ASEAN Regional Guidelines for Promoting Climate-Smart Agriculture (CSA) Practices

Volume 3

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one identity
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ASEAN Regional Guidelines for Promoting Climate-Smart Agriculture (CSA) Practices
Vol. 3

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Jakarta

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List of Acronyms and Abbreviations

AIG	Academe-Industry-Government
AMAF	ASEAN Ministers on Agriculture and Forestry
AMIA	Adaptation and Mitigation in Agriculture
AMS	ASEAN Member States
ASEAN	Association of Southeast Asian Nations
ASEC	ASEAN Secretariat
ASEAN-CRN	Association of Southeast Asian Nations - Climate Resilience Network
ATWGARD	ASEAN Technical Working Group for Agricultural and Rural Development
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
BAR	Bureau of Agricultural Research
BFAR	Bureau of Fisheries and Aquatic Resources
CCAFS	Climate Change, Agriculture and Food Security
CGIAR	Consultative Group on International Agricultural Research
CSA	Climate-smart agriculture
CSLU	Climate-smart land use
CSV	Climate-smart village
COVID	Coronavirus disease
CRTF	Climate-resilient tilapia farming
DA	Department of Agriculture
DGLAH	Directorate General of Livestock and Animal Health
DSR	Direct-seeded rice
DOST-PAGASA	Department of Science and Technology - Philippine Atmospheric, Geophysical and Astronomical Services Administration
FAO	Food and Agriculture Organization of the United Nations
FAF	Food, Agriculture and Forestry
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPS	Global Positioning System
IAARD	Indonesian Agency for Agricultural Research and Development

ICARD	Indonesian Centre for Animal Research and Development
IDRC	International Development Research Centre
IIRR	International Institute for Rural Reconstruction
IPCC	Intergovernmental Panel on Climate Change
KJWA	Koronivia Joint Work on Agriculture
LEAPS	Low-Emission Animal Production System
MARDI	Malaysian Agricultural Research and Development Institute
M&E	Monitoring and Evaluation
NSIC Rc	National Seed Industry Council Rice
NDC	Nationally Determined Contributions
NGOs	Non-Governmental Organisations
ODA	Official Development Assistance
PhilRice	Philippine Rice Research Institute
PTR	Puddled transplanted rice
PVS	Participatory varietal selection
RA	Republic Act
SEAFDEC	Southeast Asian Fisheries Development Center
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SNKI	National Strategy for Financial Inclusion
UNFCCC	United Nations Framework Convention on Climate Change
VSA	Vulnerability and Suitability Analysis

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Acknowledgement

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Rationale

This third volume (Volume 3) of the ASEAN Regional Guidelines for Promoting Climate-Smart Agriculture (CSA) Practices serves as a complement to the earlier volumes, Volume 1 and Volume 2 These previous volumes of the Guidelines define CSA as an approach that jointly addresses food security and climate change by achieving its three pillars, namely: (1) sustainably increasing agricultural productivity and incomes; (2) adapting and building resilience to climate change; and (3) reducing greenhouse gas emissions from agricultural production and processing.

Thus, Volume 3 primarily aims to provide guidance on how ASEAN Member States (AMS) can promote the adoption and upscaling of CSA practices such as the ones presented in the ASEAN Guidelines. For this purpose, Volume 3 (1) provides assessment guidelines for prioritising the CSA approaches and (2) suggests principles for the promotion and adoption of CSA approaches among AMS (Figure 1). Specifically, Chapter I of this volume presents a participatory approach that uses various indicators to prioritise CSA approaches for implementation. Chapter II then suggests key principles that could be observed to have these CSA approaches promoted and adopted at target scales (i.e. community to national).

These practical guides will help AMS in planning the scaling-up of climate change programmes for agriculture, land use and rural development. The aim is to proactively respond to the emerging impacts of climate change on social, environmental and economic aspects of food security (Intergovernmental Panel on Climate Change, 2014). In ASEAN, temperatures have been increasing at a rate of 0.14°C to 0.20°C per decade since the 1960s (Hijioka et al., 2014). In fact, climate change now explains up to 29% of experienced El Niño patterns in the region (Thirumalai et al., 2017). These climate change-driven shocks and stresses are already impacting several AMS in the form of increasing droughts, submergence and salinity, which makes agricultural production more difficult and less profitable (Ancog et al., 2020).

In addition, Volume 3 adds on to the registry of CSA approaches, highlighting those that were implemented at systems level and were found responsive to the impacts of the COVID-19 pandemic. These are outlined in Chapter III. The aim is to contribute to the goals of the ASEAN Comprehensive Recovery Framework's recognition of CSA as an important strategy for assuring food and nutrition security in a rapidly changing environment. Volume 3 further contributes to the goals and priorities as defined by the Vision and Strategic Plan for ASEAN Cooperation in Food, Agriculture and Forestry (2016-2025), the ASEAN Multi-Sectoral Framework on Climate Change: Agriculture, Fisheries and Forestry towards Food Security, and other relevant ASEAN policy frameworks.

Moreover, Chapter IV highlights the important roles played by ASEAN regional bodies in promoting and adopting CSA in the region. It also presents the key local bodies that should be actively engaged in these processes, especially in applying the principles presented in this volume.

Overall, Volume 3 provides key processes, suggestions and tangible actions that would help AMS realise their Nationally Determined Contributions (NDCs) in the areas of food, agriculture and forestry (FAF). This reaffirms ASEAN's commitment to the United Nations Framework Convention on Climate Change (UNFCCC), especially in promoting low-carbon technologies and approaches and enhancing resilience. Box 1 explains further how to use this volume in practice.

To develop Volume 3, a series of regional consultation workshops, learning events, surveys and key informant interviews were organised in consultation with the ASEAN-Climate Resilience Network (ASEAN-CRN) and the ASEAN Technical Working Group for Agricultural and Rural Development (ATWGARD).

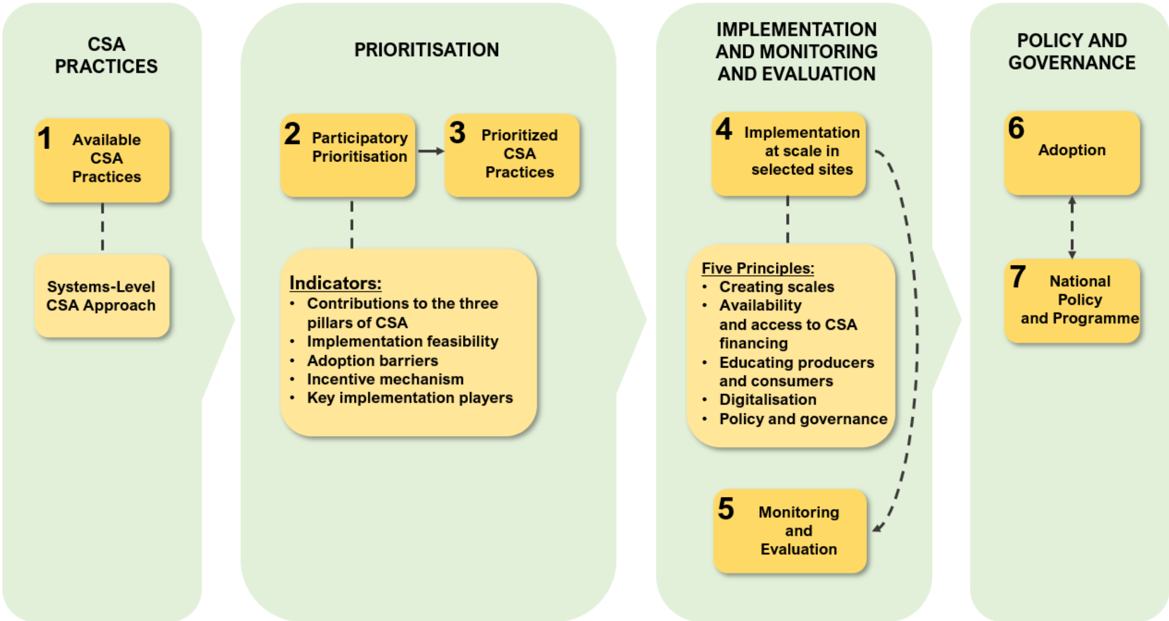

Figure 1. Stepwise process of prioritisation and implementation principles for CSA promotion and adoption

Figure 1 recognises that various CSA approaches, including the ones implemented at systems level included in Volume 3, are already in place. However, there is a lack of know-how when it comes to selecting the most appropriate CSA approaches; hence, Volume 3 presents a systematic process for prioritising CSA approaches using five indicator-based assessment guides. To scale up the adoption and promotion of the CSA approaches, Volume 3 presents five key principles that should be observed during implementation. It is envisioned that through this process, various CSA approaches could be adopted through national policies and programmes.

