

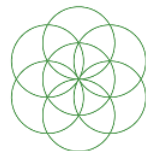
GENDER AND CLIMATE RESPONSIVE Analysis of Vegetable Value Chains in Cambodia



Implementation of the ASEAN Green Recovery through Equity and Empowerment (AGREE) Project in Cambodia



CPSA



Grow**Asia**

GENDER AND CLIMATE RESPONSIVE
Analysis of Vegetable Value Chains in Cambodia

Research Team

Marlaina Ross
Reach Syden
Sann Ra
Chandy Eng
Rojanet Ty

Project Implementer – Cambodia, Cambodia Partnership for Sustainable Agriculture

Sarin Tey

Local Partner Organizational

Outreach R&D Consulting Co., Ltd
Gender and Development for Cambodia (GADC)

Government

Provincial Department of Agriculture, Forestry, and Fisheries in Kampong Cham
General Directorate of Agriculture, Ministry of Agriculture, Forestry and Fisheries
Ministry of Commerce
Ministry of Environment

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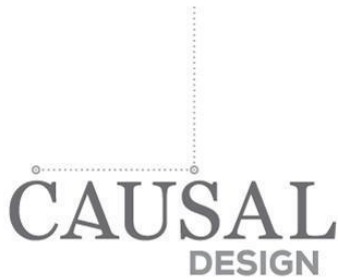
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By:



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1342 Florida Ave NW
Washington, DC 20009 USA
Tel: +1 (720) 260 4837
Email: Info@CausalDesign.com



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1.0 EXECUTIVE SUMMARY

In Cambodia, agriculture remains one of the largest contributors to economic growth and employment, particularly in rural areas. The Cambodian agricultural sector is, however, increasingly under threat from climate-driven weather events such as extreme flooding or drought. This threatens both livelihoods and food security in the country and exacerbates existing gender-based and socioeconomic inequities.

Considering the importance of the agricultural sector in Cambodia, investment in this area represents a significant opportunity to improve sustainability, increase resilience to climate change, and decrease gender-related social and economic inequalities. This study was designed to lay the foundation for addressing these issues by conducting in-depth research into a promising value chain to better understand the barriers and opportunities to improve sustainability and climate resilience and ensure equitable participation for women. For Cambodia, the selected value chain of focus is vegetables, on account of its significant potential for women to participate in a meaningful way: 70 percent of women are engaged in agriculture work and unlike in other crops, growing vegetables does not require a large plot of land or a substantial outside labor force which reduces the initial barriers to entry many women face. There is also a clear entry point for the adoption of climate-smart technologies and conversion to organic production since growing vegetable thrives even in small plots of land, hence less costly for application of climate-smart technologies such as plastic mulch, organic mulch, drip irrigation, smart-farm assistance, solar pumps, and other tools, offering an easier entry point to encourage conversion to organic production and adoption of new technology¹. And since it is considered as a high-value crop, it also projects higher potential for profitability for smallholder farmers, with studies demonstrating about 3 - 144 times higher per hectare than those from growing rice as it also follows three planting cycles per year with a relatively a flash flood, drought, or heavy rain, farmers can restart farming and relatively quickly recover lost income from production. In contrast, perennial crops such as rice can only be produced and harvested once a year, which means in the event of a natural disaster, an entire year's income can be lost.

In addition to an extensive literature review, this study utilizes primary qualitative interviews with key stakeholders along the vegetable value chain to map existing dynamics and identify barriers and opportunities for future programming. Specifically, the study focuses on women's experiences within vegetable production and processing, the use of climate-smart agricultural technologies to maximize sustainable production, and the intersection between expanding gender equity and improving climate resilience and sustainability.

Qualitative interviews revealed that largely, men and women share responsibility when it comes to farming and often make decisions together, including those related to what to plant and how to manage finances. Women tend to give more power to men in crop selection because they think that men are responsible for heavy farming activities. Although men and women often make large financial decisions together, women are generally primarily responsible for the household's finances, making independent decisions about small expenditures and managing tasks like loan repayment.

In terms of division of labor, women are more involved in "lighter" tasks such as seeding, planting, farm management, harvesting, and marketing. More physical tasks such as land preparation, spraying chemical pesticides, fertilizer application, and operating heavy farm machinery are often taken on by men, particularly on larger, commercially-oriented farms. This puts women without a male partner at a disadvantage, as they often have to hire outside labor to support these tasks. Women are also generally primarily responsible for housework and caring for dependents,

¹ PHUONG Leapheng and Florent Peter Berend ZWIERS (2018), 'The Important Role of Cambodian women in the Agriculture Sector' Grant No: 109775-001 Page 6

which some interview respondents cited as the reason they were unable to participate in agricultural trainings or capacity-building activities at the same rate as men. Both men and women have limited roles in processing, as this is a sector that is still quite limited in Cambodia. The small-scale processing that does occur, however, is generally carried out by women.

Even though women played key roles in agricultural production, their position in the leadership of the agricultural sector is limited. Women are just over half (51%) of the agricultural labor force, and produce 70% of the country's food, but are only 24% of household agricultural holding managers, 12% of agricultural extension officers and 10% of agricultural extension services beneficiaries. 60% of agricultural cooperative members and 34% of agricultural cooperative Board of Directors are women. Result of survey showed that few members of agricultural cooperative committees are women, and the women who are involved often fill administrative positions while men take on leadership roles.

Regardless of gender, the biggest challenges faced by vegetable farmers in Cambodia included fluctuations in vegetable price and demand and difficulty meeting domestic quality standards as per contract farming agreements designed to supply supermarkets or vegetable shops. Farmers with contracts to supply supermarkets and vegetable shops struggle to produce vegetables that meet the required minimum standards in terms of size, appearance, and weight due to limited agricultural technology and knowledge and difficulties adapting to variable weather conditions. Additionally, the high price of agricultural inputs (including many climate-smart technologies) hampered vegetable producers in the areas. Women face additional barriers, including challenges operating heavy machinery and time poverty² which limits their ability to access trainings and attend agriculture-related events.

These barriers also prevent farmers from accessing climate-smart interventions, with many farmers highlighting that the high upfront cost of these interventions coupled with uncertainty surrounding vegetable yields and prices made investment too risky. Largely, however, farmers were broadly aware of the benefits of these technologies, and many farmers already use more affordable interventions such as drip irrigation, spray tube irrigation/sprinklers, and plastic mulch. Costlier tools like net houses³ are less frequently used. Most farmers who do use net houses received both technical and financial support from the government or an NGO to construct them.

Based on the findings, researchers proposed the following recommendations to increase vegetable production and income of farmers and reduce gender gaps in vegetable production, such as:

1. **Develop awareness and capacity among local agricultural service providers to develop trainings and resources that are accessible to and meet the needs of both male and female farmers.** This includes ensuring all actors are aware of the specific barriers women face, how this inequity negatively impacts all members of the community, and how these constraints can be alleviated. Some options for increasing women's access may include holding trainings at times convenient for women, allowing women to attend with their children, or sharing training summaries electronically via a platform that is accessible to women in rural areas (e.g. Telegram groups which allow for voice and video messaging).
2. **Provide trainings on gender directly to both male and female farmers.** To create meaningful change for women engaged in vegetable value chains, the research team recommends considering developing and implementing these trainings at the household level. To increase sustainability, one option may be to develop the capacity of agricultural cooperatives and other existing actors to provide these trainings directly to farmers by integrating them into existing curriculum.
3. **Work with financial institutions to provide access to safe, low-cost financing options for climate-smart technologies.** One of the biggest barriers to adopting climate smart technologies such as net houses was the high cost of these products. To help farmers mitigate risk, the research team recommends working with reputable financial institutions to provide access to safe, low-cost financing options for farmers to invest in net houses and other climate-smart technologies. To increase uptake, it may be beneficial to offer loans

² Time poverty refers to the fact that women often have less free time to attend trainings or other events as a result of their disproportionate responsibilities for care work.

³ Net houses or shade houses are structures enclosed by agro nets or any other woven material to allow required sublight, moisture, and air to pass through the gaps. It creates an appropriate micro-climate conducive to plant growth.

in which the payments correspond to harvest cycles and fluctuations in crop pricing as a means of reducing uncertainty and mitigating risk for farmers.⁴

4. **Market climate-smart technologies to women by demonstrating how these technologies can meet women's unique needs.** In some cases, female farmers who did not have a male partner reported that commercial farming was more challenging as it is often physically difficult for women to take on certain tasks, including operating heavy machinery. Building awareness of climate-smart technologies should include ensuring that women are fully aware of how these technologies can help them break down barriers to entry and participate more fully in all stages of the farming process. Climate-smart technologies have a significant role to play in reducing the gender gap in labor burden for women in agriculture. Female farmers will invest in these technologies if they are well aware of its effectiveness rather than hiring labor over time. An impact approach to address this gap can be useful in developing a women-responsive climatic risk management plan focused on reducing their labor burden in agriculture, especially in areas with high climate risks. The plan includes mapping women in agriculture, climate risks, and poverty hotspots and entails understanding the role of women in agricultural activities to identify the suitable CSA options for reducing the levels of labor drudgery.
5. **Strengthening of value-added processing.** The agricultural processing section in Cambodia remains limited due to limited processing facilities and technologies, a lack of capital to develop these resources, fluctuations in the supply of qualified vegetables, and high operational costs, namely as a result of the high price of electricity. One option to address these issues could be to support the formation of public private partnerships, through which the government can collaborate with NGOs, service providers, and financial institutions to strengthen the capacity of processors. This could include introducing new processing technologies and machinery, providing technical support, facilitating contract agreements between farmers and processors, expanding market linkages between processors and domestic and international buyers, and providing financial support for manufacturing operations.
6. **Strengthening market linkages between producers and buyers.** Through qualitative interviews, farmers reported that they faced several challenges, including frequent fluctuations in the price of vegetables, limitations related to agricultural techniques, unstable demand from collectors, and the high cost of agricultural inputs. To address these challenges, the project could consider working with the government and private sector to establish and strengthen farming contracts between producers and buyers to secure stable markets for vegetable producers.

2.0 INTRODUCTION

2.1 Background/Context

Despite Cambodia's rapid economic growth and recent shift from a purely agrarian economy to a service and production-based economy, agriculture remains the backbone of the Cambodian economy. Nearly 61 percent of Cambodians live in rural areas, with 77 percent relying on agriculture, fisheries, and forestry for their livelihoods.⁵ The agricultural sector in Cambodia plays an important role in poverty reduction and employment, comprising 22.1% of GDP⁶ and generating 35% of the country's employment in 2019⁷.

Cambodia's agricultural sector is increasingly under threat from climate-driven weather events such as extreme flooding or drought. As one of the most disaster-prone countries in Southeast Asia, Cambodia regularly experiences seasonal drought, floods, and typhoons. Poor management and storage of existing water resources coupled with erratic rainfall and an increasing truncated monsoon season contribute to droughts. In addition, approximately 80% of the country's population lives along the Mekong River, an area increasingly prone to flooding during the southwest

⁴ Hira Channa, Jacob Ricker-Gilbert, Shiferaw Feleke, Tahirou Abdoulaye, Overcoming smallholder farmers' post-harvest constraints through harvest loans and storage technology: Insights from a randomized controlled trial in Tanzania, *Journal of Development Economics*, Volume 157, 2022, 102851, ISSN 0304-3878, <https://doi.org/10.1016/j.jdeveco.2022.102851>. (<https://www.sciencedirect.com/science/article/pii/S030438782200027X>)

⁵ USAID Cambodia: Agriculture and Food Security

⁶ Asian Development Bank (2021) Cambodia Agriculture, Natural Resources, and Rural Development Sector Assessment, Strategy and Road Map: <https://www.adb.org/sites/default/files/publication/718806/cambodia-agriculture-rural-development-road-map.pdf>

⁷ The World Bank "Employment in agriculture (% of total employment) (modeled ILO estimate) – Cambodia" accessed by 10th January 2023: <https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?end=2019&locations=KH&start=2018>

monsoon from mid-May to late-October⁸. In 2015 alone, the estimated loss and damage associated with climate-related natural disasters in Cambodia was USD 1.5 billion⁹.

The impacts of climate change are predicted to worsen and are forecasted to victimize seven million Cambodian smallholder farmers. As the instances of climate-driven natural disasters increase, Cambodia is ill-prepared to cope with the impacts, ranking 152nd out of 181 countries on the ND-GAIN Country Index of resilience in 2019.¹⁰ The rural poor population, of which the majority are women, are most affected by the impacts of climate change. ActionAid's 2019 Cambodia Women's Resilience Index, which captures resilience to climate change across four dimensions (economic, infrastructure, social, and institutional), found that women were less resilient than men both overall and across each individual dimension.¹¹ Women are often more severely affected by the impacts of climate change as a result of gender-based inequalities which leave them more exposed to disaster risks and limit their access to resources, healthcare, and security in the aftermath of a disaster. Women's livelihoods and domestic activities are also predominantly and disproportionately dependent on agriculture and natural resources. As women and girls are typically responsible for securing fuelwood, water, and food as well as serving as primary caregivers, their work increases both during and after a disaster, when access to these critical resources may become scarce.

In Cambodia, the government has instituted policies designed to recognize the role of women, fight against discrimination, and promote gender equality. These policies also call for the empowerment of women in agriculture, including recognizing the value of their work in the provision of food. In this male dominated sector, the most critical challenges for women include the negative impacts of traditional norms – enshrined in documents such as the Chbab Srey, or Women's Code of Conduct - in shaping the roles and responsibilities of rural women within the family and society.¹² These norms result in a lack of meaningful participation for women across all sectors, including along most agricultural value chains. These challenges are especially pronounced for vulnerable subgroups, including women with disabilities, the LGBTQI community, and indigenous women.

2.2 Research Objectives

To address these challenges, Grow Asia, a multi-stakeholder platform in Southeast Asia working in partnership with Canada's International Development and Research Center (IDRC), has begun implementation of the ASEAN Green Recovery through Equity and Empowerment (AGREE) project in Cambodia, the Philippines, and Viet Nam. To increase understanding of gender and climate-related dynamics along promising value chains in the Cambodian agricultural sector, Causal Design has partnered with Outreach R&D Consulting Co., Ltd and [Gender and Development for Cambodia](#) (GADC) organization to conduct this Gender- and Climate-responsive value chain analysis of vegetable value chains in Cambodia.

The key research objectives under this assignment included:

1. Understanding the roles that both women and men working in agriculture value chains play in climate mitigation and adaptation practices.
2. Identifying the barriers and challenges that hinder women's and men's ability to participate in and access resources and opportunities in low-carbon agriculture value chains
3. Distinguishing which climate innovation practices or solutions may help both women and men overcome gender-based constraints in agricultural value chains
4. Determining possible entry points for promoting and scaling women's empowerment and gender transformation in agricultural value chains using a low-carbon economy lens

⁸ World Bank. 2021. Climate Knowledge Portal

⁹ Open Development Cambodia "Climate change" accessed by 10th January 2023: [https://opendevelopmentcambodia.net/topics/climatechange/#:~:text=Cambodia%20lost%20%241.5%20billion%20%E2%80%93%2010,Asian%20Development%20Bank%20\(ADB\).](https://opendevelopmentcambodia.net/topics/climatechange/#:~:text=Cambodia%20lost%20%241.5%20billion%20%E2%80%93%2010,Asian%20Development%20Bank%20(ADB).)

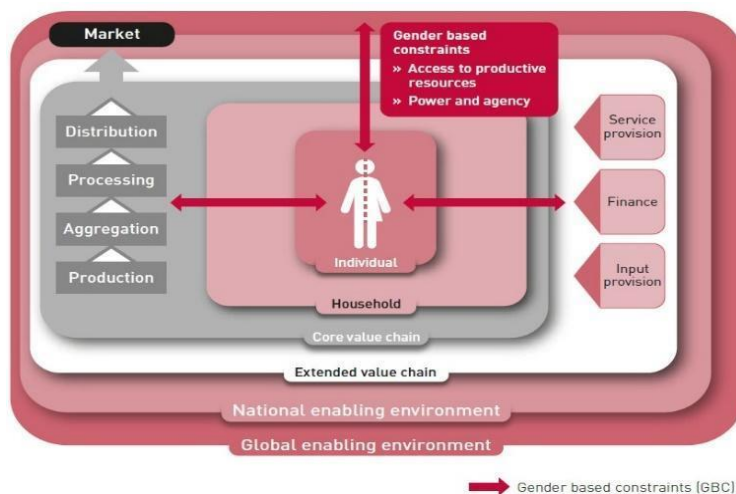
¹⁰ Notre Dame Global Adaptation Initiative, ND-GAIN Country Index, 2019.

