

## *Developing profitable, sustainable and resilient cassava-based farming systems in the Kingdom of Cambodia*

### Background Situation analysis

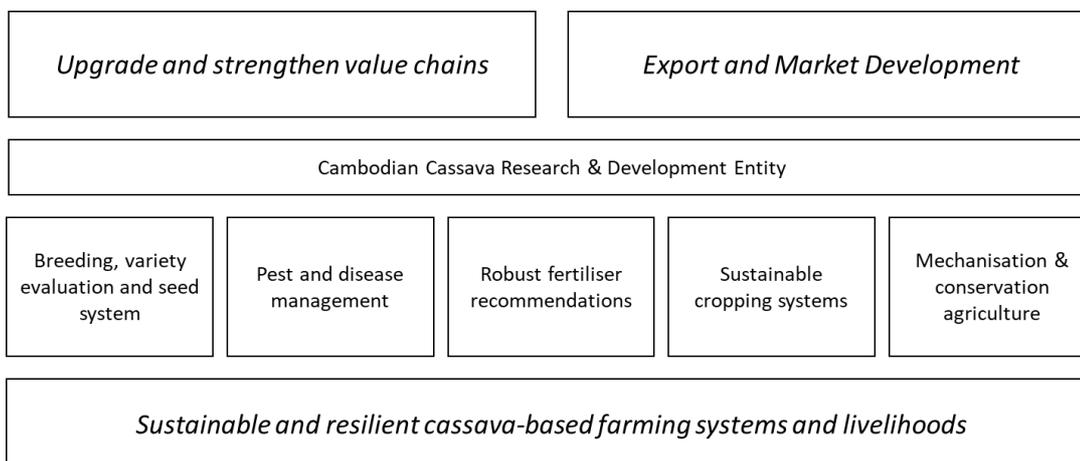
1. Cassava production in Southeast Asia has continued to expand in recent years with the relative importance of the crop continually increasing, particularly in upland regions. Southeast Asia continues to be the main source of commercial cassava-based products accounting for over 95% of the export value of cassava (fresh and dried) and cassava starch produced to meet the expanding global demand for starch and starch derivatives, animal feed, ethanol. Cassava starch is utilised in an increasingly diverse range of industrial and food products.
2. Cassava production in the region has been through several phases of development in response to changing market conditions and policies. In the 1980-90s, production of cassava initially expanded in Thailand, followed by Vietnam to largely to meet the demand in Europe animal feed markets created by changes European agricultural policy. However, during the past 10 years the expansion has moved into the hinterland of these leading cassava-processing economies with the export market focused on Asia, particularly China and East Asia. During this period, Cambodia has seen a rapid increase in production to become the third largest producer of cassava in Asia. To date, this has largely developed to provide feedstock (fresh roots) to the main processing zones located in Vietnam in the east and Thailand in the west. Dry cassava chips are also produced and exported into these two countries for domestic utilisation or re-export.
3. The initial production in Cambodia concentrated in the border regions with easy access to the regional market. However, internal and external factors such as changing land policies, rural-rural migration, and strong market conditions have seen the cultivation of cassava expand throughout Cambodia's upland provinces, reaching an estimated 650,000ha in 2015-16 yielding 14,000,000 tons of fresh roots.
4. The increase in cassava production has occurred through two main processes: farmers choosing to grow cassava instead other annual crops (most notably maize and legumes such as soybean); and the expansion of the agricultural frontier. The conversion to cassava from other upland crops has been the result of changes in relative prices and declining crop yields as soil fertility decreases over time. Cassava is able to continue to produce economic returns on increasingly marginal soils while other crops tend to become economically unprofitable.
5. As the area of cassava expands throughout the country, some regions are experiencing a simultaneous process of transition to tree-based cropping systems such as rubber and cashews. Cassava is grown as an intercrop during the establishment years of these tree-based systems, with production phased out over time as the tree crop reaches maturity. This process is described in several studies, which highlight the potential for improved

livelihoods when the transition occurs smoothly, or landlessness when price and production shocks result in excessive debt.