BOX 1. How to work with the ASEAN CSA Guidelines Volume 3 in practice

- This volume was written as a guide for policymakers and decision-makers and implementers across different scales. Hence, it will serve to guide not only officials in national agencies and institutions of AMS but also officials in the target scale of implementation (e.g. community, districts, provinces).
- The first three chapters can be read separately. The fourth chapter strongly connects with the second chapter; hence, it is essential to read the second chapter in order to understand the fourth chapter.
- The first two chapters could be considered as a ‘package’ because the first chapter feeds into the second chapter (i.e. prioritised CSA approaches will be supported by the five promotion and adoption principles). Hence, it would be particularly useful to consider them in conjunction. This step will be important for AMS or target scales of implementation that have not yet been identified and for the prioritised and appropriate CSA approaches for promotion and adoption.
- AMS or the target scale of implementation with already pre-identified CSA approaches could proceed directly to Chapter II. These CSA approaches could be promoted and adopted through the principles suggested there.
- The third chapter is independent from the other chapters. However, the CSA approaches showcased in this volume, in addition to other CSA approaches from the two previous volumes, could be subjected to the same processes presented in the first and second chapter.
- Since this volume is a complement to the first two, it is suggested that the CSA approaches presented in volumes 1 and 2 be prioritised (Chapter I) and eventually promoted and adopted by taking action in line with the key principles (Chapter II).

Chapter I: Participatory Approach to Prioritising CSA Approaches

Introduction

A systematic approach to prioritising existing CSA approaches is needed for better adaptation and mitigation planning of climate change-related programmes at the target scale (e.g. community, province, national) (Khatri-Chhetri et al., 2017; FAO 2013). For example, there are currently numerous registries containing a wide range of CSA approaches such as those included in ASEAN Regional Guidelines Vol. 1 and 2 (ASEAN CRN Regional Guidelines, 2015 and 2017), other sources such as the Compendium on CSA technologies and approaches of each AMS (Labios et al., 2019; Tan Yen et al., 2017), journal publications and other documents (e.g. institutional reports, policy briefs, project reports). Major challenges therefore exist when it comes to identifying and prioritising CSA approaches that give consideration to local climatic risks and demand for technology in diverse agro-ecological zones. Appropriately prioritised CSA approaches would mean enhanced impacts in the pillars of CSA (productivity, adaptation, mitigation) and more effective scaling up as these address local preferences and capacities.

Moreover, it is strongly recommended that a participatory approach be taken in the prioritisation process, characterised by active collaboration and engaged decision-making by diverse stakeholders. This improves the acceptance and quality of the prioritised CSA approaches and in particular increases the sense of ownership at the target scale of implementation (e.g. in communities).

In this chapter, a suggested five-step participatory assessment approach to determine CSA preferences and assess capacities for promotion and adoption among stakeholders was modified based on Khatri-Chhetri et al. (2017). Indicators were used for the (1) assessment of three-pillar contribution, (2) assessment of implementation feasibility, (3) assessment of factors facilitating adoption, (4) assessment of incentive mechanisms, and (5) assessment of key implementation players (Tables 1 to 5). This assessment has already been applied and tested in various countries (Labios et al., 2019; Khatri-Chhetri et al., 2017). See Box 2 on how to implement this approach in an actual participatory workshop setting.

Each of these assessments will be described by the (1) question it addresses or its evaluation purpose, (2) what it is used for in terms of the indicators that it covers, and (3) the scoring process or how to evaluate each indicator.

Assessment of Three-Pillar Contributions

Question addressed: Which CSA approach contributes the most to all pillars of CSA?

What for? This tool is used to assess the indicators in relation to the contributions of the CSA approach to the three CSA pillars: (1) determining productivity rate in the absence of biotic/abiotic stress, (2) resilience in the presence of biotic/abiotic stress, and (3) reduction of the greenhouse gas (GHG) emission rate.

How to assess? Table 1 serves as the scoring template for assessing each CSA approach in terms of the indicators. The first column lists the CSA approach of interest and the further columns include some key questions for assessing the three indicators.

On a Likert scale, a negative (–) value indicates a reduction, while a positive (+) value indicates an increase. For example, for the ‘productivity’ indicator, scoring is based on the approach’s contribution to productivity with a score of -10 to +10. The same applies to the other two indicators (i.e. resilience and emission). The average score is used to rank the different CSA approaches.

Table 1. Sample indicators for assessing the contributions made by the CSA approach to the three pillars of CSA

CSA Approach	Productivity		Resilience		Emission		Average
	To what extent does it help to increase productivity?	To what extent does it help to increase income?	To what extent does it help to prevent losses during climate-related events?	To what extent does it help to address risks?	How much extra fertiliser do you use?	How much extra water do you use?	

NOTE: The indicators and templates could be edited and modified based on what each group thought was appropriate for each approach, as well as for the ecosystem concerned.

Scale: A 10-point Likert scale (10% increase/decrease at each interval)

-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0 (base)	1	2	3	4	5	6	7	8	9	10

Assessment of Implementation Feasibility

Question addressed**:** Which CSA approach would be most feasible to implement?

What for? This tool is used to assess the indicators in relation to the implementation feasibility of the CSA approaches: (1) technical feasibility, (2) fiscal feasibility (e.g. cost of approach, purchasing power of target scale of implementation), (3) ethical feasibility (e.g. gender inclusivity, intergenerational equity), and (4) administrative feasibility (e.g. synergy with government plans, availability of institutionalised government funding sources).

How to assess? In terms of scoring, an ordinal scale of 0 to 5 and not applicable (NA) to very high will be used. The average score is used to rank the different CSA approaches.

Table 2. Sample indicators to assess implementation feasibility of the CSA approaches.

CSA Approach	**Technical Feasibility** (How technically cumbersome is it to implement the approach?)	**Implementing Cost of Approach** (How difficult is it to financially implement the approach?)	**Gender Inclusivity** (How actively can both genders participate and contribute to the implementation of this approach?)		**Administrative** (How easily can this approach be implemented given government programmes and policies?)	**Average**
			Female contribution	Male contribution		

NOTE: The indicators and templates could be edited and modified based on what each group thought was appropriate for each approach, as well as for the ecosystem concerned.

Scale: 0-5 (ordinal scale)

0 1 2 3 4 5

NA Low V. Low Medium High Very High

Assessment of Factors Facilitating Adoption

Question addressed: Which CSA approach would have the greatest adoption potential?

What for? This tool is used to assess the indicators in relation to the factors facilitating adoption that determine the different external and internal constraints that can affect the level of adoption by farmers and other stakeholders such as (1) availability of resources, (2) access to extension services and market, and (3) awareness and acceptability on the part of farmers.

How to assess? In terms of scoring, an ordinal scale of 0 to 5 and NA to very high will be used. The average score is used to rank the different CSA approaches.

Table 3. Sample indicators for assessing the factors facilitating adoption of the CSA approaches

CSA Approach	Availability of Finance	Availability of Machinery	Awareness among Farmers	Acceptability on the Part of Farmers	Availability of Labour	Availability of Government Support	Access to Extension Service	Access to Market	Average

NOTE: The indicators and templates could be edited and modified based on what each group thought was appropriate for each approach, as well as for the ecosystem concerned.

Scale: 0-5 (ordinal scale)

0	1	2	3	4	5
NA	Low	V. Low	Medium	High	Very High

Assessment of Incentive Mechanisms

Question addressed: Which CSA approach would have the most access to incentives?

What for? This tool is used to assess indicators in relation to incentive mechanisms that motivate or encourage farmers and other stakeholders to adopt and replicate the CSA approaches, such as (1) access to subsidies and (2) access to affordable credit, (2) access to finance advisory support, and (4) access to crop insurance.

How to assess? In terms of scoring, an ordinal scale of 0 to 5 and NA to very high will be used. The average score is used to rank the different CSA approaches.

Table 4. Sample indicators for assessing incentive mechanisms for the CSA approaches

CSA Approach	Access to Subsidies	Access to Affordable Credit	Access to Finance Advisory Support	Access to Crop Insurance	Average

NOTE: The indicators and templates could be edited and modified based on what each group thought was appropriate for each approach, as well as for the ecosystem concerned.

Scale: 0-5 (ordinal scale)

0 1 2 3 4 5

NA Low V. Low Medium High Very High

Assessment of Key Implementation Players

Question addressed: Which CSA approach will receive the most support among diverse stakeholders?

What for? This tool is used to assess indicators in relation to key implementation players that identify the respective roles and responsibilities of the different stakeholders in the dissemination of CSA approaches including (1) farmers, (2) young people, (3) civil society organisations, (4) government, and (5) private sector and others.

How to assess? In terms of scoring, an ordinal scale of 0 to 5 and NA to very high will be used. The average score is used to rank the different CSA approaches.

Table 5. Sample indicators for assessing the key players (e.g. in terms of their contribution, participation, engagement) in the implementation of the CSA approaches

CSA Approach	Farmers	Young people	Civil Society Organisations	Government	Private Sector	NGOs	Average

NOTE: The indicators and templates could be edited and modified based on what each group thought was appropriate for each approach, as well as for the ecosystem concerned.

Scale: 0-5 (ordinal scale)

0 1 2 3 4 5

NA Low V. Low Medium High Very High

Ranking the CSA Approaches

Each CSA approach will receive an average assessment score (AAS). This could be done by adding all scores received by the CSA approach for all indicators and dividing this figure by the total number of indicators used for that assessment. Place the AAS received by the CSA approach in Table 6.

Take the overall average by adding all AASs received by the CSA approach and dividing this figure by five. This will serve as the overall average score (OAS) received by that CSA approach. Compare all OASs and then rank them. Priority for implementation will now be based on this ranking.

Table 6. Summary overall score sheet for the prioritisation approach

CSA Approach	AAS for Three-Pillar Contribution	AAS for Implementation Feasibility	AAS for Factors Facilitating Adoption	AAS for Incentive Mechanism	AAS for Key Implementation Players	Overall Average Score (OAS)	Rank

NOTE: The indicators and templates could be edited and modified based on what each group thought was appropriate for each approach, as well as for the ecosystem concerned.