¹¹ ActionAid Cambodia, Cambodia Women's Resilience Index. 23 December 2019.

¹² Anderson, E., & Grace, K. (2018). From Schoolgirls to "Virtuous" Khmer Women: Interrogating Chbab Srey and Gender in Cambodian Education Policy. *Studies in Social Justice*, 12(2), 215–234. <https://doi.org/10.26522/ssj.v12i2.1626>

3.0 METHODOLOGY

Gaining a more comprehensive understanding of existing gender dynamics and climate risk reduction mechanisms required a multi-stage approach. First, the research team identified and selected a promising priority value chain based on a comprehensive desk review of existing resources/data. To reduce subjectivity in the crop selection process, crops were selected using a weighted index designed to capture multiple dimensions of interest, including profitability, production potential, engagement of women, and potential for climate adaptation, among others. A more detailed description of this process is presented in Section 2.2, below. After selecting a promising value chain for further analysis, the research team conducted a thorough literature review of currently available data to understand existing gender dynamics and climate-responsive adaptations and limitations along the value chain. Finally, the research team conducted primary qualitative interviews with a selection of key stakeholders along the chosen value chain. Qualitative interview guides were informed by information obtained through the literature review and were designed to provide more nuanced insights and first-hand perspectives in areas where existing data may be scarce.



This study is guided by **FAO's Gender-Sensitive Value Chains Framework (GSVC)** to frame the areas of inquiry particularly on the gender-based constraints experienced by women relevant to their access to resources and agency in different areas of their participation in value chain activities.

Source: FAO 2016

3.1 Research Questions

The Gender- and Climate-responsive Value Chain Analysis of Vegetable Value Chains in Cambodia is guided by the following research questions:

1. **What roles do women and men working in agriculture value chains currently play in climate mitigation and adaptation practices?**
 - a. *How is labor divided along the chosen value chain? In what value chain activities do men and women engage?*
 - i. *Which nodes of the value chain are currently dominated by women and why?*
 - b. *How is ownership of land or other assets distributed and controlled?*
 - c. *Who is in charge of financial decision-making? Who is in charge of financial management? Who has access to financial services?*
 - d. *To what extent are both women and men involved in productive decision-making within the chosen value chain?*
2. **What barriers and challenges hinder women's and men's ability to participate in and access resources and opportunities in low-carbon agriculture value chains?**
 - a. *What social, economic, and structural barriers, challenges, and opportunities exist to reducing carbon emissions along the value chain? How do these differ by gender?*

3. **What climate innovation practices or solutions may help women and men overcome gender-based constraints in agricultural value chains?**
 - a. *What existing policies and practices are already being implemented in Cambodia?*
4. **What entry points exist for promoting and scaling women's empowerment and gender transformation in agricultural value chains using a low carbon economy lens?**

3.2 Existing Climate-Smart Agriculture in Cambodia

Climate-smart agriculture (CSA) is defined by the World Bank as “an integrated approach to managing landscapes, [including] cropland, livestock, forests, and fisheries, that addresses the interlinked challenges of food security and climate change.”¹³ CSA supports the people who manage and depend on agricultural systems to mitigate the impacts of climate change while also maintaining an explicit focus on reducing emissions and addressing the drivers of climate change. CSA aims to benefit farmers, consumers, and the planet through the triple objectives of sustainably increasing productivity and income, enhancing resilience and reducing vulnerability to natural disasters, and reducing greenhouse gas emissions where possible.¹⁴ Currently, a variety of climate-smart technologies are practiced in Cambodia, including the use of drip irrigation, practicing conservation tillage, and applying net houses to crops. Table 1, below, presents an overview of the CSA technologies and practices relevant to this research.

¹³ <https://www.worldbank.org/en/topic/climate-smart-agriculture>

¹⁴ FAO “Climate-Smart Agriculture” accessed by 06 January 2023: <https://www.fao.org/climate-smart-agriculture/overview/en/>

Table 1. Existing climate-smart agriculture technologies in Cambodia

Name of technology	Purpose of farming ¹⁵	Description (why climate-smart)	Adoption in Cambodia (score) ¹⁶	Challenges	Benefit of technology
Drip irrigation	Sustainable water use and management.	The system uses pipes, valves, and small drippers or emitters transporting water from the sources (i.e. wells, tanks and or reservoirs) to the root area and applying it under particular quantity and pressure specifications. Drip irrigation technology can support farmers to adapt to climate change by providing efficient use of water supply. Particularly in areas subject to climate change impacts such as seasonal droughts, drip irrigation reduces demand for water and reduces water evaporation losses (as evaporation increases at higher temperatures).	3.93 (Very high)	There are several challenges of farmers in adopting the technology, including the fact that drip irrigation systems require a large initial investment. Additionally, they can be easily damaged by heavy rainfall or by rodents and other animals. For large farmers, it can also be difficult to combine drip irrigation with mechanized production such as tractors or other heavy machinery, which can damage pipes, tubes, or emitters.	The primary benefits to drip irrigation include: (1) It's economically efficient after installation; (2) it reduces labor requirements; (3) it has a high potential for scalability; (4) access is equitable among communities; (5) it reduces negative environmental impacts; and (6) it improves health and safety.
Sprinkler irrigation	Sustainable water use and management.	Sprinkler irrigation is a type of pressurized irrigation that consists of applying water to the soil surface using mechanical and hydraulic devices that simulate natural rainfall. Sprinkler irrigation technology can support farmers to adapt to climate	3.73 (Very high)	Challenges to using sprinkler irrigation include climate conditions, identifying a suitable water source, and high initial investment costs. Sprinklers are highly impacted by weather, and even moderate wind can alter the distribution pattern of the	Sprinkler irrigation provides a wide range of benefits, including: (1) Increasing economic efficiency after installation; (2) a high potential for scalability; (3) equitable access to resources among communities; (4) low environmental impact; (5)

¹⁵ MAFF (2019) Adaptation Technologies Guide – Agriculture:

¹⁶ MAFF set 12 criteria for assessing the adaptation of the climate smart agricultural technologies: cost, economic efficiency, labour investment, flexibility/scalability, reliance on technical support, relevance, equity, institutional feasibility, environmental impact and health and safety, market orientation, likelihood of community acceptance, and impact on climate change adaptation. Criteria were weighted by percentage (with a combined weighting of 100 percent) according to their relative importance. Each adaptation technology was then assessed and assigned a score of one to five for each criterion. The final score for technological adaptation is classified into: very high (> 3.5); high (>3- <3.5); medium (> 2.5- 3.0); low (<2.5). The highest score is considered as high adaptation.

		<p>change by making more efficient use of their water supply.</p> <p>Sprinkler irrigation technology can support farmers to adapt to climate change by making more efficient use of their water supply.</p>		<p>water droplets. In addition, when operating under high temperatures, water can evaporate at a fast rate reducing the effectiveness of the irrigation.</p> <p>This technology also relies on a clean source of water and therefore may not be suited to areas where rainfall is becoming less predictable.</p> <p>Additionally, implementation costs are higher than that of gravity-fed irrigation systems and large labor force is needed to move pipes and sprinklers in a non-permanent system.</p>	<p>increased health and safety; and (6) increased yields.</p>
Windmill water pump	Sustainable water use and management.	<p>Windmills are energy efficient, and environmentally friendly solutions for pumping water to crops.</p> <p>They present a more sustainable alternative to traditional pumps, which are often powered by gas or electricity.</p>	2.34 (Low)	<p>Challenges to adopting this technology include limited availability locally, high initial investment costs, and a lack of suitable windmill products for Cambodia (global windmills are designed for high wind speeds, while Cambodia most often experiences low wind speeds).</p>	<p>Windmills benefit farmers by allowing them to save money on maintenance costs (as compared to operating traditional water pumps) and by limiting polluting emissions during service.</p>
Solar water pumps	Sustainable water use and management.	<p>A solar-powered pump is a pump running on electricity generated by photovoltaic (PV) panels or the radiated thermal energy available from collected sunlight as opposed</p>	2.84 (Medium)	<p>Solar water pumps require a large upfront investment to install, which is often challenging for farmers. Repairs also often require hiring a skilled technician, which can be difficult to</p>	<p>Solar water pumps provide several key benefits, including: (1) Low operation and maintenance costs; (2) lower environmental impact than pumps powered by an internal</p>

		to grid electricity or diesel-run water pumps. it is highly relevant, and is environmentally friendly.		find. Additionally, these pumps will not run if the sun is not shining, requiring farmers to store water for cloudy days.	combustion engine; (3) increased access to vital water resources in remote rural locations where electricity is inaccessible.
Smart irrigation/ mobile app irrigation systems¹⁷	Sustainable water use and management.	Smart irrigation/ mobile app irrigation systems are a brand-new irrigation technology was introduced by Cambodian youth in 2019. The Smart Farm Assistance (SFA) app will allow farmers to control their water systems remotely and monitor humidity and check soil data through a few simple taps on a phone ¹⁸ .	Data not available	There are several serious challenges to adopting mobile-based solutions in rural Cambodia, including difficulties related to fluctuating internet coverage and accessibility as well as the high cost of services. Ultimately, the company originally providing this service closed due to a lack of demand for these reasons.	If applied, this technology can allow farmers to conserve both time and water. Smart irrigation systems saved up to 40% more water than gravity irrigation systems, on average.
Conservation tillage (no tillage)	Integrated soil management	Conservation tillage is any tillage practice that builds up crop residues on the soil surface to minimize the impact of water and wind erosion. ^{19,20}	2.94 (Medium)	Challenges to applying conservation tillage include the large initial investment of time and money required to purchase equipment and pesticide as well as the fact that higher levels of surface residue can result in higher plant disease and pest infestations, if not managed properly.	Conservation tillage is highly relevant for farmers and communities as it is highly scalable and minimizes the negative impact of farming on both the environment and health and safety. It is considered to have a high impact on climate change adaptation because of the perceived benefits from improved land and soil management as a result of improved management of water and organic matter.
Plastic mulch/ organic mulch	Integrated soil management	Mulch is a layer of material applied to a soil surface area to conserve	3.31 (High)	Challenges to adopting this technology include the high cost and	The key benefits to this adaptation include: (1) The high degree of

¹⁷ Smart irrigation/ mobile app irrigation systems are a brand-new irrigation technology was introduced by Cambodian youth in 2019. However, this company was closed because low adaptation from farmers as well as due to difficulty to managing the technology as a result of fluctuations in internet coverage and accessibility in some areas, and high cost of services (on-phone called to Sreyling Meng, founder of smart farm assistance).

¹⁸ KhmerTimes” Teenager aims to develop smart farms to boost productivity” accessed by 8th January 2023: https://www.khmertimeskh.com/50823929/teenager-aims-to-develop-smart-farms-to-boost-productivity/?fbclid=IwAR1NEIOVBWFrRW1YJ411Jfh-8Ycv3aOm-e_co-UHogRwGu2WE0JTtBVhyU

¹⁹ Bergtold, J. and Sailus, M. Conservation Tillage Systems in the Southeast: Production, Profitability, and Stewardship. Sustainable Agriculture Research and Education (SARE).

²⁰ It consisted of three technologies. First, no-till is a way of growing crops without disturbing the soil. This practice involves leaving the residue from last year’s crop undisturbed and planting directly into the residue on the seedbed. Second, Ridge-till is a practice where the soil is left undisturbed from harvest to planting and crops are planted on raised ridges. Third, Mulch-till techniques involve disturbing the soil between harvesting one crop and planting the next but leaving around a third of the soil covered with residues after seeding. Implements used for mulch-till techniques include chisels, sweeps, and field cultivators.

		moisture, improve the fertility and health of the soil, reduce weed growth, and enhance the visual appeal of the area.		the fact that it is relatively labor-intensive to install and maintain.	flexibility and scalability; (2) its relevance at both the farmer and community level; and (3) its low negative impact on environment, health and safety.
					It is considered to have a high impact on climate change adaptation by improving land and soil management.
Net houses	Sustainable crop management	Net houses are structures which are enclosed by agro nets or other woven material to allow required sunlight, moisture, and air to pass through the gaps, thus creating an appropriate microclimate conducive to plant growth. ²¹	Data not available	Currently, net houses are not widely utilized by Cambodian farmers due to the large upfront investment required for purchase. Farmers who have adopted the technology generally did so through support provided by the government or other NGOs. ²²	Nethouses benefit farmers by increasing agricultural yields and improving vegetable safety and quality by preventing damage from pests, preventing weeds, reducing soil moisture loss, and providing protection from harsh sunlight all while limiting the use of chemical pesticides.

²¹ HONG, S., LOR, L., BUNTONG, B., TONG, S., & LEGRAND, K. (2018). The Effectiveness of Different Net-coverings on Production Yield of Chinese mustard (*Brassica juncea*) at Royal University of Agriculture. International Journal of Environmental and Rural Development, 9 (1), 162-167.

²² The ASPIRE project, implemented by the MAFF, is an example of a project that provided nethouses to support farmers in Kampong Cham province.

3.3 Identification of Priority Value Chain

To identify the most relevant value chain(s) for further analysis, the research team adapted the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) 'Guidelines for Value Chain Selection' to construct an objective crop selection index designed to both fit the Cambodian context and align with CPSA's research objectives.²³ The final index, which is presented in more detail in Table 2, below, also incorporated measures of women's empowerment and adoption of climate-smart technologies, which were weighted more heavily to capture their importance in future components of this research. The crop selection matrix incorporated a total of seven selection criteria, including:

- **Profitability:** Defined as the profit margin of the crop per hectare (in USD). Data on profitability was obtained from various sources.²⁴ Profitability was weighted to be 20% of the total score due to its importance in terms of the overall viability of investment in the value chain, contribution to household income, and role in magnifying the positive impacts of increasing women's empowerment.
- **Area harvested:** Represents the total area under cultivation for each crop, measuring in hectares. Data on total area harvested was obtained through data collected by the annual report of the Ministry of Agriculture, Forestry and Fisheries published in 2021.
- **Processing potential:** Captures opportunities for investment and the subsequent production of higher value-added products along each value chain. It is based on a qualitative determination of current investment opportunities based on data obtained through the Strategic Framework and Programs for Economic Recovery in the Context of Living with COVID-19 in a New Normal 2021 – 2023 (published in 2021).
- **Production risk:** Defined as crop resilience to climate change, measured by the number of crop cycles per year. Crops that can be grown and harvested multiple times per year are considered to reduce farmers' vulnerability to climate-related disasters that might wipe out a harvest cycle.
- **Women's participation and empowerment:** Captured the current level and depth of engagement of women along each value chain. Value chains in which women participated at higher rates than men across all stages of production and processing were rated as 'high' in this area. Value chains in which women and men participated in the value chain at equal rates and in similar activities were given a medium score, while value chains in which women participated at a lower rate or were concentrated in lower-level activities received a 'low' score. Female participation was weighted to be 20% of the total index score due to its importance as a key programmatic and research priority. Data on women's participation was obtained through a comprehensive review of existing literature, including research conducted by the Asian Development Bank, CamboDHRRA, and the University of Sydney Institute of Agriculture into gender dynamics along various agricultural value chains in Cambodia.^{25,26,27}
- **Potential for adoption of climate-smart technology:** Refers to whether or not climate-smart technologies are currently accessible and adoptable within a given value chain. Value chains in which climate-smart technologies have largely already been adopted in Cambodia received a 'high' score in this area. Those value chains for which climate-smart solutions existed in-country and were in the early stages of adoption but had not reached the majority of producers were assigned a score of 'medium'. If these technologies were not yet available in-country or significant barriers to adoption were identified, the value chain received a 'low' score in this area. Potential for adoption of climate-smart technology was weighted to be 20% of the total index score due to its importance as a key programmatic and research priority.
- **Relevance to national priorities:** Captures a given value chain's relevance to the export priorities of the Cambodian government, as determined by the General Department of Agriculture. For this component, only two criteria were considered: Crops that were selected as relevant were given a score of 'high', while those that were not were given a score of 'low'.