6. Predominantly, the rapid increase in cassava cultivation throughout the country has not been accompanied by the adoption of improved production technologies and practices aimed at improving the long-term sustainability of the production systems. This lack of appropriate management threatens both the ongoing livelihoods of upland farmers cultivating the crop, and the development of a viable cassava-processing sector within the country.
7. Technologies and practices have been developed to improve the sustainability and profitability of cassava cultivation, including: soil management practices to maintain soil fertility, utilizing healthy planting material from high-yielding varieties, adoption of crop rotations or intercropping, and integrated pest management practices. The current lack of adoption of these practices is the result of several factors including: limited awareness of the underlying problems; lack of awareness of viable solutions; limited formal extension; lack of availability of appropriate inputs (balanced and tested fertilizers, clean planting material); lack of availability of support services (credit, insurance, brokers); uncertain markets for outputs (cassava and intercrops).
8. Therefore, the development of a cassava policy aimed at developing **profitable, sustainable and resilient** cassava production systems must not only consider the technical requirements, but also the **market or institutional innovations** needed to create an enabling environment for the development of sustainable rural livelihoods for farmers engaged in the cassava sector.
9. In various value chains and production systems, value chain actors have different incentives to enhance the adoption of the above technologies. Therefore, the scaling of new technologies will require a combination of private sector, public sector, and non-government actors to support the process. The composition of actor involvement will depend on the inherent characteristics of each specific technology, the characteristics of the production system, the characteristics of the community, and value chain characteristics.
10. Rural households engaged in cassava cultivation also manage a portfolio of farm and non-farm activities. The policy should drive productivity and sustainability of cassava production and at the same time enhance the sustainability and resilience of the whole farming system and livelihoods of households engaged in the sector. That is, this policy targets **'cassava-based'** farming systems, recognizing the importance of the other components of the production and marketing system. This broader view is required to achieve the policy's dual objectives of sustainable rural livelihoods based on the development of a viable and profitable cassava-processing sector.

## Policy Summary: Sustainable and resilient cassava-based farming systems and livelihoods.

1. The production component of the cassava policy is divided into two crosscutting sections and five interrelated sections. Each of the elements of the policy are dependent and affect others. There are eight items summaries below:



### Summary

1. Establish a Cambodian Cassava Research and Development Coordination entity;
2. Promote sustainable and resilient cassava-based farming systems and livelihoods avoiding interventions that focus on cassava in isolation of other components of a farming system;
3. Invest in cassava breeding and coordinate variety evaluation with industry stakeholders;
4. Develop viable seed systems and business models to promote the use of healthy planting material;
5. Develop and promote robust fertilizer management recommendations and flexible strategies for different agro-ecological regions of Cambodia;
6. Invest in and coordinate the monitoring, surveillance and reporting of pest and disease and promote appropriate management practices;
7. Develop cassava-based cropping system options suitable for different agro-economic regions of Cambodia; and
8. Invest in ongoing development of mechanization technologies that enable viable contracting models, address rising labour shortages, and enable the implementation of conservation agriculture practices