BOX 2. How to implement the participatory prioritisation approach in a workshop setting

- This assessment process needs to be implemented via a participatory workshop, or a series of workshops, that engage multiple and diverse stakeholders and experts across the food system including academic stakeholders, industry and market stakeholders, farmer representatives, young people, civil society and non-governmental organisations, etc.
- These workshops begin by identifying the CSA approaches that are applicable to the agro-ecosystem (e.g. lowland, upland) of the AMS or the target scale of implementation (e.g. community, district, province).
- These CSA approaches should be explained clearly to all participants of the workshop/s, thereby creating a shared understanding and knowledge level among diverse participants.
- Participants should then collectively score each CSA approach using each indicator. This process continues until all CSA approaches have been scored using all indicators in all assessments. (See discussions above for details of this).
- Collective scoring should be based on active discussion, knowledge and experiential exchanges, and consensus among participants.

At the end of this prioritisation exercise, AMS could identify the most relevant and appropriate CSA approaches that have the greatest potential for promotion and adoption. Because this was collectively decided, it is expected that these CSA approaches would result in synergistic impacts across sectors and among diverse stakeholders. However, to realise such results, it is important that these CSA approaches are actually promoted and adopted at the target level. In the next chapter, suggested principles for improved promotion and adoption of CSA approaches are discussed.

Chapter II: Suggested Principles for Promoting and Adopting CSA Approaches

Introduction

To fully obtain the benefits of the three pillars of CSA in the region, there is a need to strengthen promotion and adoption at the target levels with the active participation of multi-level, diverse stakeholders. Promotion and adoption at the target level will ensure that community members derive greater benefit from government support programmes, as well as clear measurement of the contribution to climate or carbon footprints.

The additional aim is to avoid unnecessary trade-offs in achieving the three CSA pillars, such that a focus is placed not only on improving crop/livestock/fishery productivity but on building the relevant adaptive capacities and resilience. This ensures that there is an opportunity to scale up those CSA approaches that have the greatest potential to contribute to the AMS's NDCs.

This chapter covers five principles (Figure 2) that could help operationalise the promotion and adoption of CSA approaches in ASEAN. These principles were informed by the practical experiences of AMS and refined through a series of consultation workshops and expert discussions (Labios et al., 2019).

Ideally, these five principles will help to enhance the promotion and adoption of CSA approaches.

This document also outlines suggested actions to allow AMS to effectively operationalise each principle. AMS are strongly encouraged to take these actions or scale up existing ones.

These actions are presented to include expected responses from the governments of AMS. Most responses include institutionalising or mainstreaming these actions through national programmes and policies. This would provide a concrete legal and institutional framework to operate not only on the national scale but across smaller scales in which CSA can be promoted and adopted.

Another expected governmental response includes the approval of budgets for these actions by national governments of the AMS while encouraging further support from the local governments of regions where the CSA approaches are promoted and adopted. This assures that the actions would not only be initiated but also sustained and scaled up.

In addition, actions based on each principle require the AMS to be guided by other ASEAN guidelines that are relevant for FAF (presented in each principle). This would allow AMS to implement actions that would not only benefit CSA but other key FAF priorities in the region.

Ideally, existing national programmes and policies in FAF should be reviewed by AMS so they can better gauge their readiness and capacities with regard to each principle and the relevant actions. For example, if there are already sufficient capacities related to a particular principle, then other principles could be given more attention. In summary, these five principles are all relevant and can be addressed in conjunction with each other (Figure 2).

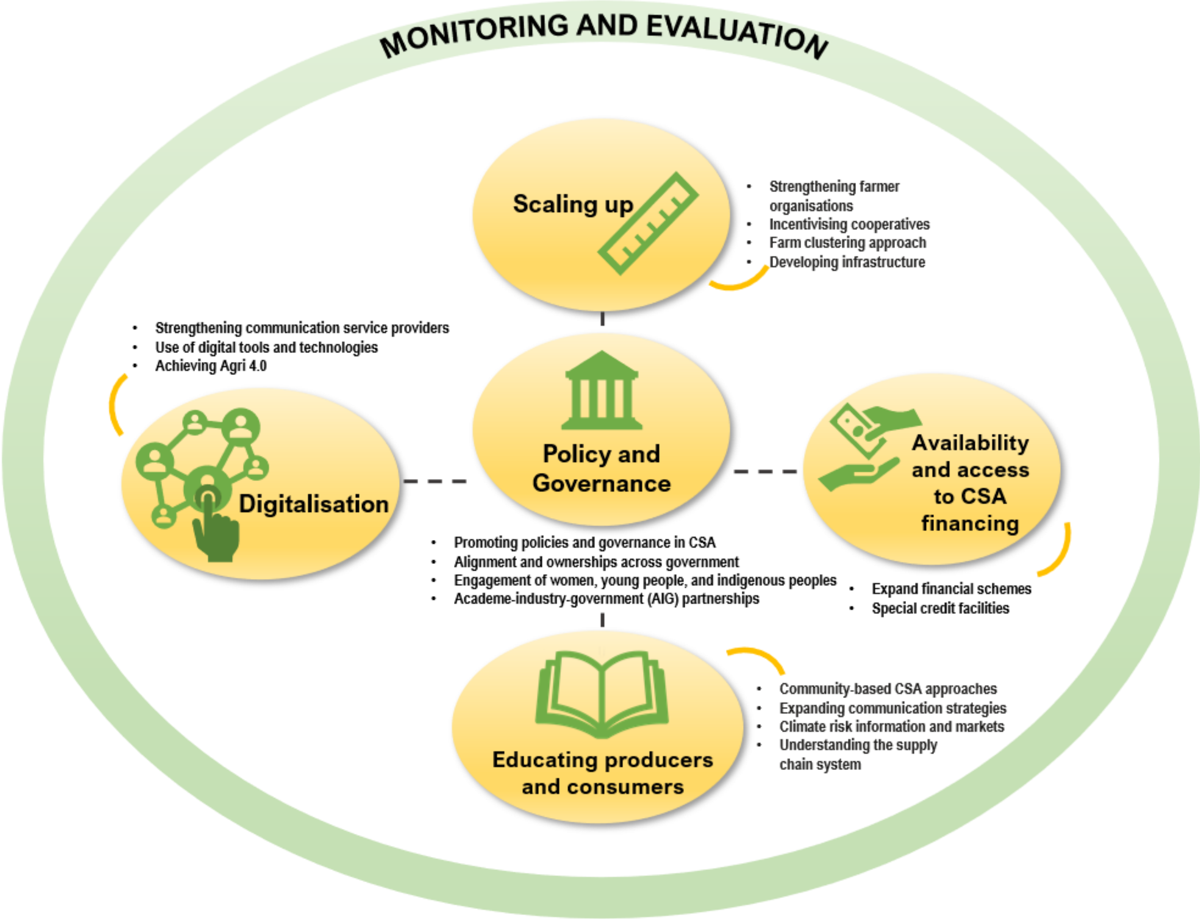

Figure 2. Five principles for promoting and adopting CSA approaches

Each of these principles will be described by the (1) the operational question it addresses or the main goal it hopes to achieve, (2) its importance or the rationale as to why it could enhance promotion and adoption, and (3) actions taken to apply the principle. Box 3 emphasises the ways in which AMS could operationalise these actions.

Principle 1: Scaling up

Operational question: To obtain the full benefits of CSA, could this be implemented on a large scale (e.g., cluster of farmers in a community with a hundred hectares or acres in communities)?

Importance: Having larger groups of farmers with clustered and consolidated farms under CSA would translate into larger production volumes, leading to better quality produce in higher quantities and greater negotiating powers (e.g. as regards price and access to support services).

Actions related to scaling up:

- The number and capacities of farmer organisations should be increased and strengthened by education and capacity-building.
- The cooperatives should be incentivised by providing easy access to government credit institutions, which can be ensured through budget allocation by the legislative body.
- Small areas should be combined into larger farms or through a farm-clustering approach, which can be addressed through national government policies and provisions.
- Infrastructure, mechanisation and technology should be developed and promoted; this could be strengthened by budget allocation by a legislative body.
- The ASEAN Guidelines for Agroforestry Development should be operationalised since they provide practical guidance on implementing programmes for landscape-scale approaches.

Principle 2: Availability of and access to CSA financing

Operational question: Is financing available for implementation of the CSA approach?

Importance: Having access to CSA financing at multiple levels (i.e. local to international) would lead to enhanced resource capital and production confidence that would allow producers to procure the goods and services needed to initiate new or expand existing CSA approaches.

Actions to make CSA financing available and accessible:

- The financial schemes of government banks and other financial institutions should be expanded; this can be done through national government policies and legislation.
- Special credit facilities or systems should be created by government and private entities.
- The ASEAN Guidelines on Promoting Responsible Investment in Food, Agriculture and Forestry should be operationalised as they provide AMS with key strategies and a guiding framework for establishing favourable conditions for responsible investment across AMS.
- The 10 Phases in Developing a National Crop Insurance Program Guide should be operationalised across AMS as it provides AMS with a list of key considerations to support formulation of national crop insurance programmes or to review existing ones.
- The ASEAN Public-Private Partnership Regional Framework for Technology Development in the Food, Agriculture and Forestry Sector should be operationalised as it guides collaborative investments and financing in the development, adoption and dissemination of sustainable technologies along the entire value chain.

Principle 3: Educating producers and consumers

Operational question: Do producers and consumers have up-to-date information on CSA practices and their potential benefits?