²³ GIZ Guidelines for Value Chain Selection: Integrating economic, environmental, social and institutional criteria. October 2015.

²⁴ Agri and Climate Smart Agriculture (CSA) Finance Market Assessment in Cambodia, July 2022 (unpublished);

Durian:<https://www.phnompenhpost.com/business/govt-lends-hand-local-durian-cultivation>; <http://www.gocambodia.com/coconut-plantation-in-cambodia.html>; <https://www.phnompenhpost.com/business/battambang-oranges-making-comeback>; H.E.P. Sokhannaro (2011) Oil Palm Expansion in South East Asia: trends and implications for local communities and indigenous peoples. Palm oil development in Cambodia, P70

²⁵ Promoting Women's Economic Empowerment in Cambodia, 2015. Asian Development Bank (ADB).

²⁶ Bunly, Kep. Gender Scoping to Enhance Development in Responsible Agricultural Investment in Cambodia, November 2020. CamboDHRRA.

²⁷ Fong, R., Rebecca Cross, and Robert Martin. 'Analysis of the vegetable value chain and gender roles in vegetable production in northwest Cambodia', 2006. The University of Sydney, Sydney Institute of Agriculture, School of Life and Environmental Sciences, Faculty of Science, Sydney, NSW 2006, Australia.

These criteria were weighted to provide an overall score for each crop, providing a more objective mechanism for selecting potential crops most suitable to the research context. Table 1, below, presents a detailed overview of the weights and scoring mechanisms associated with each of the above criteria.

Table 2. Crop Selection Matrix

Selection Criteria	Weight (%)	Unit of Measurement	High (Score 3)	Medium (Score 2)	Low (Score 1)
Profitability	20	US Dollars /hectare	More than 1000	Between 500 & 1000	Below 500
Area harvested	10	Hectares	More than 150,000	Between 50,000 & 150,000	Below 50,000
Processing potential	10	Qualitative	Significant scope for investment	Investment depends on market potential	Limited investment potential
Production risk	10	No. of crop cycles in a year (High Score attributes to lower risk & vice versa)	Low Risk – More than 3 cycles	Medium Risk – 2 to 3 cycles	High Risk – 1 cycle
Women’s participation and empowerment	20	Qualitative	High rate of women involvement in value chain and empowerment.	Medium rate of women involvement in value chain and empowerment.	Low rate of women involvement in value chain and empowerment.
Potential for adoption of climate-smart agriculture (CSA) technology	20	Qualitative	High potential for adoption of CSA technology	Medium potential for adoption of CSA technology	Low potential for adoption of CSA technology
Relevance to National Export Priorities	10	Qualitative	Highly relevant to national export priorities		Not relevant to national export priorities

Source: The crop selection matrix is adopted from the ‘Guideline for Value Chain Selection: Integrating economic, environmental, social and institutional criteria’ and the ‘Toolkit for Value Chain Analysis and Market Development: Integrating Climate Resilience and Gender Responsiveness’ published by FAO, September 2020.

The research team used the above index to assign scores to a total of 40 crops grown in Cambodia, including a selection of cash crops, vegetables, fruits, oilseeds, and beans/pulses. Based on the final index values, vegetables and rice emerged at the top of a shortlist of crops, followed by cassava, pepper (*piper spp.*), and cashew nuts. The research team ultimately selected vegetables as the focus of this research for several reasons, including:

- 1. Vegetable value chains offer significant potential for women to participate in a meaningful way.** Generally, women make up a meaningful proportion of smallholder farmers in Cambodia, with approximately 70 percent of them engaging in agriculture work on their own land or working as unpaid family workers.²⁸ Unlike rice production, growing vegetables does not require a large plot of land or a substantial outside labor force. This reduces the initial barriers to entry many women face (small land area, lack of access to capital, inability to work far from the home due to care responsibilities), opening the door for increased female engagement on the production side of the value chain.
- 2. Vegetable value chains offer a clear entry point for the adoption of climate-smart technologies and conversion to organic production.** Cambodian farmers traditionally grow vegetables on small plots of

²⁸ PHUONG Leapheng and Florent Peter Berend ZWIERS (2018) *The Important Role of Cambodian women in the Agriculture Sector*

land, making it more accessible and less costly for them to apply climate-smart technologies such as plastic mulch, organic mulch, drip irrigation, smart-farm assistance, solar pumps, and other tools. In contrast, rice farms typically have large farms, which require large initial investments to integrate climate-smart technologies. Small vegetable plots are thus thought to offer an easier entry point to encourage conversion to sustainable production and adoption of new technology.

3. **Vegetable farming offers a higher potential for profitability for smallholder farmers.** In Cambodia, vegetables (including leafy greens, cucumbers, radish, pumpkin, and eggplant) were the most profitable to produce when compared to cassava, maize, dry season rice, and wet season rice. Vegetable production results in the highest total revenue (\$2,843/ha), followed by cassava (\$1,297/ha) and dry season rice (\$992/ha). Wet season rice and maize produce the lowest total revenue at approximately \$750/ha.²⁹ Globally, vegetables are considered to be high-value crops, with studies demonstrating that profits from vegetables can be 3 - 14 times higher per hectare than those from growing rice.³⁰
1. **Vegetables offer increased protection from climate-related risks when compared with perennial crops.** Farmers can grow vegetables in more than three cycles per year. In the event of a disaster such as a flash flood, drought, or heavy rain, farmers can restart farming and relatively quickly recover lost income from production. In contrast, perennial crops such as rice, mango, and cassava can only be produced and harvested once a year. Farmers who grow these crops risk losing an entire year's income in the event of a natural disaster that wipes out production.

Table 4. Shortlisted Crops

Name of Crops	Score	Rank	Status
Vegetables*	1.44	1	Selected
Rice	1.34	2	Shortlisted
Cassava	1.04	3	Shortlisted
Pepper (piper spp.)	1.04	3	Shortlisted
Cashew	0.84	4	Shortlisted
Pineapples	0.74	5	Shortlisted

*Examples of vegetables include leafy vegetables, cucumber, radish, pumpkin, and eggplant.

3.4 Literature Review

To refine the methodological approach for this study and inform the development of qualitative questionnaires, the research team began by conducting a thorough literature review of Cambodia's vegetable sector. This included reviewing existing studies, relevant program evaluations, and government data and publications to gain an understanding of the history and economic relevance of vegetable value chains in Cambodia, key actors within these value chains, the current roles of men and women in vegetable production and processing, existing challenges faced by women engaged in the sector, and the impact of climate change and natural disasters on vegetable production in Cambodia. Key findings obtained through this literature review are presented in more detail alongside qualitative findings in the 'Results' section of this report.

²⁹ World Bank. (2015). Cambodian agriculture in transition: Opportunities and Risks (Economic and sector work report no. No. 96308-KH

³⁰ Feed the Future Innovation Lab for Horticulture "Agricultural innovations help Cambodian farmers thrive" accessed by December 29, 2022: <https://horticulture.ucdavis.edu/blog/agricultural-innovations-help-cambodian-farmers-thrive>

3.5 Qualitative Component

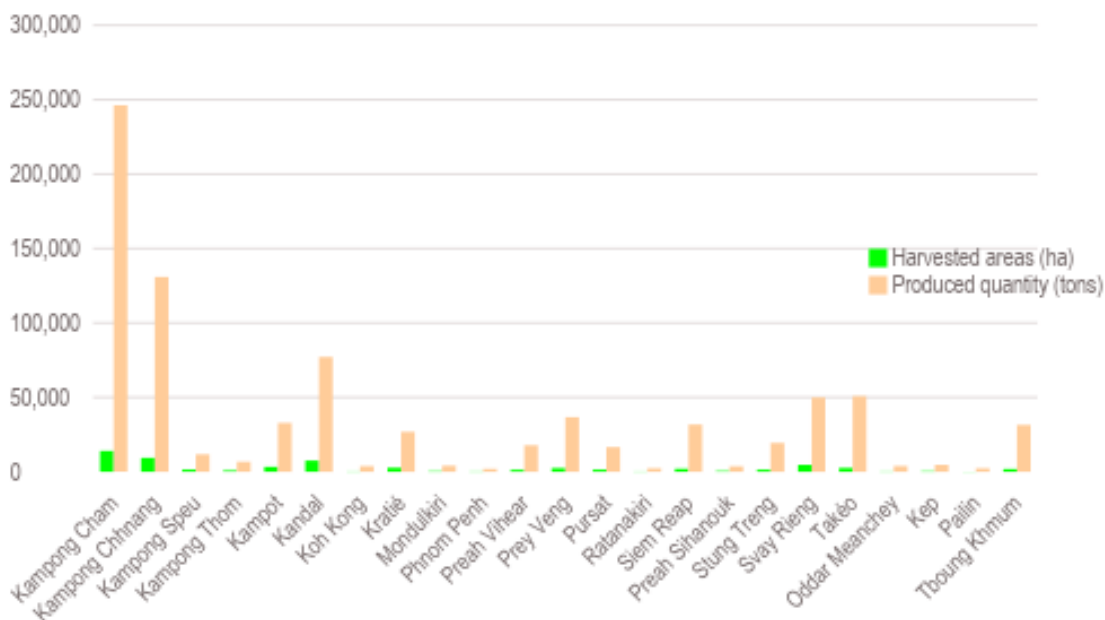
To build upon insights obtained through the literature review presented above, the research team plans to conduct a series of primary qualitative interviews to better understand the experiences of key stakeholders along all aspects of the vegetable value chain in Cambodia.

3.5.1 Sampling Frame

Selection of Geographic Areas

According to a report published by the Cambodian Ministry of Agriculture, Forestry, and Fisheries (MAFF), Cambodian vegetable production has increased by approximately 40% between 2015 and 2021, from 405,528 tons to 908,594 tons, due in large part to increased access to technology and government investment in the sector. Of the 25 provinces in Cambodia, Kampong Cham is the top vegetable-growing region, with 14,016 hectares under cultivation and total production of 246,404 tons of produce in 2021. Other top vegetable-producing provinces include Kandal and Kampong Chhnang (see Figure 1, below).³¹ The research team selected Kampong Cham as the best location to conduct qualitative interviews due to high levels of existing involvement in the vegetable sector at both the subsistence/household level as well as for commercial purposes.

Figure 1. Comparison of Vegetable Production Areas (2021)³²



Within Kampong Cham, two districts (Chamkar Leu and Steung Trong) were selected as study areas. Chamkar Leu is the top vegetable-growing district within Kampong Cham, both in terms of area under cultivation as well as volume produced. Vegetable production in Chamkar Leu is generally more commercially-oriented and the district is comprised of primarily large farmers who tend to have a greater level of access to resources and technology than the average Cambodian smallholder. While Steung Trong is the second-highest vegetable-producing district in Kampong Cham, farms in this area tend to be smaller and more oriented towards domestic markets or home

³¹ Cambodia Ministry of Agriculture, Forestry, and Fisheries; 2021.

³² Chart is created by author with data from Annual Outputs Report 2021 published by the Ministry of Agriculture, Forestry, and Fisheries (only available in Khmer)

consumption. These two areas are thought to offer as comprehensive an overview of the vegetable sector in Cambodia as possible given sample size restrictions.

Table 4. List of Vegetable Growing Areas in Kampong Cham Province

Province	District	Growing areas (ha)	Harvested areas (ha)	Yield (ton/ha)	Quantity (ton)
Kampong Cham	Batheay	5	0	0	-
	Chamkar Leu	3185	2321	12.00	27,852
	Choeung Prey	45	40	12.16	486
	Kampong Cham	70	15	5.00	75
	Kampong Seam	217	150	12.50	1,875
	Korng Meas	581	479	12.00	5,748
	Koh Sothin	183	183	5.60	1,025
	Prey Chor	112	53	11.00	583
	Srey Santhor	1204	1015	14.90	15,124
	Steung Trong	2500	1500	14.00	21,000
Total		8,102.00	5,756.00	11.01³³	73,768

Source: Report from Kampong Cham Provincial Department of Agriculture, Forestry and Fisheries accounted by August 22, 2022.

Participant Selection

The research team purposely selected respondents for inclusion in this research to ensure that the chosen respondents were sufficiently involved in local vegetable production and were adequately representative of key demographic subgroups. Based on the preliminary literature review of Cambodian vegetable production described above, the research team identified key actors most relevant for inclusion in the qualitative portion of this research. This included Provincial Department of Agriculture, Forestry and Fisheries (PDAFF) staff, representatives of agricultural enterprises, input suppliers, traders/collectors, processors, farmers, and agricultural cooperatives. A total of eight Key Informant Interviews (KIIs) were conducted with respondents both within and outside the target provinces (in cases where the respondent type manages a large region). The respondents were selected based on the relevance of their role and with the objective of maximizing female representation, where possible. Additionally, six Focus Group Discussions (FGDs) (with approximately 8-12 participants for each group) were conducted with farmers and representatives of agricultural cooperatives located in the Chamkar Leu and Steung Trong districts of Kampong Cham province. Half of all FGDs with farmers included only female participants, while FGDs conducted with agricultural representatives sought to achieve as close to equal male and female participation as possible (details provided in Table 5, below). Where possible, the research team also sought to be inclusive of diverse perspectives, including disability status, age, and ethnicity.

Table 5. Qualitative Sampling Frame

No	Respondents	Province/ city	District	Number of interviews	Interview method	Gender split
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³³ Mean of all areas in which vegetables are grown

1	PDAFF staff	Kampong Cham	K.Cham	1	KII	Female
2	Agricultural enterprises (NAV & KoC)	Phnom Penh	–	2	KII	Female
3	Input supplier	Kampong Cham	Chamkar Leu	1	KII	Female
4	Trader/collector	Kampong Cham	Chamkar Leu	1	KII	Male
			Steung Trong	1	KII	Female
6	Processor	Kampong Cham & Phnom Penh	--	2	KII	Male
8	Farmers	Kampong Cham	Chamkar Leu	1	FGD	5 Males
			Chamkar Leu	1	FGD	4 Females
			Steung Trong	1	FGD	5 Males
			Steung Trong	1	FGD	5 Females
10	Agricultural cooperatives/ cluster	Kampong Cham	Chamkar Leu	1	FGD	3 Males
11	Agricultural cooperatives/ cluster	Kampong Cham	Steung Trong	1	FGD	3 Males; 2 Females

3.5.2 Survey Tools

The research team developed qualitative interview guides for all key respondent types based on the key research questions as well as a comprehensive literature review of gender and climate-related components of vegetable value chains in Cambodia. These tools were designed to solicit information related to:

- Opportunities and constraints that women face in accessing resources
- The factors that facilitate or hinder women’s participation or benefits at each stage of the value chain
- Participants’ knowledge of and access to climate-smart technologies (including barriers to access)
- Gendered differences in terms of knowledge of and access to climate-smart technologies and practices
- The specific roles of all actors (formal and informal) engaged in the value chain (with a focus on gendered differences)

After obtaining and incorporating feedback from the project team, the research team translated all survey tools into Khmer. The research team understood the importance of ensuring that interview guides remain succinct to limit survey fatigue among respondents and maintain a high quality of responses. Each KII took approximately 30 to 45 minutes to complete (on average), while FGDs were capped at a maximum of 1.5 hours.

The research team relied on the Feminist Participatory Action Research (FPAR) approach when structuring qualitative interview guides and conducting both FGDs and KIIs. The FPAR relies on an intersectional approach to identifying experiences of discrimination, exclusion, and marginalization. It involves a range of participatory and creative data collection and analysis methods that encourage diversity of women’s experiences, identities, and power.

