capital and knowledge.				
Fair Trading Practices: Supporting suppliers' rights to fair pricing/contracts, freedom of association, and collective bargaining.				
Labour Rights: Having written agreements with their employees based on national and international labor treaties, not employing people who are not free to quit, and having free of choosing to set employment terms.				
Equity: Not discriminating against any employee and women, and supporting varying levels of ability and disability, young workers, and aged ones.				
Human Safety and Health: Providing training in health and safety for 100% of employees, and avoiding local communities from pollution and contamination.				
Cultural Diversity: Respecting the universal rights of indigenous communities, and contributing to the food sovereignty of their region				

agriculture and food systems in your country?

Thank you very much for your contribution.

THE END