Importance: Giving producers up-to-date information on the CSA approach would cultivate their agripreneurial skills and climate-ready business mindset and facilitate access to market information. Supporting informed decisions by consumers would influence them towards more sustainable options (e.g., products from CSA).

Actions to educate producers and consumers:

- More participatory approaches should be taken when scaling up community-based CSA approaches, focusing on entrepreneurial values and climate science. This can be supported by institutionalising such approaches in national agriculture and natural resources development programmes.

- Communication strategies with a focus on climate-smart, good agricultural practices (GAP) in agriculture and natural resource management should be mainstreamed in national programmes.
- Access to climate risk information and markets should be strengthened. This can be aided by creating offices for this purpose in related government agencies.
- A greater understanding of the supply chain system, especially as regards the roles of producers and consumers in the chain, should be fostered through academe-industry-government (AIG) partnerships for research and capacity-building.
- The ASEAN Regional Guidelines on Food Security and Nutrition Policy should be operationalised as they outline education policies to strengthen information on sustainable food systems.

Principle 4: Digitalisation

Operational question: Are there digital infrastructure or platforms that could foster climate-readiness and market competitiveness using the CSA approach?

Importance: Having digital infrastructure platforms that foster climate-readiness and market-competitiveness would catalyse Agriculture 4.0 by providing producers, consumers and policymakers/implementers with faster, wider-reaching and more up-to-date information.

Actions to strengthen digital infrastructure or platforms for climate-readiness and market competitiveness:

- Government partnerships and joint programmes with private communication service providers should be strengthened to expand and stabilise network reach.
- The use of digital tools and technologies, especially for marketing CSA products, should be promoted; this can be done by mainstreaming in national programmes.
- National policies and programmes should be revisited to shift towards Agriculture 4.0 that focuses on precision agriculture, the internet of things (IoT) and the use of big data to achieve efficiencies in the midst of climate change.
- The ASEAN Regional Guidelines on Promoting Digital Technology for Food and Agriculture Sector (upcoming) should be operationalised across AMS as they provide practical guidance on integrating digitalisation and technological strategies into the food and agriculture sector.

Principle 5: Policy and governance

Operational question: Are there existing policies that can support the promotion and adoption of CSA approaches?

Importance: Having local and national CSA policies provides an institutional framework and legal bases that ensure the operationalisation and implementation of CSA approaches, responding to the specific needs of diverse stakeholders and engaging with these. This is a cross-cutting principle that should be observed in relation to all other principles (i.e. ensuring that policies exist and that effective governance is observed in scaling up, financing, education and digitalisation).

If local policies and governance are not in place, they can be encouraged and implemented in the following ways (for example):

- Governments should consider formulating and implementing national standards for policies and governance of CSA that are based on the principles presented in this volume.
- Goals and the ownership of responsibilities should be aligned across government institutions to avoid contradictions and reduce trade-offs among CSA objectives.

- Inclusive and participatory policymaking should be strengthened to ensure the active engagement of women, young people and indigenous peoples. For this, please refer to AMAF's Approach to Gender Mainstreaming in the Food, Agriculture and Forestry Sectors, which provides guidance on implementing gender-responsive policies and programmes that integrate gender into agriculture and climate change.
- Academe-industry-government (AIG) partnerships and collaborations should be enhanced to allow the creation of policies that address multi-sectoral needs and co-benefits. For this, please refer to the ASEAN Public-Private Partnership Regional Framework for Technology Development in the Food, Agriculture and Forestry Sector, which serves as a framework for collaborative investments in the development, adoption and dissemination of sustainable technology along the entire value chain.

Monitoring and evaluation

Monitoring and evaluation (M&E) is important for tracking the progress of implementation and assessing the effectiveness of a given policy or intervention. It should be defined according to scale, both temporal and spatial, and include a process framework that include rules, actors and tools for assessments and reporting. The overall goal of assessments and monitoring and evaluation activities is to effectively guide the transition of sound climate-smart agriculture programmes that are successfully implemented on the ground (FAO, 2017a).

If a government institution in an AMS has applied the principles stated above, the M&E system should also focus on assessing the progress related to these principles rather than CSA approaches per se. For example, to monitor and evaluate Principle 1: Scaling up, indicators from assessment guides on key implementation players (e.g. which sectors have been engaged or still need to be engaged in CSA promotion and adoption?) and implementation feasibility could be used, as well as others that can be combined.

Other monitoring and evaluation systems for CSA could also be referred to, including 'Monitoring and evaluation systems for climate-smart agriculture', published by the Food and Agriculture Organization of the United Nations (FAO) (FAO, 2017a).

Chapter III: Selected Success Stories of System-Level Approaches to Climate-Smart Agriculture

Introduction

This chapter showcases successful CSA approaches that are implemented at systems level in Southeast Asia. Specifically, an approach at systems level is an integrated set of technologies and practices that increase productivity and incomes, enhance the resilience of livelihoods and ecosystems, and reduce and remove greenhouse gas emissions across food systems at the community level through multi-stakeholder participation. Each CSA approach also represents various forms of ‘systems’ (i.e. agro-ecological, value chain, fishery, livestock). The descriptions have been co-authored by representatives from AMS and research and implementing organisations. The approaches showcased here have already been implemented on a large scale, at least at community level, and/or integrated into the national programmes or policies of co-authoring AMS.

Contributing to the objectives of the ASEAN Comprehensive Recovery Framework, these approaches have been found important in responding to the needs arising from the COVID-19 pandemic and other global challenges.

These approaches were selected after a regional survey was disseminated among CSA experts, practitioners and policymakers/implementers across AMS. This was complemented with further inputs from various regional workshops and learning events.

Climate-Smart Village (CSV)

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Technical description

The effects of climate change, such as long-term changes in the average temperature and rainfall and variabilities in the onset and outset of seasons, are experienced differently by communities depending on their agro-ecological location. This means that adaptation to climate change is location-specific and would require engagement with local communities. The literature also contains a number of articles that already suggest the importance of community engagement for making climate change adaptation effective (Heltberg et al., 2009; Kansiime, 2012; Reid et al., 2009).

The climate-smart village (CSV) approach is used to identify, test and promote CSA in the community. The CSV approach hinges on the need for location-specificity of CSA — there is no one-size-fits-all approach in climate change adaptation in communities dominated by smallholder agriculture. The CSV approach is a participatory approach to working together with the local community in understanding climate change risks and vulnerability, identifying and testing a context-specific portfolio of CSA options and providing proof-of-concept sites for influencing policy and investments. The CSV is also a platform for integrated climate-adaptive community development where other development outcomes are realised, including livelihoods, food security, nutrition, and women’s empowerment (Vidallo et al., 2020).

The CSV approach was first developed by the Consultative Group on International Agricultural Research (CGIAR)’s Research Program on Climate Change, Agriculture and Food Security (CCAFS) to address knowledge gaps in research in CSA as well as gaps in the scaling up of CSA (CGIAR CCAFS, 2013). The implementation of CSA in the CSV includes technologies and practices that improve farm management, the use of diverse crop varieties and the integration of small livestock, small-scale aquaculture and trees into the production system of the community. The value of the CSV approach in developing and promoting CSA is that it makes it possible to demonstrate the scalability of the CSA under real-life conditions in the community. For instance, while a newly improved stress-tolerant crop variety might perform well inside research farms, it does not follow that it will be scalable once it is made available to the communities. There are a number of factors that influence the adoption by farmers of a particular CSA, such as cultural appropriateness, economic viability, the availability of extension and capital – all of these factors and how they come to play in scaling up can be studied within the CSVs together with the community members. The promotion of CSA requires work that enhances existing or facilitates new service providers such as providers of capacity development and finance that will allow farmers to transition towards CSA (CCAFS and UNFAO, 2014). CGIAR CCAFS in Southeast Asia has developed guidance on how to establish CSVs within the regional context. The process suggests an eight (8)-step process that includes determining the purpose and scope of CSV; identifying the climate risk in the target area/s; locating the CSV in a small landscape; consulting the stakeholders; evaluating the CSA options; developing a portfolio; scaling up; and monitoring and evaluating uptake and outcome (Sebastian et al., 2019).

Current status and facilitating policies and programmes

The International Institute of Rural Reconstruction (IIRR) developed a portfolio of location-specific CSA practices and technologies as a strategy for CSV implementation in the Philippines, Cambodia and Myanmar. A ‘portfolio approach’ to CSA creates space for women and marginalised farmers, providing everyone with an opportunity to contribute to climate change adaptation efforts, while also improving their livelihood status. In the municipality of Guinyangan, Quezon province, the Philippines, the portfolio of CSA practices and technologies includes diversifying understory crop production of coconut-based systems such as the cultivation of root and tuber crops and fruits such as bananas and pineapple. Practices and technologies are also proposed for rice-based systems, small-scale fisheries and the production of small livestock in the backyard (Mendez et al., 2021a and 2021b).

The CSVs in Quezon province have served to influence the work of the Philippines Department of Agriculture’s Adaptation and Mitigation in Agriculture (AMIA) programme. The Department of Agriculture (DA) started to mainstream climate-resilient agriculture in all its programmes, functions and agencies via the system-wide AMIA programme. As part of the AMIA programme, the DA created ‘AMIA Villages’ in 21 regions in the country based on the examples from the CSVs. The Guinyangan sites served as learning sites for the DA-AMIA’s personnel all over the country. The DA adopted the CSV approach but referred to the sites as AMIA villages (Koerner et al., 2019, Vidallo et al., 2019). The challenges have always been the limitation of financing mechanisms and the need to balance social learning, technological and policy support for community-driven local adaptation action.