3.5.3 Qualitative Data Collection

All FGDs were conducted in-person by a trained and experienced enumeration team to ensure the highest level of data quality. FGDs were conducted at agricultural agent (AC) centers in both Chamkar Ley and Steung Trong districts. The research team sought to conduct KIIs in person where possible; however, in some cases respondents were unwilling or unable to meet in person and interviews were conducted via video conferencing instead.

Prior to beginning data collection, both members of the enumeration team participated in a training session with the team's gender experts to ensure they had a comprehensive understanding of gender-sensitive approaches and feminist participatory research approaches to moderating FGDs.³⁴ Additionally, before beginning data collection in the field, the team's qualitative enumerator conducted two mock interviews with members of the research team to ensure he was comfortable with the guides and interview process. These mock interviews were also designed to test the interview guide, confirm all questions would be clearly understood by respondents, ensure the length of the interviews was appropriate, and prevent any possible risks to both data collectors and respondents.

At the conclusion of the training and piloting session, the enumeration team traveled to Kampong Cham to conduct the interviews. While in the field, the enumeration team worked closely with the research team and the project team to identify potential respondents and schedule interviews. Prior to beginning any interview, all participants were asked for their consent to both participate and have the interview recorded. Each interview was then recorded, transcribed verbatim into Khmer within 24 hours, and then translated into English. Transcripts were reviewed on a rolling basis to ensure quality control, which included highlighting areas for clarification and requesting callbacks, where necessary.

3.5.4 Gender-Sensitive Approach

This research was conducted “with” and “for” women, not “on” women. Women are key agents of economic and social change both in the family and society. The benefits of this are yet to be fully recognized in the field of agriculture. Women dominate small-scale vegetable growing in most countries. However, large-scale production and parts of the postharvest value chain such as transportation, storage, and marketing can be the domain of either men or women, depending on the context.

Based on the FAO Guiding Framework for Gender-Sensitive Value Chains, a gender equality approach³⁵ was adopted and incorporated into this research to enable the research team to disaggregate agricultural value chains through the lens of gender roles and power dynamics to understand women's needs. The study was designed and implemented with a gender-aware approach that included gender-sensitive themes, allowing the research team to understand the nuanced gender dynamics at all stages of the selected value chain. In addition, it's helpful for the research recommendations for programmatic teams to identify and execute effective interventions designed to maximize the meaningful participation of and benefit to both women and men within these value chains.

To ensure women's perspectives and experiences are appropriately captured; the qualitative interviews were disaggregated by gender. Women-only FGDs are held with female farmers to allow them to speak freely about their unique experiences. A challenge of FGD with members of agricultural cooperatives is that most of their committee members are men; however, the research team ensured all questionnaires were designed with a gender-aware approach to elicit the perspectives of all participants, men, and women. Moreover, as mentioned previously, the enumeration team was trained on a gender-awareness approach by the team's gender experts. The training focused on gender-sensitive interview strategies that increased the conceptual understanding of enumerators on gender in the context of agriculture value chains in Cambodia.

At the analysis stage, the research team used ATLAS.ti's disaggregation capabilities to disaggregate data by gender and conducted a nuanced analysis focused on women's access to and control over resources, labour patterns, use of and access to resources, ability to exercise their rights, and realization of benefits along the value chain as

³⁴ Both members of the enumeration team were male

³⁵ 2016 FAO – Guiding Framework for developing gender-sensitive value chains

compared to men. Gender-specific indicators such as the participation, voice, and empowerment of women and other stakeholders were identified and broken down during the analysis stage of the research. The findings compiled into a comprehensive research report alongside accompanying recommendations related to the opportunities and challenges to gender-mainstreaming that exist within the selected value chain.

3.6 Methodology: Qualitative Data Analysis

The research team analyzed all qualitative interview transcripts using ATLAS.ti, a Computer Assisted Qualitative Data Analysis Software (CAQDAS), using a qualitative content approach. Coding was both deductive and inductive, with an initial codebook drafted based on research questions and known key themes, with further codes and subcodes added as they emerged from the data. The finalized codebook, at the point of saturation with no more codes, was added and applied to the whole dataset. The data was analyzed by using ATLAS.ti's analytical capacities, which include code-document comparison, code distribution, and examining code co-occurrences, to elucidate findings. Analysts identify salient and impactful quotes to illustrate, emphasize, and add context to findings presented in deliverables.

Qualitative findings were then triangulated with key results emerging from the team's comprehensive literature review. Where possible, the research team has also presented relevant quantitative statistics and figures obtained through existing published research to further triangulate the results emerging from the qualitative data. All findings are presented in more detail in Section 4, below.

3.7 Study Limitations

The results of this study are subject to some important limitations related to the qualitative sample size, representativeness of the qualitative component of the study, and lack of quantitative, measured data on carbon emissions associated with vegetable production

Qualitative sampling: To accommodate resource constraints, the qualitative sample for this study was limited to a total of eight KIIs and six FGDs conducted within two districts of Kampong Cham province. While this does meet minimum sample size requirements to reach the point of saturation (after which no new key themes are emerging from the data) for key, cross-cutting themes, it is likely too small of a sample to be considered fully representative of subthemes. Similarly, while the research team attempted to disaggregate by gender and other key characteristics of interest (including farm type) where possible, the limited sample size means it's possible that some nuanced differences between these groups were not fully captured.

Additionally, the research team limited the sample to Kampong Cham province to maximize the number of interviews it was possible to conduct given the existing resources for data collection. As described above, Kampong Cham is one of the largest vegetable-producing provinces in Cambodia and was selected as it includes a substantial number of both subsistence and commercial farmers. Nevertheless, conducting data collection in a single province limits the generalizability of the findings to the broader Cambodian vegetable sector.

Further, lack of greenhouse gas (GHG) emissions data on vegetable production is also considered as a limitation of this study. The secondary data on the GHG is not accessible in Cambodia. The GHG emission varied by soil texture, method of farming, soil temperature and humidity, region, and crops³⁶. Therefore, accessed data from other regions are not able to use in this study.

Moreover, the study did not identify the vegetable varieties which are the most profitable and highly demanded from local and international markets.

³⁶ Sheila Wachiye, Lutz Merbold, Timo Vesala, Janne Rinne, Matti Räsänen, Sonja Leitner, Petri Pellikka (2019) Soil greenhouse gas emission under different land-use types in Savana ecosystem of Kenya

4.0 SECTOR OVERVIEW: VEGETABLE VALUE CHAINS

4.1 Global Market Trends

Globally, the fresh vegetable market was valued at USD 632.54 billion in 2021 and is projected to expand at a compound annual growth rate (CAGR) of 2.8% from 2022 to 2028. This increase in market size is attributed to increased consumer expenditure on fresh food products as a result of rising health concerns and expanded awareness of the benefits of fresh and healthy products among households in both developing and developed countries.

Demand is projected to increase rapidly in the aftermath of the COVID-19 pandemic, which had a substantial and negative impact on the vegetable market. Lockdowns and government restrictions on the movement of people and goods during the pandemic significantly disrupted distribution channels and suspended or limited the supply of vegetables, in some cases for months at a time. This had a significant impact on the export and import of fresh vegetables across the globe. As the world recovers from the pandemic, demand for fresh vegetables has increased, creating opportunities for new market players. As a result, the vegetable market is expected to experience healthy market growth over the next several years.

Post-pandemic increases in demand are largely attributed to increased disposable income among consumers, economic growth in developing nations, an increased appetite for processed food within the developed world, and an expanding global population. The Asia-Pacific represents the largest producer and consumer of fresh vegetables, accounting for 65% of the global market share in 2021. This is largely due to the huge consumer base in large countries such as China, India, and Japan, which drive demand in the region. Vegetable consumption is expected to continue to rise in Asia, with increasing concerns about health, growing disposable incomes, and large populations with increased purchasing power propelling increases in demand.

North America represents the fastest-growing market for vegetables, with a forecasted CAGR³⁷ of 4.1% between 2022 and 2028. Consumption of fresh food products has increased in the U.S. and Canada due to a conscientious shift towards healthier and more nutritious food as well as increasing disposable incomes. A continued trend towards healthier lifestyles and diets as well as the increased availability of fresh produce is expected to support continued market growth for the next several years.

Offline distribution channels, namely physical markets or grocery stores, remain consumers' preferred method for purchasing produce. These platforms, which represented more than 80% of the global market share in 2021, allow consumers to physically verify product quality. Offline channels are expected to remain dominant in the forecast period due to improved distribution channel networks across the globe.

The online segment of the fresh vegetable market is anticipated to register the fastest growth, with a forecasted CAGR of 3.4% between 2022 and 2028. The internet penetration rate in developing countries expanded substantially within the last decade, which led to the significant growth of the e-commerce sector worldwide. This has supported the growth of the online produce market, with suppliers increasingly pivoting towards offering products via their websites or other e-commerce platforms. E-commerce is expected to continue to expand, driving overall market growth in the coming years.³⁸

4.2 Overview of the Cambodian Vegetable Sector

Agriculture remains a dominant economic sector in Cambodia, where almost 61 percent of Cambodians live in rural areas and 77 percent rely directly on agriculture, forestry, and fisheries for their livelihoods.³⁹ Vegetable farming

³⁷ Compound annual growth rate (CAGR) is a business and investing specific term for the geometric progression ratio that provides a constant rate of return over the time period. CAGR is calculated by $CAGR(t_0, t_n) = (v(t_n)/v(t_0))^{1/t_n - t_0} - 1$. Where $V(t_0)$ is the initial value, $v(t_n)$ is the end value, and $t_n - t_0$ is the number of years (Wikipedia "Compound annual growth rate" accessed by December 29, 2022: https://en.wikipedia.org/wiki/Compound_annual_growth_rate).

³⁸ Grand View Research "Market Analysis Report" accessed by 6th December 2022: <https://www.grandviewresearch.com/industry-analysis/fresh-vegetables-market-report/toc>

³⁹ USAID Cambodia: Agriculture and Food Security

specifically represents one of the main sources of income for rural people. Vegetable production has increased substantially in recent years, with the total land under cultivation expanding by approximately 40% in the six years between 2015 and 2021 (from 47,373 hectares to 66,434 hectares). This has corresponded with dramatic increases in production during the same period, from 405,528 tons in 2015 to 908,594 tons in 2021 (table 4).

Table 6. Progress of Cambodian Vegetable Production⁴⁰

Items/year	2015	2018	2019	2020	2021	CAGR %
Growing area (HA)	47,373	4,427	57,262	69,859	66,434	6.89%
Harvested areas (HA)	47,285	24,422	57,258	68,389	66,089	6.93%
Production (tons)	405,528	224,590	682,012	810,063	908,594	17.51%

4.2.1 Market Trends

Although Cambodian consumers prefer to purchase Cambodian-produced vegetables, believing them to be safer due to lower levels of chemical use, domestic production is not sufficient to meet domestic demand.⁴¹ In Cambodia, approximately 52% of total daily market demand for vegetables is imported from overseas, namely from neighboring Thailand or Vietnam.

A needs assessment conducted in 2020 revealed that Cambodia would need to produce approximately 489,000 metric tons of vegetables per year to fully meet consumer demand. Currently, domestic products account for approximately 45% of market demand during the wet season and up to 70% during the peak production period occurring during the dry season. As a result, Cambodia is required to import around 114,000 tons of vegetables per year to meet local demand, which presents a substantial opportunity for local actors within the vegetable value chains⁴².

This is especially true considering the substantial development of the Cambodian food and beverage market in recent years, which has experienced investments from regional and international brands. Rapid economic growth, urbanization, and an expansion of the tourism sector in major cities such as Siem Reap and Phnom Penh have driven an expansion in demand for processed vegetables and fruits in Cambodia. Fresh cut vegetables, dried vegetables, pickles, sauces, fruit juices, ketchups, puree, and wine represent increasingly popular processed food and beverage products consumed in Cambodia.⁴³

Rising demand within international markets in the region has also contributed to the expansion of Cambodia's fruit and vegetable exports in recent years. Vietnam, China, Thailand, and Japan are major importers of fresh produce from the country. The Royal Government of Cambodia has made major agreements with importing countries to have a direct access to these export markets without relying on intermediary partners. For instance, the country has gained direct export access of its bananas to China from the General Administration of Customs of China (GACC).⁴⁴

⁴⁰ Source: MAFF Annual report 2015-2021: <https://elibrary.maff.gov.kh/books/5af3a999a04a5>

⁴¹ USAID (2015). An Analysis of Three Commodity Value Chains in Cambodia

⁴² Need Assessment of the Traceability System for Vegetable Value Chain 2020: https://www.techostartup.center/media/uploads/resource/files/Traceability_Vegetables.pdf

⁴³ Report linker "Cambodia Fruits and Vegetables Market – Growth, Trends, and Forecast (2020 - 2025)" accessed by 6th December 2022: <https://www.reportlinker.com/p05891636/Cambodia-Fruits-and-Vegetables-Market-Growth-Trends-and-Forecast.html>

⁴⁴ Report linker "Cambodia Fruits and Vegetables Market – Growth, Trends, and Forecast (2020 - 2025)" accessed by 6th December 2022: <https://www.reportlinker.com/p05891636/Cambodia-Fruits-and-Vegetables-Market-Growth-Trends-and-Forecast.html>

4.2.2 Gender Roles in the Cambodian Vegetable Sector

Women play a key role in vegetable production and integrated models that recognize women's potential to capitalize on and value-add to vegetable products will advance the vegetable industry in Cambodia. The traditional farming norm in Cambodia is based on a patriarchal social structure. Men do most of the heavy labor activities such as land preparation and application of pesticides and herbicides, while women are more predominantly involved in monetary decision-making such as managing the household finances and selling the produce. In some contexts, women were in the field only a few hours a day while the children were at school. Women participated in crop planting and hand-weeding as these were tasks that were not as time-sensitive nor perceived as 'unsafe' as pesticide and herbicide application.⁴⁵ The report of Asian Development Bank 2018 showed similarly that women are key actors in the value chains, especially for rice. They are producers, collectors, and rice millers, and operate their own enterprises. Rural women generally have joint access and control over land and capital together with their husbands and are solely responsible for managing finances for the household. There is equal access for men and women to markets. Both husband and wife jointly agree when, where and to whom to sell the crop, but it is the responsibility of the wife to contact the local (usually female) collector. Nationally, women represent about 60% of agricultural cooperative members, and over a third of all fruit and vegetable processing enterprises.⁴⁶

Nationally 22% of all Cambodian households are headed by women. Households headed by women are likely to be more vulnerable, have smaller landholdings than men, and more frequently suffer from labor shortages.⁴⁷ Female-headed households with two or more children are even more likely to be poor and girls in these households are more likely to drop out of school to work.

Government laws and policies designed to promote gender equality are often not applied in practice. This is limiting for a large number of women, particularly in rural areas, whose family, community, and societal rights and power remain constrained by a traditional mindset and social norms (see Section 3.2.6 for more information). By exaggerating gender inequality, climate change also reinforces a structural root cause of violence against women and girls.

4.2.3 Challenges of Women in Vegetable Production

Vegetable production is largely believed to represent a positive diversification opportunity for improved livelihoods; however, the required technical knowledge and resource base precludes many farmers from engaging in the sector. In Cambodia, vegetable value chains are characterized by unrealized potential, with a lack of coordinated supply and demand and specific infrastructure for transport and storage limiting development.