- I. Establish a Cambodia Cassava Research and Development Coordination Entity
  1. The successful implementation of the production component of the policy depends on strong linkages created between producers and other value chain actors, including the core value chain actors (collectors, traders, processors, and exporters), and other supporting actors in the value chain (credit providers, input retailers, extension services etc.). The policy should create the institutional environment for enhancing these linkages and intervening in areas of market failure.
  2. The sustainability of the sector requires coordinated and strategic support and investment. Partnerships between public, private sector, and producers is required to set priorities, invest in research and development, and establish responsibilities. With limited resources to address these current and emerging issues, coordination is required through the establishment of an “Entity” for coordinating cassava research and development activities. From here on referred to as the ‘cassava research and development entity’ (CRDE).
  3. The CRDE should establish statutes, including the development of a Steering committee representing stakeholders from Private Sector, Government, Producers Organisations, Research, and Development Organisations. The CRDE should act as a platform where government, private sector, research, farmer organizations can meet to discuss problems, opportunities, and set priorities for investment in research and development within the sector – including production issues, value chain and processing, export and market development.
    - a. The CRDE should seek to coordinate donor investments in R&D to ensure sustainable funding for long-term core activities (breeding and variety evaluation, pest and disease surveillance and robust clean-seed system). These activities are critical to the welfare of the sector, but cannot be efficiently sustained through ad hoc project support, and will benefit greatly from coordination. Over time, there should be a transition to an increasing level of industry and national government support with a declining dependence on external donor funding.
    - b. The CRDE should act as a national coordination platform (technical working group) to facilitate, coordinate and streamline information, program investments and interventions for pest and disease management.
    - c. The CRDE should act as a data repository for research and development activities and seek to coordinate activities through common protocol participatory farmer fertility management trials conducted in conjunction with public and private stakeholder.
    - d. The CRDE should organise an annual symposium where research results it funds/supports/coordinates are presented to industry and research stakeholders. The CRDE should take a role in the coordinate of capacity building of PDAFF and private sector based on new research and emerging priorities.

## II. Promote resilient and sustainable cassava-based farming systems and livelihoods

1. Cambodian cassava producers are exposed to both production and market risk and uncertainty. A national cassava policy should not only seek to promote cassava production and productivity, but should also be developed in the context of sustainable farming systems and household livelihoods. For this reason the policy should encourage, where appropriate, cropping system and livelihood **diversification**. It should address the physical, technical, market, and institutional constraints to developing more profitable and resilient **cassava-based** farming systems.
2. Cropping system diversification is a key component required to address productivity and sustainability issues around soil fertility and health, pest and disease management, and reducing market risk. Interventions promoted by the cassava policy should not expose smallholders to unacceptable levels of risk, and should promote risk management strategies through on-farm methods (diversification) or market mechanisms (insurance, savings).
3. Viable cropping system **options** should be developed and promoted for the different agro-economic regions of Cambodia. These options should take into account the current biophysical and economic situation, as well as production and market risks. The development of cropping options should consider climate variability and establishment mechanisms to inform farmers of expected conditions (climatic and market) prior to the growing season through the development of decision support tools.
4. The long-term suitability of cassava in Cambodia remains relatively neutral under climate change scenarios, however other intercrops or rotations are less (or more) resilient. The impacts of climate change on local cassava production and regional markets should inform investment and planning decisions.
5. Other elements of the cassava policy should include reference to cassava-based cropping systems. Robust fertilizer recommendations (section V) should be developed with reference to cropping system options, rather than being only based on maximising cassava yields in monoculture production systems in a single year. Policies and practices to improve variety evaluations and seed systems need to address the opportunities and constraints for rotation and intercrops (section IV). Research into mechanization (section VII) should take into account the technical and economic aspects of diversified cropping systems.