In Myanmar, the Government has made a commitment to advance climate-smart agriculture in the country in order to contribute to food security and environmental protection. As a response to that commitment, the Myanmar Government adopted the Myanmar Climate-Smart Agriculture Strategy (MCSAS) to provide the framework for developing the technical, policy and investment environment to promote CSA in the country (Hom et al., 2015).

As a response to Myanmar’s MCSAS, four climate-smart villages representing the major agro-ecologies of the country – dry zone, mountain, delta and uplands – have been established and maintained since 2017. These sites have involved at least 500 households by supporting their efforts to develop and test a portfolio of CSA options based on their agro-ecology. The knowledge from the action research generated by the Myanmar CSVs also contributed to the National CSA Center of Yezin Agriculture University to promote CSA in agriculture education and research in Myanmar (Htwe et al., 2019).

Funding

The CCAFS, the Department of Agriculture and IDRC Canada supported the work on climate-smart villages in Myanmar, the Philippines and Cambodia. Potential sources of funding for CSV programmes can include ODA funding (such as that provided to local and international NGOs) for the case of Myanmar. The other source of funding for CSVs is the government. In the Philippines, the Government is already investing in the CSV approach via the DA AMIA programme. The Philippines DA AMIA programme has now evolved into an enterprise development programme to transform CSA practices and technologies into viable group-based community enterprises that the private sector can engage with by providing support in terms of capital and market access. The other area in which the government can make use of the CSV approach is by integrating it into local-government extension programmes as in the case of Guinyangan, Quezon by closely working with the Municipal Agriculture Office and providing the programmes with learning materials and learning events for extension workers. This enables them to learn a more participatory approach to providing services related to climate-smart agriculture.

Field/Community operationalisation

Community-based engagement with local government support is the basis for achieving both scale-up and sustainability goals. This includes social preparation, learning groups and the farmer-to-farmer approach. A priority is therefore placed on social learning, which outlasts the technologies in some cases. This means that CSA promotion is also about processes, not just the technologies and practices themselves (Mendez et al., 2021).

In the Myanmar CSV, a 3-step process was implemented: (1) understanding climate risks and vulnerabilities, (2) identifying and testing CSA technologies and practices in response to the risks and vulnerabilities, and (3) social learning for scaling up and sustainability. Under the second step of identifying and testing, a Community Adaptation Fund was created to enable members of the CSVs to access and support the trials of the CSA technologies and practices applicable to their farms (Vidallo et al., 2019b). A systematised menu of socio-technical methodologies and tools was developed (Table 7) to facilitate engagement with community members in the CSVs. The socio-technical approach is consistent with the principles of participatory action research where community members are not passive receivers of aid and assistance but are active participants in the generation of learning and the implementation of solutions in the CSVs.

As there is a CSA portfolio in each of the CSVs, there will be pockets of farmer adopters in the CSV who are testing and learning from a specific CSA. There might be households practicing agroforestry; some households that do not have extensive farmland may only have homestead gardens and small livestock; some households with significant land for primary crop production may have a patch of their land dedicated to participatory varietal selection (PVS) or crop trials for introduced crops. This was the case in the Htee Pu Township CSV in the Myanmar dry zone where farmers started to re-introduce sorghum into their production. Therefore they first have to test how sorghum will grow in their own agro-ecological context. Table 8 presents a summary of CSA options promoted and adopted by farmers and their households in the four Myanmar CSVs.

Table 7. Summary of socio-technical methodologies and tools in the Myanmar CSVs

Steps in the establishment of CSVs	Methods/Tools	Purpose	Socio	Technical
Social preparation	Opening wedge activities	To build community trust and initial interest in taking part	•	
Assessment of agricultural	Household surveys	To facilitate targeting and monitoring of outcomes	•	

Steps in the establishment of CSVs	Methods/Tools	Purpose	Socio	Technical
systems and climate change risk	Participatory vulnerability assessments and gender analysis	To collectively identify and analyse climate risks to agriculture and gender To build awareness of climate change risks	•	•
Identification of options for adaptation	Focus group discussions (sector-based)	To develop a menu of options based on local knowledge	•	•
	Secondary research	To identify latest technologies and practices developed by scientists		•
Multi-location and Participatory testing of identified options	Participatory varietal selection	To field-test new varieties of major crops To characterise new varieties vis-à-vis specific climate conditions		•
	Crop trials	To field-test crops introduced to the system		•
	Demonstration	To field-test integrated systems (e.g. trees, small livestock, gardens)		•
	Setting up adaptation fund	To support strategic adaptation options	•	
Social learning via farmer-to- farmer learning	Farmer learning groups Farmer field days	To share knowledge and materials To develop farmer specialists	•	
Scaling up CSVs	Roving workshops	To build awareness of policymakers and NGOs	•	

Source: Barbon et al., 2021.

Table 8. CSA options and location of implementation in Myanmar CSVs

Climate change adaptation options supported by the CSV Adaptation Fund	No. of individual adopters (unless otherwise indicated)			Climate-smart villages where the options are implemented			
	2018	2019	2020	Htee Pu	Taung Khamauk	Ma Sein	Sakta
1. Participatory varietal selection (PVS) for new improved varieties	38	65	122	•	•		
2. Diversification of farm production with vegetables; legumes with crop trials for new introduced crops	30	61	80	•	•		•
3. Integration of fruit tree in farms (avocado, mango, banana, jackfruit, oranges)	70	109	125	•	•	•	•
4. Planting of legume trees in farms and along boundaries (*Alnus spp, Casia spp, Gliricidia spp*)	17	13	89	•	•		•

5.	Homestead production of vegetables, fruits, and cash crops	40	70	132	•	•	•	•
6.	Small livestock production in homesteads	32	44	150	•	•	•	•
7.	Aquaculture (homestead and farm ponds)	7	21	20			•	•
8.	Community-based animal propagation centres (pigs, chickens, ducks and fish)	0	16	1	•	•	•	•
9.	School gardens (vegetables, fodder, fruit trees)	3 sch	4 sch	4 sch	•	•	•	•
10.	Improving water storage facilities (at HH)	0	1	7				•

Source: Barbon et al., 2021.

How it addresses the food system

When a CSA approach features diversification and intensification, it can naturally contribute to local food systems. Change has to be transformational, but transformation is a gradual and incremental process. The CSV approach here used the end-to-end approach, focusing on the entire process from household consumption to market sales and annual crops (grains, legumes, root and tuber crops), small livestock and high-value trees (fruit and coffee and cocoa), which already shows an understanding of food systems. This is of course possible because the focus is on smallholders with two hectares and less (i.e. the majority of farmers).

The data collected in the Myanmar CSVs from 2018 to 2020 indicated that households adopting any of the CSA options have better household diet diversity scores. It was also noted that there is an increase in the percentage of households consuming their own agriculture produce, which is likely the reason why the data indicated change in the diet diversification of households in the CSVs (Barbon et al., 2021b).

A good example of sustainable CSA used in the CSV is agroforestry, which offers some of the best opportunities for a community to achieve both mitigation and adaptation objectives. Fruit trees, coffee, cocoa, banana and roots crops are examples of combining trees and shrubs with different canopy spread coverage. Trees bear fruit and can generate additional income for the farmers. Diversification through understory crops, fruit trees, livestock and root and tuber crops can help farmers cope with future climate change by diversifying their income through less risky enterprises.

Contributions to the three pillars of CSA

The diversification approach that was referred to above is the key to addressing the three pillars. Its multi-commodity aspect maximizes synergy in these three pillars. Carbon is stored in the soil and above the soil. Agrobiodiversity is enhanced and micro-climates are created, helping address (to a certain extent) rising temperatures. If chemicals are used, they are only micro-dosed; pesticides are only used where essential. This led to the development of a low-carbon approach. With diversified cropping, both price and climate risks can be mitigated.

The introduction of fruit trees and legume trees to the production systems in the four Myanmar CSVs also provides a multiplicity of benefits to the Myanmar smallholder farmers, such as soil conservation via litter fall from legume trees (*Cassia sp.* and *Alnus sp.*), protection against strong winds and high temperatures plus the benefit of additional income from fruit trees. IIRR conducted a case study of the benefits of integrating fruit trees into the dryland production system of CSV in Htee Pu Township in Myanmar. Aside from the potential cash income generated from fruits, these fruit trees also sequester a significant volume of CO_2 (Manilay et al., 2021).

Contributions to the COVID-19 response

Studies have already indicated that in communities with access to farmland in Cambodia, Myanmar and the Philippines, food supply chains might have been disrupted, but food availability overall was not compromised. This is supported by the fact that in the Philippines and Myanmar CSVs, increased consumption by farmers of their own produce in 2020 suggests that diversifying the production of smallholder farms is likely to act as a food security buffer during times of crisis (Barbon et al., 2021b).

Another study conducted to determine the impacts of COVID-19 on the local agro-food system in the CSVs indicated high mean household diet diversity scores for the CSVs in Myanmar, Cambodia, and the Philippines despite the disruptions in the food supply chains in 2020 (Espino et al., 2020).

The pandemic has helped understand the value of smallholder systems in conferring resilience. If diversified, multiple objectives are achieved in supporting community-based CSA on farms and in community gardens.