Women farmers in particular currently have limited capacity and opportunities to diversify agricultural practices and lessen dependency on climate-sensitive and stressed natural resources; limited access to knowledge regarding new agricultural production and post-production techniques and technologies; limited mobility to avoid disasters stemming from their domestic and agricultural responsibilities; limited access to farmland; limited access to credit/financial services; and greater workloads such as household responsibilities for cleaning, cooking, and caring for children, elders, and the home.⁴⁸

4.2.4 Impact of Climate Change on Cambodian Vegetable Production

The Cambodian agricultural sector is considered to be a subsistence and family-based farming system. In recent years, the agricultural sector has been adversely affected by natural disasters, including droughts and floods that have led to fluctuations in annual agricultural production. This is primarily a result of reliance on rainwater and inefficient irrigation systems.⁴⁹ Prolonged droughts have been responsible for the most severe impacts on

⁴⁵ www.agronomyaustralia.org/conference-proceedings

⁴⁶ Climate-Friendly Agribusiness Value Chains Sector Project: Report and Recommendation of the President | Asian Development Bank

⁴⁷ Climate-Friendly Agribusiness Value Chains Sector Project: Detailed Gender Analysis (adb.org)

⁴⁸ Women in Agribusiness Value Chains (ifc.org)

⁴⁹ National Strategic Development Plan (NSDP) 2019-2023

Cambodia's agricultural production across all four agro-ecological zones.⁵⁰ Rural households who largely rely on agriculture for their livelihoods are highly vulnerable to climate-related weather events, while those dependent on water resources have medium to high levels of vulnerability. In the Tonle Sap Lake region, Mekong floodplains, and coastal areas, the biggest threats to agriculture and water resources include flooding, including damage from sudden flash flood, windstorms, and drought. In these areas, local communities' adaptive capacity across both the agriculture sector and water resource management was assessed at low to medium.

High levels of vulnerability to climate-related events can be attributed to local communities' low adaptive capacities, which are influenced by factors such as poverty (most rural residents are still living just above the poverty line), poor infrastructure, lack of social safety nets (lack of resilience), low understanding of the causes and effects of climate change, and inadequate hazard predictions and warnings even though climate-related disasters are becoming increasingly frequent. Currently, rural communities generally cope with climate risks using traditional ad hoc (i.e., unplanned) adaptive actions, which are not sufficient to mitigate the effects of worsening floods, droughts, and windstorms. Access to information remains a challenge, as information is currently not provided in an easy-to-understand format suitable for people with low literacy skills or without technological means (Monin, 2021).⁵¹

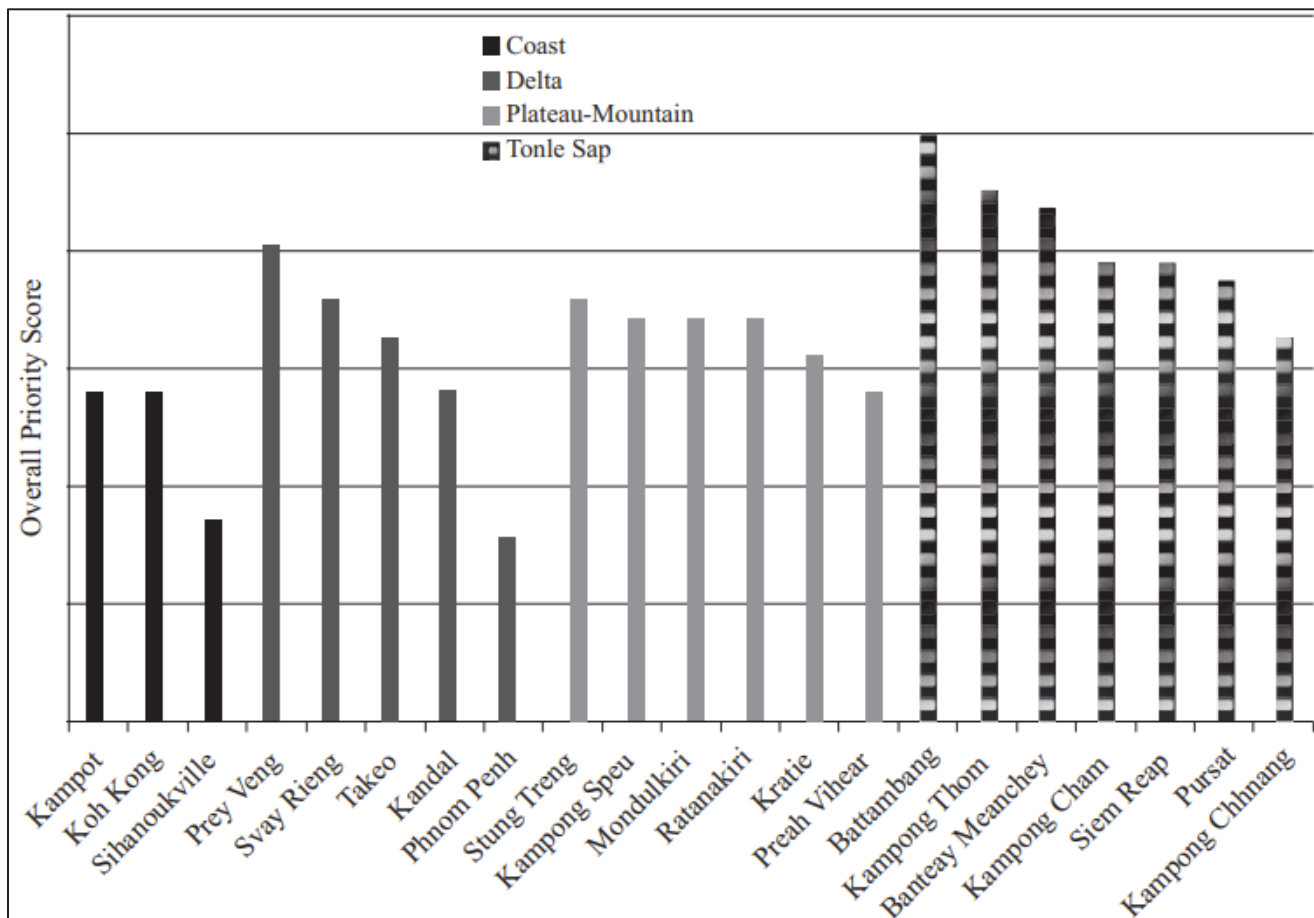
Cambodia is projected to experience warming of 3.1°C by the 2090s, against the baseline conditions over 1986–2005 under the highest emissions pathway. Without action, the population exposed to an extreme flooding could grow by around 4 million by the 2040s; however, human development factors such as the damming of the Mekong River as well as the large-scale dams built on its tributaries may alter future flood dynamics. The projected climate change trends indicate more severe floods and droughts, which are expected to affect Cambodia's GDP by nearly 10% by 2050. Climate change will additionally reduce the productivity of the Tonle Sap Lake and Cambodia's fisheries – a significant threat to the livelihoods and nourishment of many poor and rural communities who relied on upon rain-fed agriculture.⁵² Provinces located in the Tonle Sap region, including Kampong Cham, are among the most vulnerable due to their high level of dependence on natural resources for livelihoods and subsistence (see Figure 2).

Figure 2. Vulnerability by Province

⁵⁰ Tonle Sap Lake Region, Coastal Regions, Plateau/Mountainous, and Plains

⁵¹ Nong Monin (2021) The Impacts of Climate Change on Agriculture and Water Resources in Cambodia: From Local Communities' Perspectives. Working Paper Series No. 125

⁵² Climate Risk Country Profile: Cambodia. <https://www.sketchbubble.com/en/presentation-conceptual-framework.html>



Source: Hang Phirun (2013) Climate Change Adaptation and Livelihoods in Inclusive Growth: A Review of Climate Change Impacts and Adaptive Capacity in Cambodia. Working Paper series No. 82

According to Cambodia’s updated Nationally Determined Contribution (NDC) from 2020, Cambodia’s vulnerability is characterized by frequent floods and irregular rainfall, coupled with an agrarian based economy, limited human and financial resources, insufficient physical infrastructure, and limited access to technologies. Socio-economic status, location, access to resources and technologies all influence Cambodian’s ability to manage climate impacts. Different social groups experience climate vulnerability differently, and women, children, the disabled, the elderly and other socially marginalized groups are often hit harder. The initial NDC was developed quickly, which made conducting far-reaching consultations challenging. As such, some crucial areas of climate change policy and implementation were not adequately analyzed, namely Gender; Youth involvement; and engagement with the Private sector. Regarding Gender, all sectors, especially waste and energy, are key to mitigation. For adaptation, agriculture, forestry, and fisheries sectors are particularly important, and all ministries provided targets for women’s participation. Gender-balanced training and awareness material and the promotion of ‘women champions’ are key. Most Ministries included gender disaggregated targets of each action across these areas. In the human health sector, the importance of gender-disaggregated data is considered a priority, especially to understand the different impacts of air-and vector-borne diseases on women and men.

4.2.5 Enabling Policy

The Government of Cambodia’s Rectangular Strategy Phase III 2014–2018 (RS III) provides the framework for policies and strategies addressing poverty reduction and promoting the economic empowerment of women. The objectives of RS III relate to economic growth, employment particularly for youth, and strengthening institutional capacity and governance. Gender equality is not explicitly mentioned in the overarching objective of RS III, but the

document clearly refers to promoting the role of women in the economy, empowering women, and further mainstreaming gender in government initiatives as priorities. To improve the agricultural sector, the Cambodian government additionally has been developing and implementing the National Rectangular Strategy Phase III (NRS III), National Strategic Development Plan (NSDP) 2014-2018, and Agricultural Extension Policy adopted 2015. Other regulatory frameworks such as Law on Agricultural Cooperatives 2013, Law on Pesticide and Chemical Fertilizer control 2012, Prakas on the Implementation of Good Agricultural Practice (GAP) 2012, Measure on Fresh Fruits and Vegetable Production 2012, Seed Management and Plant Breeder's Right 2008 and tax exemptions for agricultural land use, tariff free (custom duty) import of fertilizers and tariff free import of agricultural machinery facilitate improvement of the agricultural sector. Therefore, agricultural production, including vegetables, has been increasing remarkably. In contrast, there were some weaknesses such as limitation of institutional capacity, weakness of inter-institutional-ministerial coordination, unalignment of daily activities of staff to objectives and policy of government in the policy implementation during NRS III 2014-2018.

In addition to this, the Cambodian government has been continuing its Rectangular Strategy Phase IV (2019- 2023) for Growth, Employment, Equity and Efficiency: Building the Foundation Towards Realizing the Cambodian Vision 2050. The government continually considers agricultural development and sustainable natural resource management in its strategy: 1. Promotion of agricultural sector and rural development- strengthening the role of agriculture sector in generating jobs, ensuring food security, reducing poverty, and developing rural areas; 2. Sustainable management of natural resource and culture- striking a balance between the development and preservation aimed at promoting the contribution to the development of agriculture, industry and tourism sectors, strengthening the management of mineral resources, ensuring the sustainability of forest and fisheries resources and ecological system along with the protection and development of the national cultural heritage; 3. Ensuring environmental sustainability and preemptive response to climate change- promoting urban development with a good and clean living environment along with enhanced well-being of the people and socio-economic efficiency; and 4. Strengthening urban planning and management- minimizing the environmental impacts, enhancing the capacity to adapt to climate change, and contribute to reducing the global climate change to ensure sustainable development. Increasing the usage of environmental-friendly and climate-friendly technologies in physical infrastructure and socio-economic development are considered as key priority of agricultural development

Besides the agricultural sector development, improvement in gender equity and social protection is one of the top priorities of the Cambodian government as stated in the NRS IV. The strategy focuses on strengthening gender equity and social protection to enhance social-economic situation and strengthen women's role in the society who are the backbone of the economy and society.⁵³ Various strategic plans and policies were improved and/ or developed to support the implementation of the first angle of the NRS IV, for instance Neary Rattanak Strategic Plan, National Social Protection Policy Framework 2016-2025, National Population Policy 2016-2030, National Policy on Ageing 2017-2030.

Moreover, the updated Nationally Determined Contribution (NDC) published in late 2020 included many gender mainstreaming points. The updated NDC pays particular attention to gender and vulnerable groups in an effort to ensure that Cambodia's adaptation and mitigation actions contribute to a more inclusive society and the country is able to fulfill its commitments in accordance with the United Nations Framework Convention on Climate Change (UNFCCC) by 2030.

5.0 RESULTS

This section is designed to address the study's key research questions through evidence obtained from primary qualitative interviews with key respondents, which is triangulated with key findings from the existing literature on gender and climate-dynamics within Cambodian's vegetable value chains.

⁵³ The Royal Government of Cambodia. Rectangular Strategy Phase IV 2018

5.1 Profile of Respondents

Qualitative interviews with farmers revealed that the majority of surveyed farmers grow vegetables for commercial purposes. The most commonly grown vegetables include cucumber, lemongrass, cabbage, mustard greens, and curly kale. A small portion of farmers also reported growing cassava or corn.

While most farmers exclusively grew vegetables, a small number also grew rubber trees, rice, turmeric or engaged in other livelihood activities such as raising animals. The majority of farmers reported growing their vegetables on a small plot of land ranging from roughly 10 acres to 50 acres. Farmers who grew vegetables for commercial purposes reported slightly larger plots of land, ranging from 50 acres to around less than 3 ha.

As described in the sampling section above, the research team sought to ensure that the qualitative sample was as representative of both male and female actors as possible. This included conducting separate FGDs with both male and female farmers to allow women to speak freely and openly about their experiences. The vast majority of respondents surveyed (both male and female) reported that they were married, although several respondents stated they were either single or widowed. Overall, the level of educational attainment among respondents was low, with most respondents reporting having a primary education or less. See Table 7, below, for a detailed breakdown of respondent demographics.

Table 7. Farmer FGD Respondent Demographics, by District

	Chamkar Leu	Steung Trong	Total
Gender			
Male	8	7	15
Female	4	7	11
Marital Status			
Married	12	12	24
Single	--	1	1
Widowed	--	1	1
Age			
25-39	7	7	14
40-59	5	7	12
Education			
No schooling	2	--	2
Primary school	9	11	20
Secondary school	1	3	4

5.2 Value Chain Mapping

A value chain is the full range of activities that are required to bring a product or service from its conception to the final consumers. This includes activities such as design, production, marketing, distribution and support services to the final consumer.⁵⁴ Qualitative interviews revealed that vegetable value chains in Kampong Cham province are largely comprised of seven key actors or stakeholders, including agricultural input suppliers, farmers, traders/collectors, agricultural enterprises, processors, agricultural cooperatives, Provincial Department of Agriculture, Forestry, and Fisheries, and consumers (see Figure 3, below).

⁵⁴ "Value Chain" accessed by November 26, 2022: <https://www.fao.org/flw-in-fish-value-chains/value-chain/en/>

The roles and responsibilities of each actor include:

A) Input supplier: Input suppliers in Kampong Cham are generally small-scale, local suppliers who purchase products from Kampong Cham municipality and Phnom Penh to sell to local farmers. The most common products sold by input suppliers include seeds for various types of vegetables and rice, fertilizers, hormones, pesticides, and small farming equipment including lawnmowers, pump machines, pump motors, and pesticide sprayers.

B) Farmers: The majority of surveyed farmers have been growing vegetables for commercial purposes, while a minority of them grow vegetable household's consumption. As described above, farmers growing vegetables for commercial purposes tended to have larger plots of land, while small-scale farmers growing vegetables for subsistence or selling at local markets reported much smaller growing areas. In general, commercial farmers grow vegetables in a large plot, ranging from 50 acres to around 3 ha. On the contrary, small-scale farmers grow vegetables in the small plot of land, ranging from roughly 10 acres to 50 acres. The most common vegetables grown in the study areas included cucumber, lemongrass, cabbage, mustard greens, and curly kale are common products in the studied areas. A small proportion of farmers also reported growing cassava, corn, rubber tree, rice, and turmeric or engaging in other livelihood activities such as livestock raising. Most farmers reported growing different leafy vegetables at a time on the same plot.

Commercial farmers generally decided which vegetables to produce by responding to demand from AC and/ or local brokers. Agreements with these entities were generally arranged through informal contracts, with none of the farmers surveyed reporting that they had an official agreement with an AC or broker. Most of the farmers interviewed reported that they had previously worked with agricultural projects or in contract farming to sell their produce; however, these arrangements did not function smoothly due to difficulties with delivering vegetables that met the quality standards stipulated in the contract. Farmers attributed these challenges to their limited agricultural techniques, unstable acceptable market, as well as difficulties with the weather that affected growing conditions to invest in high price smart technology since the market price is not stable. Further challenge is that farmers have limited market information, so they could not sell all products timely to market with competitive prices.