## III. Invest in cassava breeding and variety evaluations

1. There are many cassava varieties grown throughout the world. Farmers have selected these varieties for a range of reasons, including high yields, good eating qualities, ease of peeling, early maturity, and resistance to a diversity of pests and diseases. Cassava breeders continue to develop varieties that are better adapted to environmental and biological stresses. Cambodia currently does not have a national cassava breeding program. In other programs in the region and abroad, there are new varieties under development for specific markets and applications.
2. Varieties will perform differently in different agro-ecological zones, depending on factors such as soil type, climate, and agronomic management practices. High-yielding varieties have been bred specifically for high-density, monoculture conditions. It should be recognized that less effort has been made to date on selecting for plant types adapted to diversified and low-input systems; for this reason farmer varieties should not be excluded from evaluations and further development.
3. **In the short-term**, the productivity of the Cambodian cassava sector can benefit from ongoing evaluation of existing varieties from regional breeding programs, and through receiving advanced clones for adaptation trials and evaluation with value chain actors. In order to do so there are several actions required:
  - a. Procure information of the current varietal composition across the Cambodian agricultural landscape using advanced DNA-based molecular methods.
  - b. Establish a mandate and procedures for institutions to receive advanced clones from international breeding programs, such as CIAT, or breeding programs in neighbouring countries;
  - c. Invest in physical and human capacity within these institutions to conduct adaptation trials. Establish common protocols for trials and minimum criteria for data collection;
  - d. Encourage active participation in regional and global breeders networks, such as the Asian Cassava Breeders Network;
  - e. Establish rapid multiplication centres in core cassava growing regions, where new varieties can be multiplied for evaluation and distribution;
  - f. Conduct a characterisation of the Cambodia cassava growing areas for strategic evaluation of cassava varieties with cassava farmers and other value chain stakeholders;
  - g. Coordinate the evaluation and analysis of new cultivars through the CRDE.
4. Establishing Cambodia's own breeding program for ongoing genetic improvement within the country is a **long-term** priority that requires secured long-term funding. While the breeding objectives of Cambodia remain similar to the neighbouring countries, initiating a local breeding program is not considered a high priority until secure funding from Industry and Government can be assured. The fact that Cambodia remains a non-signatory to the international convention on plant breeders rights (UPOV) further reduces

incentives for domestic breeding programs. This also poses a significant disadvantage since other national breeding programs within the region (who also seek to establish competitive industries) may be hesitant to share new varietal releases. The viability of establishing a separate Cambodian breeding program should be evaluated.

#### IV. Develop viable seed systems and promote the use of healthy planting material adapted to local conditions

- 1. Promote appropriate on-farm management of planting material.** As a vegetatively propagated crop, the use of healthy planting material (stem cuttings) is essential to reducing pest and disease pressures, and improves productivity. The use of high quality stems from vigorously growing mother plants that has been well supplied with essential nutrients impacts the yield of the subsequent crop. The length of time between harvest and planting and the storage of stems is also important, as stake viability is drastically reduced with time. Existing techniques for preferential management of planting material, including using positive and negative selection, can sustain yields and reduce pest and disease pressures. These simple on-farm strategies should be promoted to farmers in partnership with local extension and value chain actors, including dissemination through extension campaigns.
- 2. Development of clean seed systems for the provision of quality cassava stakes.** The movement of infected stakes is one of the primary mechanisms of the spread of pests and diseases. Many potential clean seed system pipelines for cassava exist. These include a range from relatively high-tech and costly pipelines beginning from in-vitro & other micropropagation techniques, to open field multiplication, local seed business development, and different levels of certification from farmer seed, quality declared seed (QDS), and lab-tested, formally certified seed. Business cases for several options specific to Cambodia's context should be evaluated and promising avenues piloted. Physical isolation and seed management at higher elevations where white flies do not occur should be explored when considering the location of pilot activities or open field multiplication sites.
- 3. Strengthen the involvement of industry actors** in the provision of information and in the production of clean planting materials. Cambodia is currently a net-importer of significant amounts of planting material from neighbouring countries. Farmers frequently purchase new planting material of poor or unknown quality. The medium of movement of these stakes is often traders, who deal in quantities of stakes sourced from multiple origins, increasing risk of infection, and providing no guarantee of varietal identity. While the large movement of planting material through the value chain can result in movement of pest and disease, it presents an entry point through the development of viable business models. Some degree of 'formality' in the provision of planting material can also help to reduce uncertainties and risk.

4. Recognition of 'farmer seed' in the seed law and joining international conventions such as International Convention of Protection of New Varieties (UPOV) are steps that can be taken to enhance development and distribution of new cultivars or varieties for the benefit of farmers and industry. Steps toward regulation of the informal seed sector are unlikely to succeed if their roles in the system are not recognized at some level.