Direct-Seeded Rice (DSR) System Approach

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Technical description

Major constraints in the rice value chain commonly include tight local supply and high domestic prices of paddy and milled rice, low yield, and high production and marketing costs. The high costs are due to high labour costs and insufficient crucial infrastructure and market facilities (e.g. modern storage, cheap transport, and energy) (Mataia et al., 2020).

The predominant method of rice establishment in many countries in Asia is manual puddled transplanted rice (PTR). Despite the advantages in crop establishment, weed management and nutrient accessibility (Johnson et al., 2010; Rao et al., 2007), PTR is a highly resource-intensive practice (in terms of labour, water and energy). Recently, these resources are increasingly becoming scarce and consequently expensive (Kumar and Ladha, 2011). The shortage of labour became even worse during the spread of COVID-19 due to the lockdown in many countries. Moreover, puddled flooded rice systems are also a major emitter of methane, an important GHG responsible for global warming, contributing ~10-20% of total global annual methane emissions (Wassman et al., 2009). Drudgery involved in PTR is largely undertaken by women farmers, which also raises a significant social concern. It is also perceived as one of the major factors leading to less willingness of the young generation to engage in the profession, thus making farm succession uncertain. Taking these factors together, PTR becomes less sustainable, less profitable and less attractive to farmers, especially women and young people. An alternative rice production system is therefore required for addressing the above-mentioned challenges.

Direct-seeded rice (DSR), probably the oldest method of crop establishment, is gaining popularity because of its low-input demand. It saves scarce and expensive resources such as labour and water and reduces GHG emissions (Kumar and Ladha 2011; Basavalingaiah et al., 2020; Sudhir-Yadav et al., 2011a, b; Gathala et al., 2013). The direct-seeded rice (DSR) system is a CSA approach that addresses many of these constraints, as it aims to reduce labour cost and GHG emissions. DSR may reduce labour costs by 42% compared with puddled transplanted rice (PTR) and machine-transplanted rice (MTR) (Devkota et al., 2020). The reduction in GHG emissions from DSR mainly stems from non-puddled preparation of fields (dry direct seeding), no pre-season flooding, and the implementation of alternate wetting and drying (Dong et al., 2006; IRRI Rice Knowledge Bank).

There are two ways in which rice can be direct-seeded – manually or mechanically. Manual DSR involves broadcasting dry or pre-germinated rice seeds to the rice field. Mechanical DSR includes the use of equipment such as the drum seeder or hand tractor-mounted seed drill (IRRI Rice Knowledge Bank; Bautista et al., 2019). There are two types of DSR establishment – dry and wet DSR. Dry DSR is more commonly used in rainfed and upland areas. It involves the sowing of dry seeds on a dry soil surface and then incorporating the seeds either by ploughing or harrowing. Wet DSR is practiced during the dry and wet seasons in irrigated and rainfed areas. It involves either the broadcasting of pre-germinated seeds manually or drilling in rows with the use of a drum seeder or small farm mechanical seeder on a wet, well-levelled paddy.

Other important climate-smart good agricultural practices of the DSR approach are the use of land levelling during land preparation (e.g. laser land levelling), high-yield stress-tolerant rice varieties (e.g. drought, salinity and submergence-tolerant varieties), integrated nutrient management (e.g. use of site-specific nutrient management), integrated disease and pest management, post-harvest management (e.g. use of hermetic bag grain storage and solar tunnel bubble drier) (Buresh and Wit, 2008; CGIAR CCAFS, 2015; Mackill et al., 2012; Manzanilla et al., 2011; Gummert et al., 2020).

Current status and facilitating policies and programmes

In 2017, the International Rice Research Institute convened the Direct Seeded Rice Consortium (DSRC) with members across Asia and the Pacific. This is a public-private, multi-stakeholder research-for-development platform on direct-seeded rice (DSR) that was set up to improve the environmental and socio-economic sustainability of rice production systems by developing and optimising innovations, practices and methodologies to facilitate the wide-scale adoption of mechanised and precise DSR in Asia and Africa (https://dsrc.irri.org/home).

Despite the averred governmental intention to promote DSR, there is a lack of enabling policies and a disconnect in information delivery from the public and private sectors to farmers in many countries in the region. Furthermore, advanced DSR technologies that enable the attainment of productivity similar to that of puddled transplanted rice (PTR) have not been fully transferred to the countries. In Cambodia, 90% of the rice is established using broadcast DSR, but productivity and profitability have remained low for the following reasons: (1) the use of poor-quality seed saved by the farmers; (2) high seeding rates (150 – 330 kg ha^{-1}); (3) poor weed, water and nutrient management, higher lodging associated with high seed rate; and (4) low adoption of mechanisation for crop establishment. In Myanmar, about 38% of the cultivated area is currently under DSR. In Ayeyarwady and East Bago regions, DSR has been practiced in around 70% of the area. In the Philippines, about 35% of the 4.5M ha for rice in the country use DSR. The Department of Agriculture-Philippine Rice Research Institute's (DA-PhilRice) Rice-based Farm Households Survey found that the number of DSR farmers in the Philippines increased from 27% in 1996 to 36% in 2016 (Mataia et al., 2020). Farmers in two provinces of the Philippines – Aurora and Sultan Kudarat – are 100% adopters of DSR during the wet season. Another province, Antique, is the only province that practices DSR during the dry season.

In Sultan Kudarat province on the island of Mindanao, the Philippines, the DA-PhilRice Midsayap Office and the National Irrigation Administration (NIA) promote the practice of p*anggas* or dry DSR using non-pregerminated rice seeds. Alongside *panggas,* the emphasis is on good land preparation. Among farmers in Lambayong, Sultan Kudarat, good land preparation means preparing the land 15 days prior to the start of *panggas*. To do this, a disc plough is used during the first passing. To kill weeds, a second passing is performed 10 days after the first. During the third passing, a rotavator is used to pulverise the soil. The benefits of good land preparation include uniform growth and maturity of rice, more effective and efficient fertiliser application, better weed management and enhanced water management.

It was reported that yields in *panggas* are comparable to or even higher than those of PTR, the conventional way of planting rice in the country. Farmers in Sultan Kudarat were able to harvest 120-150 *cavans* (about 50 kg per *cavan*) per hectare using *panggas*. Farmers also reported an average of USD 140 per hectare savings in their labour costs, i.e. as compared with PTR. Other benefits of *panggas* include uniform rice growth and maturity, more effective and efficient fertiliser application, better weed management and enhanced water management.

In both Myanmar and the Philippines, broadcast DSR with a high seeding rate using 100-180 kg/ha is often practiced and the majority of farmers use their own saved seeds. Thus, the capacity for strengthening and adopting advanced DSR technology is important for the efficient and sustainable implementation of DSR in some Asian countries.

Funding

There are a number of projects on DSR in the Philippines that are being funded through multiple channels and sources. For example, DA-PhilRice is currently funding a project to breed DSR varieties under anaerobic conditions. Nationwide, there are also several projects that are being funded by the DA through the Bureau of Agricultural Research (BAR) under the country's National Rice Program. An example of these programmes is the collaboration between DA-PhilRice and the University of the Philippines Los Baños, which delivers a package of technologies on DSR for rice, corn, and mung beans. The project is called 'Mechanized seeding technology: Improving crop productivity and increasing income in rice-based rainfed and water- scarce environments in the Philippines'.

For a more concerted effort towards DSR promotion, it would be worth looking into the inclusion of DSR in the next strategic plan of PhilRice (2023-2028) and in the long-term rice roadmap.

Furthermore, there is a United Nations Food and Agriculture Organization (FAO)-funded project in Cambodia, Myanmar and the Philippines on DSR, 'Building capacity for promoting economically and environmentally efficient rice production through direct-seeded rice in the Philippines'. This project will run until January 2023.

In Cambodia, the Cambodia-Australia Agricultural Value Chain Program (CAVAC) has been supported by the Australian Government's Department of Foreign Affairs and Trade (DFAT) and implemented by Cardno (Australia) since 2010. CAVAC's overarching goal is to promote a commercially viable, resilient agriculture sector that supports inclusive growth. It aims to achieve this goal by supporting profitable irrigated agriculture and an increasingly competitive agriculture industry (CAVAC, 2021a). Among the CSA approaches supported by the programme on DSR are the use of laser land levelling, mechanised seeders (both for dry DSR and wet DSR systems), high-yield stress-tolerant varieties and other best management practices (CAVAC, 2021b and 2021c).

Field/Community operationalisation

DSR was practiced by farmers in the Philippines long before the CSA concept was introduced. In the past, rice was planted in many ways, one of which was *sabog* or direct seeding. This was done in lowland rice paddies with dikes where irrigation proved insufficient. With the development of the national irrigation system in the country, farmers shifted to PTR, especially during the dry season.

Many farmers shifted from PTR to DSR due to the scarcity of labour for transplanting and hand weeding and the need to intensify the production system from one to two or three crops per year (De Datta and Nantasomsaran, 1991; Pandey and Velasco, 2002). With the availability of early-maturing and high-yielding varieties (e.g. PhilRice developed varieties such as NSIC Rc 298, Rc 624, and Rc 626 with yields ranging from 5.3 to 9.3 t/ha) as well as effective and compatible herbicides and other associated best management practices for production and post-production along the value chain, DSR became well-known and widely adopted by farmers across the country.