There are three main sources of farming inputs. First, farmers generally procured agricultural inputs such as plastic mulch, trellises, chemical fertilizers, farming tools and equipment from input suppliers in the areas. Second, they produced home-made fertilizers such as solid and liquid compost for their farming. Third, in some cases, farmers who have engaged in agricultural projects operating in the region reported receiving agricultural inputs from the implementing institutions. For instance, Kampong Cham's Provincial Department of Agriculture, Forestry and Fisheries (PDAFF) provided agricultural inputs such as trellises, seeds, and plastic mulch to farmers who participated in the activities of ASPIRE project.

C) Trader/collector: Vegetable farmers reported that they primarily sell their products to agricultural cooperative (AC), clusters, or collectors in their village who collect vegetable products for distribution to local markets and other provinces. Farmers who supplied vegetables to either ACs or clusters reported benefitting from a secure market, as ACs or clusters procured their vegetables based on a predefined agreement. In contrast, farmers who sold their products to collectors did not have clear supply agreement and faced unstable demand as a result. The majority of farmers interviewed reported engaging in contract farming with ACs, clusters, or other enterprises. Although they benefited from the increased security these arrangements offered, many farmers also reported challenges with contract farming due to difficulties meeting the quantity and quality expectations of the ACs and their ultimate clients. Farmers attributed these challenges to their limited agricultural techniques and unpredictable weather.

D) Agricultural enterprises (AE): AEs are businesses primarily engaged in the production of food and fiber, ranching and raising of livestock, aquaculture and other agriculture related industries. Representatives of two agricultural enterprises were interviewed for this study. These AEs grew vegetables with their own greenhouse farms, were involved in contract farming with farmers and selling agricultural products including vegetables and processed products, and also sold agricultural inputs such as seeds. To ensure farmers produce vegetable products in compliance with the required standards, the enterprises trained farmers on the EU and USDA organic standards,

vegetable growing techniques, including land preparation, seedling, planting, farm management, harvest and postharvest management, organic fertilizer production, and pesticide production and its application. In addition, both enterprises provide technical assistance to producers to ensure the produced vegetables meet the required standards.

These enterprises performed as marketing actors for farmers, purchasing vegetables from producers' groups, clusters, and agricultural cooperatives to sell in Phnom Penh city. AEs generally established contracts with their suppliers, although this was not always the case. To ensure the quantity and quality of vegetables in their stores, both AEs reported that they had established their own greenhouses. The collected vegetables were cleaned, graded and packaged with the label of enterprises.

"We are farmers in ASPIRE project, so we produced vegetable based on CAMGAP standards-a little or no application of chemical fertilizers and pesticides. Therefore, yield was a bit low. Currently, we produced vegetable based conventional method and sell to markets. Price of vegetable is determined by collectors because there are only one or two collectors in the area", AC Steung Trong.

"Previous year, we used to supply vegetables to organic shops in Phnom Penh, but we later on stopped supply the products to these shops because our farmers could not comply with the required quality specifications. For instance, shops required cabbages between 0.8 kg to 1 KG. In reality, weight of cabbages varied based seasons- good seasons it is up to 2kg, while bad season it is less than 0.8kg. Weight of harvested products were not equal, so shops could not collect all products. As a result, we decided to stop collaborating with the shops", AC Chamkar Leu.

E) Processor: Processors are responsible for processing of raw and intermediate inputs derived from the agricultural sector, including vegetables, to preserving goods for end user consumption. This may or may not include value-added processing. Since vegetables are commonly sold fresh, most enterprises simply cleaned, graded, and packaged vegetables to prepare them for sale as raw produce at markets or grocery stores. Through qualitative interviews, surveyed processors reported that vegetable processing in Cambodia is limited due to fluctuation of vegetable supply and high operational costs. Similarly, a study conducted by the Asian Development Bank in 2021 showed that Cambodia has limited postharvest handling and processing capacity. The same year, only about 10% of Cambodia's total agricultural outputs were processed within the country and processed agricultural exports represented only 8% of total official exports by value. Barriers to agricultural processing in Cambodia include reliability and cost of electricity, the high cost of informal payments required to obtain permits and documentation, lack of skills and information, difficulties in obtaining development capital, limited access to technology and machinery, and lack of investment.⁵⁵ A similar study conducted the same year also reported that Cambodian food's manufacturing industry faced challenges, with poor infrastructure, an unreliable supply of raw materials, a lack of competitiveness for locally-produced products due to high operating costs, and a relatively small domestic market.⁵⁶ The agro-processing industry contributed only \$589.83 million or 2.4 per cent of Cambodia's GDP in 2018. On the contrary neighboring country like Thailand makes use of 80% of the country's agricultural produce⁵⁷. Currently, Cambodia's agro processing industry is a mix of micro, small and medium enterprises (MSMEs) producing primarily for the domestic market and located close to production zones and large-scale food processing companies such as rice snack manufacturer and exporter Lyly. Constraints to the development of agro-industry include low quality production, underdeveloped transport and logistics infrastructure, and high electricity costs⁵⁸. At present, the Government is also focusing on improving the agro processing sector of the country through policy changes and development of appropriate infrastructures necessary to lay down a strong foundation for the industry. Through the

⁵⁵ Asian Development Bank (2021) Cambodia Agriculture, Natural Resources, and Rural Development Sector Assessment, Strategy and Road Map: <https://www.adb.org/sites/default/files/publication/718806/cambodia-agriculture-rural-development-road-map.pdf>

⁵⁶ Minh Nguyen (2021) Cambodia Exporter Guide: https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Cambodia%20Exporter%20Guide_Ho%20Chi%20Minh%20City_Cambodia_05-03-2021.pdf

⁵⁷ Kingdom's agro-processing potential – Phnom Penh Post

⁵⁸ Partnership Ready Cambodia: Agriculture And Food Processing

Cambodia Industrial Development Policy 2015-2025, the Government has planned to increase the export of processed agricultural products to 12 per cent by 2025.⁵⁹

F) Agricultural Cooperatives (ACs): A cooperative is an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise.⁶⁰ Agricultural cooperatives play a key role in linking farmers to markets, providing a collective platform for negotiating with buyers, offering aggregating, marketing and processing services, providing distribution channels for primary products, and delivering training, business planning and capacity building services to their members.⁶¹ A study conducted by the Ministry of Agriculture, Forestry and Fisheries revealed that most Cambodian agricultural cooperative businesses focus on credit and saving services and the supply of farm inputs. The marketing of agricultural products is very challenging for most cooperatives because they lack experience and often have insufficient financial resources.⁶² The result of the survey showed that agricultural cooperatives in the study areas play important roles in both expanding the agricultural market and increasing access to finance. For instance, ACs are responsible for creating linkages between traders and vegetable producers within cooperatives, providing farmers with a stable market for their product. In addition, agricultural cooperatives have worked to establish savings groups which provide financial support to members. The management committees organized monthly meetings to collect member's deposits and provided low interest loans to borrowers, including small-scale farmers who may not have been able to access finance otherwise. Qualitative interviews revealed that women are not involved in ACs at high rates and the majority focus primarily on the operational tasks of the cooperatives, including administration, accounting, loan processing, and marketing. In contrast, most managerial roles are filled by men. There is only one female committee member in Steung Trong AC and none in Chamka Leu AC.

G) Provincial Department of Agriculture, Forestry and Fisheries (PDAFF): The PDAFF is a government entity operating under the Ministry of Agriculture, Forestry and Fisheries (MAFF) which supports the MAFF with the implementation of agricultural activities in the province. The primary responsibilities of the PDAFF include collaboration with relevant stakeholders to improve agriculture, livestock and aquaculture production and marketing, management of natural resources required for the agricultural sector, management of ACs and cooperative unions, and management of agricultural input suppliers in the province. The Kampong Cham PDAFF has been providing agricultural training to farmers and agricultural cooperatives, implementing government programs in the agricultural sector and collaborating with local and international organizations working in the province.

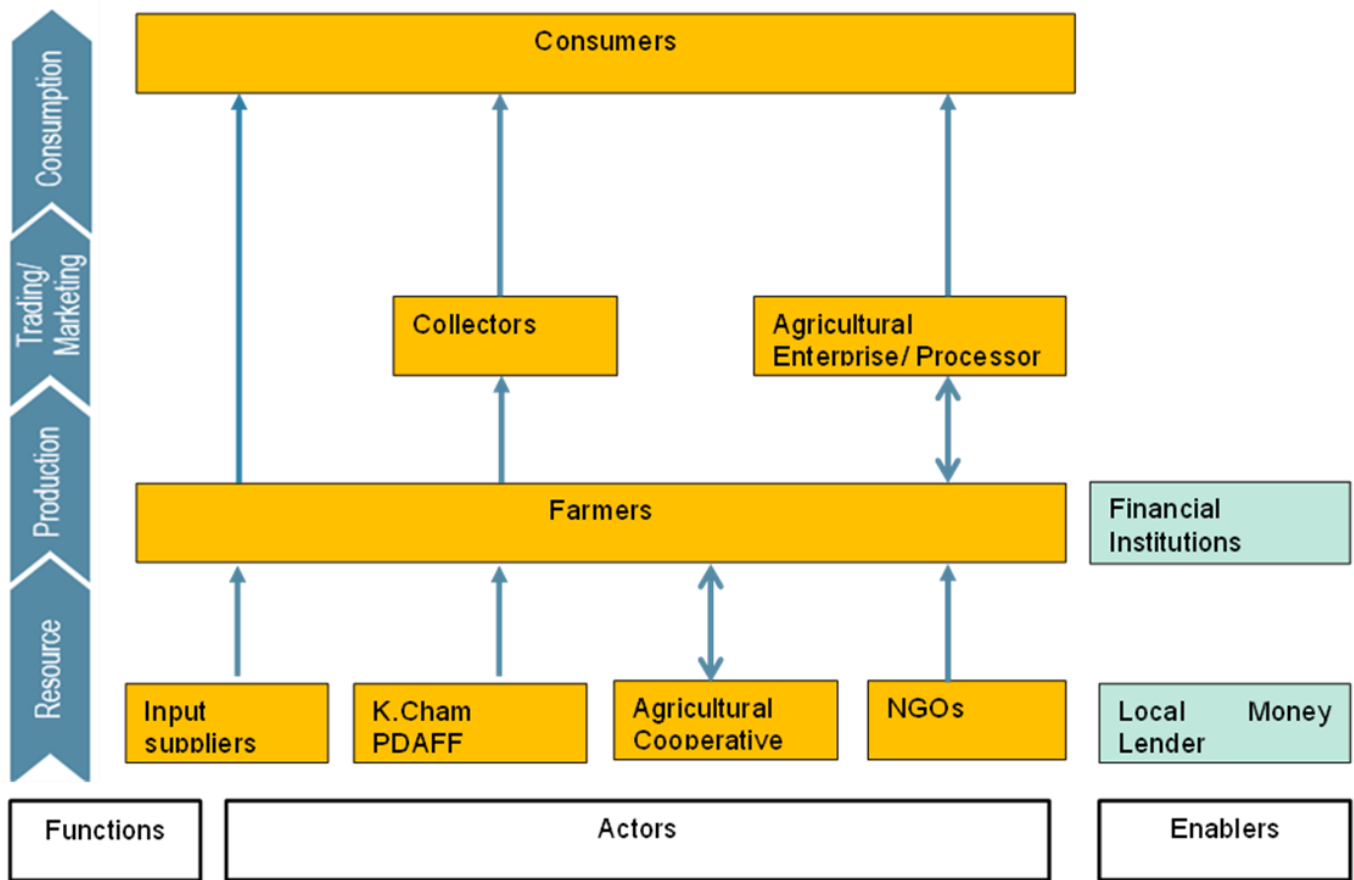
⁵⁹ Royal Government of Cambodia "Cambodia Industrial Development Policy 2015 – 2025" accessed by 10th January 2023: https://www.eurocham-cambodia.org/uploads/97dae-idp_19may15_com_official.pdf

⁶⁰ Agricultural Cooperative Alliance "Definition of a Cooperative", accessed by 28th November 2022: <https://www.ica.coop/en/cooperatives/cooperative-identity>



⁶¹ Asian Development Bank "The Role of Agricultural Cooperatives in Helping Reduce Poverty in Asia and the Pacific", accessed by 28th November 2022: <https://www.adb.org/annual-meeting/2018/events/agricultural-cooperatives#:~:text=Agricultural%20cooperatives%20play%20a%20key,planning%20and%20capacity%20building%20services>

⁶² The Potential of Cooperatives in Agricultural Supply Chains in Cambodia "Cooperatives in Supply Chains", accessed by 28th November 2022: <https://www.dgrv.coop/publications/the-potential-of-cooperatives-in-agricultural-supply-chains-in-cambodia/#:~:text=According%20to%20a%20study%20conducted,such%20as%20seeds%20and%20fertilizers.>

Figure 3. Vegetable Value Chains in Kampong Cham Province



Note:

-  Represents physical flow of inputs and products
-  Represent two ways flow of information and technologies

Source: Author

5.3 4Gender Roles and Opportunities

An analysis of gender roles in vegetable production showed that both women and men share responsibilities across most stages of vegetable production (see Figure 4). Crop selection is the primary stage of vegetable production. Although both women and men generally decide on which crops to grow together based on market demand, some female farmers interviewed reported that women sometimes defer to their husbands to make the ultimate decision as they feel as men, they will be the ones responsible for the majority of the heavy labor required to grow the chosen crop.

“We [my husband and I] help each other and discuss with each other on what to grow and in the whole process of vegetable production.” -FGD, female farmer

“It is the same, what we want to grow is different, so I need to follow him as well.” -FGD, female farmer

“Regarding the decision to grow vegetable, mostly my husband decides what to grow and we help each other in the growing production.” – FGD, farmer, female.

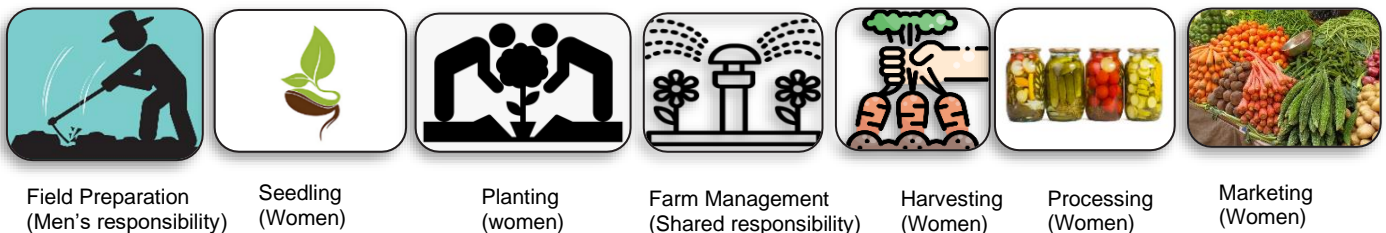
When it comes to seeding, planting, farm management, harvesting, and marketing, women generally take on the bulk of the responsibility. However, they have a limited role in land preparation, spraying chemical pesticides, fertilizer application, operating farm machinery such as tractor and tiller trolley because these stages require labour intensive and heavy work which are generally responsible by men.

“Before I have grown cucumbers, I have grown it for 5 years. Regarding the decision to grow vegetables, mostly my husband decides what to grow and we help each other in the growing production. I mainly involve in planting, taking of the vegetables and harvesting. My husband would be responsible for other tasks that demand heavy physical strength. For vegetable, we grow cucumber, cabbage, Mustard greens, Curly kale, etc. we grow approximately 32 acres.” - FGD, farmer, female.

It was notified that widowers who have been growing vegetables, usually hired farm workers to support in land preparation and pesticide application. Therefore, production costs are increased compared to farmers who have their own laborers. As a result, they have small or no profits from vegetable production. According to a 2006 study conducted in Cambodia, men mostly did the heavy farming activities such as land preparation and application of pesticides and herbicides, while women were more predominantly involved in monetary decision-making such as managing the household finances and selling the produce. However, an equal workload was shared among males and females in farming roles where hard labour was not required, for example planting and weeding crops.⁶³

Opportunities in the post-harvest and process sector are largely dominated by women; however, it is important to note that the processing sector in general is quite limited in Cambodia. The processing that does occur generally does not add much value. As processing is generally dominated by women, particularly at the household level, the lack of a robust processing sector may be limiting opportunities for women at later stages of the vegetable value chain. The final stage of the value chain, marketing, is largely dominated by women. This is especially true on larger, commercial farms, where women are responsible for bringing products to market.