## V. Develop and promote robust fertilizer recommendation for agro-ecological zones

1. Cassava achieves its best yields under proper management. With a lack of inputs to replenish the nutrients removed by harvest, it is inevitable that yields will decline. However, with appropriate fertilizer application, research shows that yields can be maintained over longer periods of continuous cropping. However, in the long-term this is not a replacement for the more holistic management of soil management and health.
2. Many participatory trials have shown that even a relatively conservative application of fertilizer in the appropriate balance of N:P:K, applied at the right time, and with appropriate placement, can provide farmers with very attractive returns on investment. Farmers in Cambodia are often unaware of the correct type of fertilizer to use, an economically appropriate rate, or when to apply the fertilizer to the crop. Furthermore, these fertilizers are frequently not accessible for smallholder farmers. Several actions that should be taken:
  - a. Develop a characterisation of the main cassava agroecological zones based on soil types and climate as a means of developing broad, robust fertility recommendations. A robust recommendation provides farmers with an attractive return on investment for a range of probable farm-gate prices and takes into account production risk.
  - b. Encourage fertilizer companies to create and market blends targeted specifically for cassava production for specific zones. These should provide the appropriate mix of nutrients in easily purchased quantities. It should be ensured that accurate extension information about the products and their application techniques are provided in Khmer with the product.
  - c. Improve the distribution arrangements between fertiliser companies and retailers, and the provision of associated technical advice and information.
  - d. Improve access to credit for the purchase of inputs that are based on the use of appropriate inputs.
  - e. Test and certify new products that aim to enhance soil fertility in terms of their efficacy. Regularly test fertilizers for their nutrient content, and ensure that products certified specifically for use on cassava bear an insignia stating such.

## VI. Pest and disease

1. Cassava production in Southeast Asia was nearly free from phytosanitary constraints until recently. A complex of invasive arthropod pests and disease are now significantly affecting cassava production in the region, including Cambodia.
2. There is an urgent need for coordinated investment in research and capacity building to develop a more comprehensive understanding of the local population dynamics and control of invasive pests (such as mealybug and mites) and to understand the causes, spread and control of new diseases such as cassava witches broom disease (CWB), and cassava mosaic disease (CMD). Several actions are suggested below:
  - a. The development and promotion of locally appropriate Integrated Pest Management (IPM) packages is of critical importance, including the promotion of alternatives to the increasingly widespread use of pesticides.
  - b. Implementation of capacity building, awareness raising and extension, including the development of appropriate extension and communication materials (including video, radio, or other innovative media). This needs to happen at all levels (from technicians to farmers).
  - c. Set-up a system for near-real-time intelligence of disease presence and incidence, and appropriate communication strategies for farmers and industry actors.
  - d. Implementation of quarantine measures that restrict the movement of planting materials out of infected areas. Encourage the production and marketing of clean planting materials in regions that are currently disease-free.
  - e. Progressively control the movement of uncertified planting material across national borders as the domestic supply of healthy planting materials increases.
  - f. Implementation of a scheme with a clear incentive system for farmer-level reporting, eradication, and replacement of infected materials.

## VII. Invest in the development of mechanisation options that address labour shortages and enable the implementation of conservation agriculture practices

1. Labour prices in Cambodia have risen significantly in recent years, and available household labour to perform peak season operations, such as planting and harvesting, will continue to decline as household livelihoods become increasingly diversified. Farmers are already preferentially adopting technologies that save labour, such as contract land preparation, and the widespread use of herbicides to reduce labour requirements for weeding.

- Ongoing investment in the development of economically viable machinery and contracting models is needed to move beyond pilot scale on conservation agriculture. Financing and leasing arrangements for equipment need exploring, and other sustainable mechanisms should be evaluated to encourage the use of proven conservation agriculture practices. Exploration and evaluation of mechanisms to encourage more sustainable cultivation practices, particularly in key sensitive areas, should be pursued, including innovative mechanisms such as the production of certified organic or 'environmentally safe' products.

## Appendix