PalayCheck (*palay* means rice) involves a system of key checks that verify the desired outputs after following recommended technologies/practices. It is worth mentioning that DSR is embedded in this rice production system, which is a platform for integrated crop management in the Philippines. Under this system, DSR is massively promoted by choosing the right variety to be planted, good land preparation, right seeding rate and time of planting, choosing the compatible establishment technique, application of compatible and effective herbicides, right timing and level of water, appropriate nutrient recommendations, effective pest management and proper time of harvesting (PhilRice, 2020; PhilRice 2007).

In rainfed areas, DSR is the common practice. When there is already enough water, land preparation may commence and be completed within a week followed by the broadcasting of pre-germinated seeds and crop establishment. Nutrient management is also dependent on water availability; hence, fertilizer is applied in only 1-2 splits to most DSR in rainfed areas.

Various studies have been conducted on how to improve the practice of DSR in the Philippines. These studies include the development of a hand tractor-mounted seed drill to address drudgery issues (Bautista et al., 2019), a comparative study on different wet direct-seeding methods (hand broadcasting, drum seeding and mechanical seeding), efficacies of different flooding depths (Sta Ines et al., 2010; Capistrano et al., 2005; Javier and Furuya, 1999), validation of weed control methods and the PalayCheck System (Donayre et al., 2021; Oren and Cruz, 2009), nutrient management (Liu et al., 2019; Malabayabas et al., 2001) and development of varieties (Solis et al., 2003; Padolina et al., 2005).

How it addresses the food system

DSR must be seen as a strong mechanism for adaptation to the impacts of climate change. While there may be yield issues as compared with PTR, this is not always true as shown in the case of Region XII on the island of Mindanao, the Philippines mentioned above. DSR allows food systems to continue producing rice despite water shortages, which are projected to worsen during the climate change regime. In the Philippines, most areas that practice DSR are rainfed areas where farmers also practice crop diversification.

In addition, as referred to in the sections above, DSR has several advantages that help build more resilient farm-to-table systems. Greatly reduced labour cost is a main contribution of DSR, and this is important in the Philippines as the bulk of the expenses related to rice production stem from hired labour. In a country where most farmers borrow money to finance their rice cultivation expenses, DSR enables farmers to attain comparable rice yields at lower cost, as has been shown in the case of farmers in Lambayong, Sultan Kudarat in the Philippines.

Contributions to the three pillars of CSA

Among the three pillars of CSA, DSR contributes the most to reducing greenhouse gas emissions. This has been documented in several studies that compare the greenhouse gas emissions of different crop establishment methods (Devkota et al., 2020). DSR's contribution is also strong when it comes to adaptation and building resilience. For example, it is established that DSR does not need as much water as its conventional counterparts (i.e., PTR) and is therefore being used in most water-scarce communities (Devkota et al., 2020). This then becomes a very effective adaptation mechanism given that weather extremes such as drought are expected to become more frequent in the climate change regime. With this, it follows that DSR can also contribute to the resilience of rice-farming communities in water-scarce areas. The contribution of DSR to productivity is not very well defined given that many studies have documented the yield penalty in DSR relative to PTR (Xu et al., 2019; Chamara, 2018). Other studies, however, have shown that this is not irremediable as there are technological fixes that could be applied to close or at least narrow the gap. For example, late-season N application increased the yield of DSR as compared with the usual N application (Liu et al., 2019). A study exploring sowing depth also shows some promise of closing the yield gap (Chamara et al., 2018).

Contributions to the COVID-19 response

The pandemic is a game-changer in so many ways. It has greatly affected people's livelihoods and, consequently, their income. Given that DSR reduces labour requirements, it then goes without saying that it has enabled farming families to better manage their resources. Likewise, it is also a COVID-safe strategy, given that fewer farm workers are needed to work on the farm during crop establishment. Developments on DSR prove that DSR is indeed a COVID-safe strategy, especially with respect to the use of drones, GPS and sensors (Villano et al., 2019). Drone seeding has already taken off in some provinces in the Philippines such as in Tarlac (Yap, 2020).

To sustain this, government support is necessary in terms of policy and information drive. Appropriate DSR technologies for dry-seeded rice and wet-seeded rice should be demonstrated and taught to farmers.

Climate-Resilient Tilapia Farming

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Technical description

Aquaculture production serves as a significant economic driver in several Southeast Asian countries including Cambodia, Indonesia, Laos, Myanmar, the Philippines, Thailand and Viet Nam. It is also a major source of animal protein that helps these countries achieve food and nutrition security. However, aquaculture production in the region faces several climate risks that could prove adverse (e.g. increased average temperatures). Various climate-smart aquaculture systems have been developed including rice-fish farming programmes in Indonesia and Viet Nam (FAO, 2019). In the Philippines, a system called 'Climate-Resilient Tilapia Farming Practice' is being piloted to model a climate-smart approach for aquaculture that could be eventually scaled up to other ASEAN countries.

Climate-Resilient Tilapia Farming Practice (CRTFP) is an approach that combines aquaculture technologies, agrometeorological technologies and capacity building among aquaculture producers. By implementing a portfolio of multiple technologies and practices, it hopes to address the multi-faceted challenges that climate change could pose for tilapia aquaculture. Specifically, CRTFP includes:

- Utilisation of 'climate-smart fingerlings' characterised by advance sizes (5-10g^{-pc}) that were particularly nursed to adapt to varied climatological conditions
- Introduction and/or enhancement of existing nursing systems
- Application of weather hazard and climate-risk assessments
- Expanded dissemination of weather forecasts
- Skills-building among aquaculture producers for an integrated monitoring system of key aquaculture variables (e.g. water quality)
- Promotion and adoption of other good aquaculture practices (GAqP) among aquaculture producers

The following discussion highlights the experience gained in the Philippines.

Current status and facilitating policies and programmes

CRTFP is being piloted and promoted by the Bureau of Fisheries and Aquatic Resources (BFAR) in the Caraga region of the Philippines. This is the national agency mandated by the Philippine Fisheries Code to provide extensive development support services in the country's fisheries production. It creates and implements projects relative to the improvement of sustainable fisheries production that is resilient to climate change.

Specifically, CRTFP is being designed and implemented under a BFAR and FAO collaboration for two projects on 'Building Capacities for Climate-Resilient Tilapia Farming in the Philippines' and 'Promote Scaling-up of Innovative Rice-Fish Farming and Climate-Resilient Tilapia Pond Culture Practices for Blue Growth in Asia'. It is an important endeavour to operationalise the country's RA No. 9729 and 10174 (Climate Change Act of 2009) for the aquaculture sector.

Funding

Piloting of CRTFP was funded by the FAO together with its implementing partners including the Department of Science and Technology - Philippine Atmospheric, Geophysical and Astronomical Services Administration (DOST-PAGASA), Caraga State University and the Philippine Crop Insurance Corporation. A national strategy for upscaling CRTFP is now being created to increase the number of tilapia farmers who use this approach.

Field/Community operationalisation

Tilapia farmer cooperators for the piloting of CRTFP were trained in climate and weather systems, climate change events and their effects on tilapia farming practices, good and innovative technologies, and practices of CRTFP including nursing systems for 'climate-smart fingerlings' and integrated monitoring systems. Demonstration farms were developed to provide farmers with concrete ideas on how to implement this portfolio of technologies and practices. Farmer cooperators were assisted in adopting and retrofitting these in their respective aquaculture farms.

Fisheries technicians in local governments were capacitated to provide advice on the possible impact of weather systems based on forecasts. They were also trained to interpret weather data from agro-meteorological equipment. These fisheries technicians worked closely with the tilapia farmer cooperators to implement measures based on these forecasts.

How it addresses the food system

CRTFP is an important approach to sustaining the animal-protein component of food systems amid the challenges of climate change. It strengthens the production aspect of aquaculture – ensuring sustainable supplies of tilapia to support subsistence, livelihoods, and the greater economies of scale by which it is implemented (e.g. municipality, province).

Contributions to the three pillars of CSA

CRTFP focuses on building the resilience of aquaculture production by redefining tilapia farming with climate-smart technologies and practices, especially on the use of climate data and nursery management. Providing tilapia farmers with the skills to implement these also helps build their adaptive capacities by (1) increasing their knowledge to strategise given real-time weather forecasts and other climate data and (2) improving their farm operations skills, especially as regards nursery management. While it is not explicitly focused on increasing production outputs, it is foreseen as a critical approach to sustain tilapia regardless of current and future climate risks.

Contributions to the COVID-19 response

While CRTFP did not directly address the impacts of COVID-19, the benefits of using this approach have allowed tilapia farmers to implement strategies that helped them cope with the pandemic's impacts. For example, COVID-19 has put tremendous pressure on aquaculture producers in relation to accessing inputs. However, CRTFP farmers who were trained in GAqP were able to utilise locally available resources as alternatives for these inputs. While extension services were halted, CRTFP farmers have demonstrated a certain level of confidence in the climate-smart management of their farms (e.g. use of available weather forecasts from the internet).

Low-Emission Animal Production System

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Technical description

The livestock sector contributes to countries' incomes and livelihoods, assets, nutrition and food security. Across AMS, and particularly in least-developed countries, livestock husbandry by smallholders helps alleviate poverty and boost food security and gender equality (Strategic Plan of Action for ASEAN Cooperation in Livestock, 2016-2020). However, the sector is also widely recognised to be a contributor to global GHG emissions by generating significant emissions of CO_2, methane and nitrous oxide, while improper management of livestock waste is also identified as one of the largest contributors to water pollution. Farming also generates potential pathogens and animal diseases that can pose risks to public health (ASEAN-CRN, 2021). In 2019, the Southeast Asian region contributed 4% to the world's methane emissions from enteric fermentation and 8% from manure management.