Figure 4. Participation of Men and Women in Vegetable Production



Source: Author

5.3.1 Access to Resources

Equitable access to resources, including inputs, knowledge, and assets, is vital to ensuring women involved in the agricultural sector have equal access to meaningful and profitable livelihoods.

Resource and information accessibility can be broken down into five distinct components, described below:

Farm Inputs and Machinery (Assets): Both male and female farmers reported that when it comes to selecting which crops to grow and purchasing large or expensive inputs (e.g. tractors, tiller trolleys, hand tractors, or other

⁶³ Rebecca Fong, Rebecca Cross, Robert Martin and Daniel K.Y. Tan (2006) Analysis of the vegetable value chain and gender roles in vegetable production in northwest Cambodia

tools), both the husband and wife discuss and make a decision together.. Women in Cambodia are generally responsible for managing the household's finances, however, and therefore generally make decisions independently when it comes to purchasing smaller inputs such as seeds, fertilizer and other household expenditures.

Agricultural Extension Services: Women and men have equal opportunities to access agricultural extension services such as skills trainings, meetings, workshops, and other events; however, access is rarely equal in reality. Women reported that in many cases, they were unable to attend these events or access these resources due to the burden of household and care work, concerns related to security and transportation from their homes to the extension services office, a bias towards only presenting agriculture-related information to male household heads, cultural biases influencing men to discourage their wives from attending trainings, and limitations of women's education (illiteracy is still higher among women than men).⁶⁴

Land: Women generally have reduced access to land due to difficulty accessing information about the land titling process, difficulties for widowed or single women to obtain paperwork proving their single status, and gender imbalances in control and decision-making related to land. Of the 33,819,000 hectares of agricultural land in Cambodia, only 12% (approximately 448,000 hectares) is owned by female-headed households.⁶⁵ Lack of access to land limits women's ability to engage in commercial or subsistence farming, particularly for women who are widowed or unmarried.

Credit: Generally, male and female farmers reported equal opportunities to access credit. This is largely due to the fact that women's signatures are required alongside their husbands when obtaining a loan from the bank. In reality, however, gender inequities remain when it comes to accessing credit and decision-making related to financing. Women tend to face greater barriers to accessing financial information, which has been attributed to a shortage of information from the government and private institutions as well as to the fact that women often don't have the time to attend trainings or seek out information due to their disproportionate responsibilities around the home.

Markets: The majority of farmers continue to sell their main crops to traders or collectors in their village just after harvest. Although women are generally responsible for marketing the households' crops, female farmers were found to face greater challenges than men when it came to accessing markets for their products. This is largely due to the fact that agricultural businesses run by women are less likely to be formally registered. Women also face additional difficulties accessing networks and obtaining partnerships and time constraints remain a barrier. This is particularly true when it comes to accessing more profitable international markets.⁶⁶

⁶⁴ Socio-Economic Survey 2016. accessed by 1 January 2023: <http://www.nis.gov.kh/nis/CSSES/Final%20Report%20CSSES%202016.pdf>

⁶⁵ Cambodia Socio-Economic Survey 2019. accessed by 1 February 2023: https://www.nis.gov.kh/nis/CSSES/Final%20Report%20of%20Cambodia%20Socio-Economic%20Survey%202019-20_EN.pdf

⁶⁶ World Bank (2019). Exploring the Opportunities for Women-owned SMEs in Cambodia

5.3.2 Decision-Making

Productive Decision Making: Farmers reported that although generally productive decisions such as which crops to grow were made by the couple together, women would in some cases defer to their husbands regarding crop selection out of consideration for the fact that the men would generally be responsible for the heavy labor associated with the chosen crop. This aligns with existing research, which highlights that women generally opt to make decisions jointly with their husbands when it comes to agriculture production, including which crops or crop varieties to plant.⁶⁷

Financial Decision Making: All respondents reported that both husband and wife were involved when it came to deciding whether to take out a loan from a financial institution or not, as both parties are required to sign all relevant loan application documents. The majority of respondents agreed, however, that women have more power now than they did previously when it comes to borrowing money and are generally primarily responsible for preparing the loan documents and repaying the loan to the financial institution. Nevertheless, it is often men who have the final say when it comes to large financial decisions, including taking out a loan and how to allocate the funds. Farmers highlighted that while men are fully aware of the size of loan and payment schedule, the responsibility for managing and repaying the loan falls to their wives.

5.3.3 Barriers and Challenges

Barriers to Vegetable Farming

All participants were aware that advanced and climate-smart technologies can help farmers boost vegetable production and highlighted that these technologies were available within their communities, but reported that they often face barriers when it comes to accessing them. One of the biggest challenges reported was the cost of these technologies, which often require a significant upfront investment. Farmers are reluctant to invest, as the price of vegetable products and demand fluctuate substantially throughout the season and are weather-dependent. Most technologies need to be purchased at the planting stage, before farmers know what their harvest and profitability will look like, increasing the risk of such an investment.

Additionally, although farmers are broadly aware of the existence of smart agricultural technologies, they have limited access to updated technological information. This is largely attributed to limited government support as well as a lack of awareness among farmers as to where to go for this type of information. Farmers have not been updated on what crops are profitable and what they are able to grow and sell in the local market. Even the farming of those crops requires more labor and is vulnerable to pests. Some practices are good but farmers fail to continue using them because they neglect the practices.

Finally, farmers reported that the price of agricultural inputs generally, including fertilizers and chemical pesticides, has made vegetable farming less profitable.

Barriers to Women's Participation

Through qualitative interviews with farmers, it was apparent that women face more challenges than men when it comes to participating in agricultural production. Women generally suffer from greater time poverty, as in addition to their responsibility on the farm, they are also expected to take on most or all of the housework, including cooking, cleaning, and caring for young children or the elderly. Due to their domestic responsibilities, women also have more limited opportunities to join agricultural technical trainings, providing them with fewer opportunities to develop new skills or access new technologies (including climate-smart practices and technologies). In some cases, husbands also discourage their wives from joining the trainings even if they do have the time, as the husband feels that if he is already participating in the training there is no need for his wife to join. As a result, women have limited ability to apply new techniques, technology and/ or farming equipment in vegetable production.

⁶⁷ Verzosa, F., Cabriole, M., Sin Thant, P., Phen, B., et. al. (December 2021). Pathways to Women's Empowerment in the Promotion of Climate Smart Agriculture in the Philippines, Myanmar, and Cambodia. International Institute of Rural Reconstruction (IIRR).

“Women participate in small-scale vegetable production than men. Women are good at doing business, since they are attention to details and patient in their job. However, they are pressured because they are not encouraged and supported from husband.” – Agricultural Enterprise.

Women also reported physical challenges when it comes to operating heavy farming equipment, which is often required to produce vegetables. Women who are married generally rely on their husbands for these tasks; however, unmarried or widowed women reported being forced to hire outside labor, which affected the profitability of their farming activities.

“Mostly women working with their husbands in the farm. If they do not have husbands, it would be difficult for them to do farming, so they can hire workers to support in farming. As a result, they may not get the profits since production cost is high.” – FGD, female, farmer.

5.4 Climate Impact of Climate Change on Vegetable Production

5.4.1 Overview of Existing Dynamics

An increase in heat-stress conditions, rising evaporative demand, and shifting rainfall patterns may have multifaceted impacts on Cambodia's agricultural systems, including vegetable production. Concurrently, domestic vegetable supply is highly seasonal and inadequate to meet the domestic food demand, which consequently poses risks to food security locally, particularly in rural areas.⁶⁸ The Royal Government of Cambodia has prioritized efforts to minimize the impact of climate change, including enhancing the capacity of relevant institutions to adapt to climate change and contribute to reducing global climate change to ensure sustainable development.

Due to the significance of the agricultural sector within the Cambodian economy, expanding the availability and use of environmentally friendly agricultural tools and practices presents a significant opportunity to mitigate climate risk and environmental degradation while also promoting equitable economic growth among rural communities. Through strong collaboration between the government and the private sector, the application of climate-smart agricultural technologies has been increasing rapidly within the Cambodian agricultural sector. Various smart technologies such as drip/ sprinklers, plastic mulch, organic mulch, no-tillage, net houses, smart irrigation/ mobile app irrigation systems, spray tube irrigation systems, and solar pumps have been promoted in Cambodian vegetable and horticulture production. The adoption of Climate-Smart Agriculture (CSA) brings enormous benefits to farmers in terms of increasing economic efficiency, reducing labour requirements, expanding the potential for scalability, increasing equity within communities, and reducing negative impacts on the environment, health, and safety. Despite the myriad of benefits these technologies offer, they still require a large upfront investment, which remains a significant barrier for many farmers.⁶⁹

5.4.2 Climate-Smart Agriculture Technologies in Vegetable Production

Drip irrigation, spray tube irrigation system, and plastic mulch are common technologies used in the vegetable production in the study areas. These technologies have been reducing labour costs, boosting production, and increasing income from vegetable farming. Nethouses bring great benefits to vegetable farmers in terms of damage prevention from pests, reducing pesticide application, preventing weeds, reducing soil moisture loss, depleting sunlight, increasing yields, and providing safe food. This technology is suitable to reduce climate impact on production. However, it is not a commonly practiced technology because farmers need to spend huge money for the technology. Generally, farmers who adopted this technology received support from the government and NGOs through the project, for instance PDAFF provides nethouses to agricultural cooperative and farmers in the study areas through the ASPIRE project. Farmers are still required to contribute a small amount towards the budget for installation.

⁶⁸ Alvar-Beltrán, J., Soldan, R., Ly, P., Seng, V., Srun, K., Manzanos, R., ... & Heureux, A. (2022). Climate change impacts on irrigated crops in Cambodia. *Agricultural and Forest Meteorology*, 324, 109105.

⁶⁹ Ministry of Agriculture, Forestry and Fisheries (2019) *Adaptation Technologies Guide- Agriculture*

Women face additional barriers to accessing and applying climate-smart technologies. As described above, cultural norms and socio-economic status dictate that women are responsible for most of all of the housework and childcare for the family. Lack of time, poor routes, and location as a result of these competing responsibilities prevents women from participating in agricultural technical trainings offered by the government, NGOs, and other institutions to raise awareness about these technologies, their benefits, and how they can be applied. Additionally, in some cases, men discourage their wives from attending the trainings, as they feel it is unnecessary to have both partners attend. It was found during the validation workshop that there was a lack of facilitation and support mechanisms, such as a technical working group for supporting women’s entrepreneurs and available grant and/ or loan funds with affordable conditions from the government, NGOs, and private sectors, that enabled women to start their businesses.

As women generally play a substantial role in productive and financial decision-making, however, having the opportunity to learn about the benefits of these technologies may increase the likelihood that the household ultimately decides to adopt them. Many technologies require a substantial upfront investment, but if both women and men are convinced of the benefits, they may be more likely to take this risk.

5.5 Overcoming Gendered Barriers through Climate-Smart Interventions

5.5.1 Existing Policies and Practices

The Government of Cambodia’s Rectangular Strategy Phase III 2014–2018 (RS III) provides the framework for policies and strategies addressing poverty reduction and promoting the economic empowerment of women. Gender equality is not explicitly mentioned in the overarching objective of RS III, but the document clearly refers to promoting the role of women in the economy, empowering women, and further mainstreaming gender in government initiatives as priorities⁷⁰. As a result, the Royal Government has achieved some great results such as mainstreaming gender equity in policy framework and national development plan, reducing gender gap in education, vocational training and civil service; widening women entrepreneurship initiative, reducing domestic violence and sexual abuse against women and children, uplifting social morality, women’s dignity, and the well being of Cambodian families, and improving legal service for women and children, veterans, and persons with disabilities. With the above mentioned results, women in Cambodia still face discrimination. Additionally, work and family burden is still a barrier for women to be involved in education, economic, social and political sectors. Trafficking of and violence against women and children, especially for migrated women, is still prevalent while the coverage of national social assistance program and social security scheme remains limited.

The Rectangular Strategy, Phase IV, 2019-2023, sets out the government’s overarching objectives and a roadmap for economic growth, development, and the reduction of poverty. The government strategy recognizes women as “the backbone of the Cambodian society and economy”. Under the fourth rectangle, capacity and human resource development, the government strategy proposes to improve the social-economic status of women by strengthening education program, vocational training programs, empowering women with technical and entrepreneurial skills, promoting the role of women in the public sector, strengthening women’s abilities to pursue leadership at management and technical levels and further mainstreaming of gender in government initiatives, updating and implementing the Neary Rattanak Strategic Plan by continuing to mainstreaming gender in the development policies and plans in all sectors, and strengthening partnership with stakeholders to prevent trafficking of and violence against women and children.⁷¹

The National Gender Policy, Neary Rattanak V 2019-2023, is a 5-year strategic plan for strengthening gender mainstreaming and women’s empowerment. It was developed by the Ministry of Women Affairs (MOWA) to support the government’s rectangular strategy phase IV to strengthen gender equality in every sector and at every level to promote the advancement and empowerment of women. The strategy focuses on six prioritized areas:

⁷⁰ Government of Cambodia (2013) Rectangular Strategy” for Growth, Employment, Equity and Efficiency Phase III. Phnom Penh

⁷¹ Government of Cambodia. 2018. Rectangular Strategy for Growth, Employment, Equity, and Efficiency, Phase IV. Phnom Penh

1. Expand research and assessment programs on gender and formulate and coordinate in order to implement the first national policy on Gender Equality and Sectoral Program.
2. Promote and facilitate gender mainstreaming within the sectoral framework strategic plans and national programs, including the Public Administration Reform (PAR) program, the Decentralization and De-concentration (D&D) program, and the Public Financial Management Reform program (PFMRP).
3. Strengthen the capacity of gender mainstreaming mechanisms at all levels, including the Gender Mainstreaming Action Group (GMAG) in different sectors, the Technical Working Group on Gender (TWG-G), the Women and Children's Consultative Committees at the Capital, Provincial, Municipal, District and Khan (WCCC), the Women and Children Committee at Communes and Sangkats and relevant stakeholders.
4. Strengthen systems and mechanisms for monitoring and evaluating gender mainstreaming and women's empowerment in the different sectors.
5. Promote public awareness and support for the promotion of gender equality, including the implementation of programs on public behavior change and overcome negative gender stereotypes in society that discriminate against women and girls in all forms.
6. Promote new initiatives, lessons learned and best practices on the implementation of gender mainstreaming in policies, programs and sectors, as well as to strengthen the knowledge of management and sharing.⁷²
7. The MOWA has formed a Gender and Climate Change Committee, which gathers information on gender and climate change, conducts studies on the impact of climate change on women and children and builds climate change capacity in the ministry's departments. The MOWA has also integrated climate change, green growth, and disaster risk management into Neary Rattanak IV, the National Policy on Gender Equality and Women's Empowerment. In addition, as part of Cambodia's periodic reporting to the Convention on Ending all Forms of Discrimination Against Women (CEDAW), the Cambodia National Council for Women (CNCW) responds specifically to the disproportionate impacts of climate change on rural women and acknowledges the policy and programme efforts underway in Cambodia to mitigate these impacts.

The Gender Mainstreaming Policy and Strategic Framework in Agriculture Sector 2022-2026 is developed by the Ministry of Agriculture, Forestry and Fisheries to support the Cambodian National Rectangular Strategy Phase IV to strengthen gender equality in every sector and at every level and to promote the advancement and empowerment of women. The strategy focuses on four main objectives:

1. Promoting women's economic empowerment through women's equitable access to and use of resources and services and improved conditions for women in agriculture.
2. Strengthening capacities, resources and commitment within MAFF to ensure effective mainstreaming of gender perspectives into the agriculture sector.
3. Increasing capacity of women and men, equal representation and participation in agriculture sector.
4. Improving collaboration and coordination between all stakeholders in agriculture sector, climate change and natural resource management⁷³.