Myanmar, Indonesia and Viet Nam are the top three methane-emitting countries which account for 12% to 33% of emissions in the region (FAOStat, 2021).

It is therefore important to develop climate-smart animal production systems that are not only resilient to the impacts of climate change but also help mitigate it. In Indonesia, this is addressed through livestock mitigation technologies focused on (1) improving animal feed technology (rations and supplements/concentrates), (2) converting livestock manure into biogas and compost, and (3) breeding to obtain adaptive livestock breeds with low-emission enteric fermentation. Collectively, these are part of the Low-Emission Animal Production System (LEAPS) which comprises livestock mitigation technologies that improve sustainability and reduce environmental impact.

Current status and facilitating policies and programmes

Implementation of LEAPS is grounded in Indonesia's Low Carbon Development Initiative (LCDI) that aims to maintain economic and social growth through development activities that are geared to reducing GHG emissions and GHG emission intensity, as well as minimising the exploitation of natural resources. Each of the three mitigation technologies is facilitated by its respective programmes and key implementing institutions. This includes the Directorate General of Livestock and Animal Health (DGLAH) under the Ministry of Agriculture of Indonesia which leads animal feed technologies. The institution is also active in adaptive breeding together with the Indonesian Agency for Agricultural Research and Development (IAARD). On the other hand, manure management and biogas technologies are being spearheaded by the Directorate General of Infrastructure and Agricultural Facilities. Promotion of these mitigation technologies is still focused on smallholder farmers.

Funding

Funding for the mitigation technologies under LEAPS comes from the National Budget Scheme, which grants funds to local government institutions in Indonesia. In addition to that, some of the provincial and district governments also provide funding to keep the programme running. This is also coupled with research grants and private financial support for the key institutions outlined above that enable the application of these technologies.

Field/Community operationalisation

LEAPS mitigation technologies are transferred to farms by providing advice from extension workers or local officials to farmers. Climate-smart feed improvement practices include (1) the introduction of nitrogen-rich legumes (e.g. *Indigofera sp* and *Leucaena sp)* as feed rations coupled with the construction of mini-feed mills, (2) utilisation of rice straw derived from sustainable farming as cattle feed, and (3) breeding climate-tolerant forage species (e.g. *Stenotaprhum* sp.).

Climate-smart technologies for manure management focus on the distribution of digesters for biogas. In the case of Pangalengan District of West Java, Indonesia, the Government provided the local cooperative with the digester for biogas production. The members of the local cooperative pay as much as 1 litre of milk per day for one year until the whole amount is fully paid. Another case in Lumajang District, West Java, Indonesia, is the implementation of an integrated energy-environment-economy approach that gives low-income farmers access to biogas energy.

On the other hand, climate-smart technologies for adaptive breeding highlight the propagation of local breeds, especially of cattle (e.g., Bali cattle, Ongole and Madura cattle). Adaptive breeding is also applied to other animals such as chickens and ducks.

How it addresses the food system

Mitigation technologies under LEAPS provide important contributions to optimise production not only in terms of livestock outputs but also as regards other dimensions for the economic, social and environmental well-being of communities.

For example, biogas provides a clean, renewable and reliable source of power. In fact, each biogas digester provides energy to fuel stoves and lamps which is shared by two to three farm households. Another example is that the enhanced utilisation of legumes as feed also results in better sanitary conditions (e.g. reduced seepage of chemical-laden wastes) and promotes local investments for natural produce markets (e.g. opportunities for organic livestock production).

Contributions to the three pillars of CSA

LEAPS main contribution is on GHG emission reduction as it reduces overall needs for energy-intensive inputs while providing cleaner alternatives. In complement, the overall carbon footprints of farming systems utilizing these technologies are much lower, even offering potentials for net zero carbon if integrated properly in this production system. It also serves as a significant model for achieving productivity in the livestock sector while building its resilience and the adaptive capacities of livestock farmers. Its role in productivity mainly lies in its focus on reducing costly input by providing natural alternatives (e.g. commercial feed vs. legumes) and maximising circularity in the use of local resources (such as biogas). The development of better livestock breeds through adaptive breeding reduces production risks associated with climate change.

Contributions to the COVID-19 response

The primary challenges in livestock farming during the COVID-19 pandemic include decreasing feedstock, especially the difficulty of obtaining inputs given the closure of markets. This has been alleviated by farmers observing LEAPS technologies since they have actively used locally grown resources (e.g. legumes) that meet the nutritional needs of the animals. Locally produced feedstuffs eventually reduce dependency on the commercial market, especially when the farms' own crops are used as feedstuffs.

Chapter IV: Relevant Stakeholders and Their Roles in CSA Adoption and Promotion in ASEAN

Further promoting and adopting CSA in the ASEAN region requires collaboration across different levels and countries. To be successful in applying the five suggested principles presented in Chapter II of this document, various institutions and stakeholders should be active in forging and steering regional collaboration arrangements. The different regional ASEAN sectoral bodies active in areas such as FAF, rural development and climate change play important roles in shaping the direction taken and nudging actions in line with these principles.

The ASEAN-CRN, under the regional policy guidance of ATWGARD, serves as a central platform that facilitates the sharing and dissemination of knowledge and experience among AMS and can play a key role in informing about strategies to implement the five principles elaborated in Chapter II. ASEAN-CRN also takes the lead in catalysing support from various partners including development organisations, research institutions, academic consortiums and civil society organisations, and promotes cross-sectoral cooperation within ASEAN.

These regional entities such as ASEAN sectoral bodies and ASEAN-CRN could play significant roles in relation to each principle through the following:

- ❖ (Principle 1, Scaling up): Regional entities should regularly inform AMS about successful cases and empirical evidence on the actions that have led to the scaling up of CSA approaches. This would allow AMS to better design their policies and actions based on tried and tested experiences by other AMS.
- ❖ (Principle 2, Available and Accessible Financing): Regional entities should proactively create linkages between AMS and global and regional funding institutions for CSA. This would allow AMS to expand their sources of funding, especially for initialising and/or scaling up CSA approaches. They should further promote dialogue on how to mobilise funding from different sources, including the private sector, for CSA practices.
- ❖ (Principle 3, Educating Consumers and Producers): Regional entities together with partners should create more regional and multi-stakeholder knowledge exchanges and capacity-building through workshops and conferences, for example. This would allow AMS to share their respective best practices and lessons learned.
- ❖ (Principle 4, Digitalisation): Regional entities should steer regional collaboration to create information and communications technology (ICT) infrastructure and platforms, especially through creating dialogues with private ICT service providers. This would allow AMS to better engage in private-public partnerships for digitalisation that aim to achieve Agriculture 4.0 in the region and to optimize the application of technologies such as precision agriculture, the internet of things (IoT), and the use of big data.
- ❖ (Principle 5, Policy and Governance): Regional entities should more strongly focus on developing plans for the dissemination and application of regional policies and more stringent follow-up via monitoring and review/updating processes. They should also continuously review ASEAN guidelines in terms of their applicability and relevance as new information and experiences arise. This would allow AMS to have a more targeted orientation and regionalised approach to the achievement of the three pillars of CSA that is timely and evolves concurrently with new information.

By 2021, ASEAN, with the support of selected AMS, has made two joint submissions on the Koronivia Joint Work on Agriculture (KJWA) to the United Nations Framework Convention on Climate Change (UNFCCC).[1] These documents could further complement what was discussed above as they outline regional priorities and roles for addressing agriculture and food security in the climate change regime. They highlighted regional activities in supporting cooperation and knowledge-sharing on planning, finance, governance, policy frameworks, achieving scale through innovative approaches, enhancing gender equity and social inclusion, and research and knowledge systems.

At the local level, the following institutions and stakeholders should be actively involved in initiating multi-level collaboration arrangements based on these principles, especially in implementing the actions outlined in this volume (Table 9).

Table 9. Local institutions and stakeholders and their significance with regard to applying the principles for promoting and adopting CSA

Institution/ Stakeholders	**Principle 1:** Scaling up	**Principle 2:** Financing	**Principle 3**: Education	**Principle 4:** Digitalisation	**Principle 5:** Policy and Governance
National food, agriculture, forestry, environment and fisheries agencies	√	√	√	√	√
Provincial food, agriculture, forestry, environment and fisheries agencies	√		√	√	√
Local food, agriculture, forestry, environment and fisheries agencies	√		√	√	√
National/local banks and other financing institutions		√			
Local research institutions	√		√	√	√
Local academic institutions	√	√	√	√	√
Farmer groups and farming organisations	√		√	√	
Civil society organisations	√		√	√	
Private institutions	√	√	√	√	√
Local development organisations and non-governmental organisations	√	√	√	√	
Sectoral groups (e.g., women's groups, young people's groups)	√		√	√	

[1] The documents can be accessed through the UNFCCC submission portal: submission 2018 on topic 2a: https://www4.unfccc.int/sites/SubmissionsStaging/Documents/201810291449---ASEAN%20Submission%20to%20UNFCCC%20Modalities-19Oct2018.doc.pdf; submission 2020 on topic 2e and 2f: https://www4.unfccc.int/sites/SubmissionsStaging/Documents/202004181609---Submission%20by%20ASEAN%20on%20KJWA%202(e)%20and%202(f).pdf.

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