The NDC update process was initiated with the relevant line ministries and included contributions from a number of development partner experts and the participation of stakeholders from a range of different sectors. Every effort was made to conduct consultations in a gender responsive way.

The keys enabling actions in NDC update 2020 are:

1. Strengthen institutional capacities at national and sub-national levels to integrate gender responsiveness in climate change adaptation policies, plans, programming, including gender sensitive budgeting by (MoWA),
2. Enhance coordination and implementing accountability mechanisms to reduce climate change vulnerabilities of disadvantaged women and other marginalized groups such as ethnic minority women and men, People with Disabilities (PWD), youth, and the elderly.
3. In NDC update 2020's detailed mitigation measure, most priority actions have a specific target for women's participation that ranges from 15% to 70%. Gender and age disaggregated data are crucially important in

⁷² The Government of Cambodia, MOWA (2020) Neary Rattanak V, 2019-2023. Phnom Penh.

⁷³ The Gender Mainstreaming Policy and Strategic Framework in Agriculture Sector 2022-2026

measuring the success of the gender targets, not only related to women's participation but also women's access to skills and technology, as well as women in climate-related decision making.

5.5.2 Future Opportunities

Climate-smart technology and practices offer significant potential for addressing the barriers women currently face to achieving equity in agricultural. According to Dr. Manuel Reyes, a research professor at the Kansas State University, a vegetable growing experiment in Siem Reap province revealed that combining no-tillage and drip irrigation system freed the women farmers from carrying water, tilling, and weeding. Similarly, studies conducted in other country contexts indicated that the adoption of CSA practices including zero tillage machines, laser land leveling, green manuring, crop harvesters, weeder, solar pump irrigation, and post-harvest management practices can substantially reduce women's labor burden and also improved women's access to agricultural resources and decision-making process as well as provide linkages to new market opportunities.⁷⁴ In addition to this, the study of the United Republic of Tanzania showed that female and male producers have freer incomes after adopting CSA technologies in their farms. CSA technologies such as drip/sprinkler irrigation system, net-house, solar water pump and other smart technologies can be the best option for increasing women participation in vegetable production. Adoption of the climate-smart agriculture (CSA) technologies reduce women's labor burden in agriculture.

Opportunities for individual women in accessing trainings and climate smart technologies in vegetables production and value chains

Qualitative interviews conducted for this study revealed that while agricultural trainings related to climate smart technologies are open to both women and men, women still generally have less opportunity to join in practice due to competing care responsibilities and social norms which discourage their attendance. These trainings provide farmers with valuable knowledge related to CSA, including agriculture techniques, pesticide application, and technologies which include tractors, tiller trolleys, drip irrigation, plastic mulch, sprinkler, and others farm tech.

Women who are unable to attend these trainings are limited in their ability to apply these new skills and technologies to their farms properly. They may also not see the value of investing in such technologies, which often carry large initial investments, if they have not been trained to understand the benefits in terms of yields, income, and the health and safety of the family.

Women are already integrated into many stages of the vegetable value chain, including soil preparation, covering with plastic mulch, seeding, transplanting, drainage, fertile, irrigation, weeding, harvesting, market connection and negotiation, financial decision-making, and management. Increasing women's awareness of CSA technologies and their benefits presents a significant opportunity to increase the adoption of these technologies. In order to do so, it is necessary to provide trainings that meet the unique needs of women and to work to break down social and cultural barriers that continue to prevent women from participating fully in this space. Suggestions for how to achieve this are provided in more detail in the Recommendations section, below.

Opportunities for the private sector, NGOs, and other non-governmental actors

The survey revealed that private sectors (input firms, MFIs/Banks) also play crucial roles in motivating women to engage in the vegetable production, processing, and marketing by ensuring that services are accessible for women and meet women's unique needs. For example, by ensuring that financing is available to women (regardless of their marital status) with a low collateral requirement would allow women to more readily invest in valuable agricultural inputs, including climate-smart technologies. This could also be achieved by input service providers, who would offer low cost financing for their products to both women and men, which would support with increasing the uptake of climate-smart technology more generally. Suppliers of climate-smart technology should also focus their marketing and training on how their technologies meet the unique needs of women, as often these tools have outsized benefits for female farmers by reducing other constraints they face (e.g. time poverty or limitations around heavy labor). This will not only increase women's productivity but also contribute to promote women's participation in this sector more broadly while simultaneously reducing the climate impact of vegetable farming.

Improved policy, guidelines, and market spaces

⁷⁴ Khatri et al, 2020

Government and community groups and development NGOs (PDAFF, ACs, NGOs) should also seek to provide equal opportunities to women to engage in the vegetable production and value chains through establishment of policies and guidelines, female-focused trainings, marketing events for women (exhibitions), and capacity building for existing systems actors to ensure gender considerations are integrated appropriately across all stages of the value chain. This would allow women to join a community and build networks to promote their products, with linkages to marketplaces where applicable. This would also provide a platform to showcase the benefits of climate-smart technologies, allowing women to share their success stories and learn from each other.

To overcome the social norms that women confront in the agricultural sector generally, government actors can work with NGOs and other key stakeholders to incorporate a gender mainstreaming approach into providing agricultural trainings. Additionally, the government could also allocate resources towards conducting further research into the role that women play in mitigating climate change and increasing resilience in agriculture to better understand the unique and evolving needs of women in this space.

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

In Cambodia, agriculture remains one of the largest economic sectors, contributing to the livelihoods of close to 60% of the Cambodian population.⁷⁵ Increasingly, however, the Cambodian agricultural sector has been under threat as a result of climate-driven weather events such as extreme flooding or droughts. This threatens both livelihoods and food security and serves to exacerbate existing gender-based and socio-economic inequalities.

To ensure a stable future for rural Cambodian households, it is necessary to adopt an approach that enhances resilience to existing climate-related challenges while also improving sustainability, increasing equity, and supporting smallholder farmers economically. This research sought to lay a foundation for addressing these issues by more fully unpacking the significant overlap between promoting women's participation in agriculture in a meaningful way and expanding the use of climate-smart technologies.

This study focused on vegetable value chains in Cambodia, as vegetables were found to represent the greatest existing opportunity to achieve meaningful and profitable change across each of the key areas of interest.

Gender Roles

Qualitative interviews conducted as part of this study suggested that most Cambodian farmers of both genders feel that largely, men and women share responsibility when it comes to vegetable production and often makes both farming decisions together. Nevertheless, women and men still reported distinct responsibilities along the value chain, with women taking responsibility for the bulk of the 'lighter' tasks (including seeding, planting, farm management, harvesting, and marketing) while men took on tasks that were considered dangerous or required more physical strength (including operating heavy machinery or applying fertilizer).

Women were also most heavily involved in post-harvest tasks, including processing and marketing. The processing sector in Cambodia in general is quite limited, however, processing was reported to add little value to agricultural products. Expanding and enhancing processing activities may present a potential opportunity to increase women's participation within vegetable value chains (see Recommendations, below). Although women are engaged in agricultural associations and cooperatives, they tend to hold administrative positions while leadership positions continue to be dominated by men.

When it comes to accessing key resources, including trainings, financing, and agricultural inputs, women remain limited. The biggest barrier remains the fact that women often take on a disproportionate share of care and housework, leaving them with little free time. Additionally, in some cases, women reported that their husbands discouraged them from attending the training or social norms resulting in information being delivered more informally

⁷⁵ Food and Agriculture Organization of the United Nations. *Joint Press Release: Release of the Report of the Cambodia Agriculture Survey 2020*. 22 September 2022.

to the male head of households. Both women and men reported that women were also limited by their physical strength, which prevented them from engaging in certain manual labor tasks.

These barriers limit women's ability to participate in vegetable production fully and also hinder their understanding and adoption of climate-smart technologies. At the same time, adopting climate-smart interventions may present an opportunity for women to overcome these barriers. Interventions such as drip irrigation and sprinkles free up time, increasing the time women have available to invest in themselves or accomplish other tasks. Net houses and similar interventions reduce the need for pesticides, a task often seen as dangerous and not suitable for women. Increasing women's awareness of the unique and likely disproportionate benefits these tools have for them presents a meaningful opportunity to expand adoption.

Climate-Smart Interventions

Currently, the adoption of most climate-smart technologies in Cambodia remains low. Most farmers surveyed had heard of at least one climate-smart intervention, and understood at least some of the potential benefits it offered in terms of increased yield and vegetable quality, but barriers still exist to actually adopting the technology in practice. The most commonly cited barrier was the high upfront cost of many interventions, including net houses and advanced irrigation systems. These interventions often require farmers to take out a loan, generally at the beginning of the planting season when the intervention would be installed. Despite the potential economic returns, farmers perceive taking out a loan as high risk in the face of unstable harvests and fluctuating vegetable prices. Market stabilization and other risk-reduction mechanisms, combined with accessible and affordable financing options, may offer a solution and increase adoption of these technologies among farmers.

Based on the findings, researchers proposed the following recommendations to increase vegetable production and income of farmers and reduce gender gaps in vegetable production, including:

6.2 Recommendations

The government

The study revealed that the processing sector is limited in Cambodia and provided less value added to agricultural productions. Women have been suffering from time poverty as a result of overwhelming housework and agricultural activities. They have also limited access to agricultural training and resources. One of the key findings is that adopting climate-smart agricultural technologies have been providing huge profits to farmers in terms of increasing yield, income, and reduced burden of women in the vegetable farming activities. However, farmers are reluctant to invest in these technologies because the price of products and demand are unstable throughout the season. In addition, farmers need to have a huge initial investment. The following recommendations would propose to address the challenges of women and encourage them to fully participate in vegetable production.

First, in order to scale up the adoption of CSA in Cambodia, the government should bring together agri technology providers, financial institutions and extension service providers like NGOs for unified provision of CSA technologies, financing them and providing adequate knowledge transfer to the farmers required for using these technologies respectively.

Second, the government should promote the climate-smart agriculture (CSA) technologies application in Cambodia. The promotion of public private partnership (PPP) model and reduction of regulatory burden in farm input sectors can help to reduce price of agricultural inputs and CSA technologies so that the challenges of technological accessibilities and its application in Cambodia can be fixed.

Third, with the household duties, women have less time to participate in any capacity-building activities, so the government should have an awareness or training plan on climate-smart agriculture technologies applications that are convenient for female farmers to be involved, or sharing training summaries electronically via a platform that is accessible to women in rural areas (e.g., Telegram groups which allow for voice and video messaging). In addition, the provincial department of agriculture, forestry, and fisheries (PDAFF) should provide further technical assistance to farmers so they can apply the technologies effectively.

Fourth, the agricultural processing sector in Cambodia remains limited due to limited processing facilities and technologies, a lack of capital to develop these resources, fluctuations in the supply of qualified vegetables, and high operational costs, namely as a result of the high price of electricity. Even where vegetable processing facilities do exist, processing generally does not add significant value. One option to address these issues could be to provincial department of agriculture, forestry, and fisheries (PDAFF) should provide further technical assistance to farmers so they can apply the technologies effectively. This could include introducing new processing technologies and machinery, providing technical support, facilitating contract agreements between farmers and processors, expanding market linkages between processors and domestic and international buyers, and providing financial support for manufacturing operations.

Fifth, the government should collaborate with agricultural cooperatives, NGOs, agricultural service providers, and enterprises to raise awareness and develop solutions. This includes ensuring these actors are aware of the specific barrier women faced, how this inequity negatively impacts all members of the community, and how these constraints can be alleviated.

Sixth, to help farmers mitigate risk, the government should work with financial institutions to provide access to safe, low-cost financing options for farmers to invest in net houses and other CSA technologies. To increase uptake, it may be beneficial to offer loans in which the payments correspond to harvest cycles and fluctuations in crop pricing as a means of reducing uncertainty and mitigating risk for farmers.

Seven, the government and private sector should establish entrepreneur technical working groups to facilitate and support farmers and women-led agricultural enterprise to access agricultural and entrepreneurship skills and financial scheme such as grant and/ or affordable loan. Eight, the government and private sector should take further action to promote women in leadership of agricultural cooperative and enterprise by encouraging women to stand for election of cooperative committees.

Ninth, the government should work with financial institutions, and input suppliers to simplify or set up visible guidelines and procedures to enable women to access to financial scheme to start up the enterprises.

Financial Institutions, NGOs, and Agri Technology Providers

The research team proposed several recommendations for the financial institution.

First, the financial institutions play crucial roles in motivating women to engage in the vegetable production, processing, and marketing by ensuring that services are accessible for women and meet women's unique needs. Providing financial services with low interest rate and a low or non-collateral requirement allows women to more readily invest in valuable agricultural inputs and CSA technologies. Therefore, adoption of CSA technologies would be generally increased. Further, loan products and documentation should be simplified to ensure the loan products are accessible by women owned enterprises.

Second, suppliers of CSA technologies should focus their marketing and training on how their technologies meet the unique needs of women, as often these tools bring significant benefits for female farmers by reducing other constraints they face (e.g. time poverty or limitations around heavy labor). This will not only increase women's productivity but also contribute to promote women's participation in this sector more broadly while simultaneously reducing the climate impact of vegetable farming.

Third, NGOs and agri-technology providers should invest in raising awareness of climate-smart technologies among female farmers, especially those who don't have a male partner, to know the advantage of technologies that can help them break down barriers to entry and participate fully in all stages of the farming process. These relevant actors should coordinate having the plan includes mapping women in agriculture, climate risks, and poverty hotspots and entails understanding the role of women in agricultural activities to identify the suitable CSA options for reducing the levels of labor drudgery.

Fourth, NGOs and Agri Technology Providers should ensure technologies and productive resources are accessible by women. For instance, the information related training and workshop should be shared to both husband and wife so that women can have a chance to participate these events. The schedule of training and workshop should be flexible to ensure women can participate the events. In addition, technical assistances on the adopted technologies should be made to ensure both men and women farmers can apply the technologies in their farms effectively.

Fourth, NGOs and agri-technology providers should provide training on gender and its intersectional approaches to both male and female farmers. Previous projects, including the MASE 2 project implemented by World Vision in Cambodia, have seen successes in empowering female farmers through targeted training focused on healthy gender dynamics within communities and families. Similarly, Damnai Sabai Mongkul which is initiated by the ASEAN CRN will go beyond its pilot stage and benefit a larger number of farmers, and increase their resilience to climate change. The project trained farmers in Preah Vihear province to use a rice variety tolerant to droughts and floods when planted at low lying fields. This training, provided to both male and female farmers, was found to have successfully increased women’s access to resources and agency to participate in meaningful tasks in agriculture. Additionally, the training helped to address time poverty among women by encouraging men to participate more meaningfully in household and domestic chores. To create meaningful change for women engaged in vegetable value chains, the research team recommends considering developing and implementing this training at the household level. Another best approach for sustainability is capacity development for farmers by agricultural cooperatives and other existing actors in the community.

CPSA/GrowAsia

The CPSA/ GrowAsia could consider working with the government and private sector to establish and strengthen farming contracts between producers and buyers to secure stable markets for vegetable producers. To simultaneously encourage climate-smart and green agriculture, contract farming agreements could include provisions which offer higher prices for crops grown using Good Agricultural Practices (GAP). In doing so, it is important to provide support for farmers to meet GAP standards, including facilitating trainings, working with input suppliers to reduce the cost of sustainable farming inputs or offer appropriate financing solutions, and identifying solutions for helping farmers prepare for and afford the cost of formal GAP certification.

7.0 ANNEX

7.1 Questionnaire and Interview Guides



CPSA [FGD]
Tool_[Farmer].docx



CPSA [FGD]
Tool_[Processor].do



CPSA [FGD]
Tool_Agriculture Co



CPSA [KII]_Input
Supplier.docx



CPSA [KII]_PDAFF
Staff.docx



CPSA [KII]_Private
Sector Business.doc

7.2 Atlas.ti codebook



CPSA_Inclusive
Value Chain_ Codeb