ADB TA-9993 THA: Climate Change Adaptation in Agriculture for Enhanced Recovery and Sustainability of Highlands

Gender Conscious Climate-Smart Agriculture for Highlands

Exploring the links between climate smart agriculture and gender relations in highlands

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AIT Asian Institute of Technology
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TA 9993-THA: Climate Change Adaptation in Agriculture for Enhanced Recovery and Sustainability of Highlands

Knowledge Product

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Executive Summary

In June 2020, the Asian Development Bank (ADB) approved a Technical Assistance (TA) to Thailand entitled "Climate Change Adaptation in Agriculture for Enhanced Recovery and Sustainability of Highlands" with financial support from the Japan Fund for Prosperous and Resilient Asia and the Pacific (JFPR). The Ministry of Agriculture and Cooperatives (MOAC) is the executing agency, and the Office of Agricultural Economics (OAE) is the coordination and implementing agency.

The TA objectives align with the strategies, goals and principles set out in the Thai Master Plan on Agriculture under the National Strategy (2018–2037), the Twelfth National Economic and Social Development Plan (2017–2021) and the Sufficiency Economy Philosophy.

The TA aims to reduce climate change vulnerability and enhance the adaptive capacity of highland communities and ecosystems to cope with current and projected climate change impacts; improve household livelihoods, food/nutrition security; and boost rural employment and support Thailand's economic recovery amid the coronavirus disease (COVID-19) pandemic.

The TA's expected outcome is improved agricultural competitiveness in the highlands of Thailand via an enhanced enabling environment for the adoption of climate-smart agriculture (CSA) in the project areas. The TA has four main outputs:

(1) Local and regional capacity to assess climate change vulnerability of highland agriculture evaluated.
(2) Gender and COVID-19-responsive CSA practices prioritized and analyzed.
(3) A quantitative and qualitative assessment of agricultural product quality, value addition and market linkages; and
(4) Strengthened capacity of local governments and communities to address climate change.

The objective of TA output (ii) is an empirical based understanding of gender responsiveness to climate change aligned with prioritized CSA practices in the highland areas of Nan Province. Gender responsiveness means both men and women have the same opportunity to learn and engage in CSA practices and to share their experiences with a wider farming community in similar geographical, agricultural, and cultural settings.

The articulation of an ADB gender and development policy in 1998[1] superseded the 1985 Women in Development approach and placed the ADB at the forefront of gender parity initiatives at the time, including gender equality in agriculture. Gender disparities continue in education, individual and family health, nutritional status, employment opportunities and wages, migration, political participation and leadership and decision making at both household and community levels. The World Economic Forum 2022 Global Gender Gap report[2] indicates that overall gender disparities in 2022 have increased from 67.8% to 68.1% in 2021. The increased gender disparities apply to less developed regions, including some countries in Asia. A total of 13 out of the 19 countries comprising the East Asia-Pacific region have improved the 2022 scores of the global gender index, a marginal improvement since 2021.

[1] ADB (2003) Gender and Development https://www.adb.org/documents/policy-gender-and-development and https://www.adb.org/what-we-do/themes/gender/main (accessed July 2022)

[2] World Economic Forum (2022) https://www3.weforum.org/docs/WEF_GGGR_2021.pdf (accessed July 2021)

Thailand ranks 8th of the 19 countries with an overall score of 0.709. Of the 146 evaluated countries, Thailand ranks 79th overall; 15th for economic participation and opportunity; 92nd for educational attainment; 37th for health and survival; and 130th in political empowerment.

Gender parity is a central pillar of the ADB program to promote CSA initially in Bua Yai Subdistrict and extended to other programs relevant to highland communities. Accounting for gender is a critical focus, given its centrality in the production and reproduction of poverty, its contribution to nutritional insecurity and gender-balanced household decision-making.

The concept of gender needs to be understood as a cross-cutting socio-cultural variable. It is an overarching variable in the sense that gender can also be applied to all other cross-cutting variables focused on social inclusiveness, such as race, class, age, and ethnicity. Substantial disparities in education, poverty, nutrition security and economic opportunities exist amongst the diverse highland ethnic minorities[3]. Ethnic disparities are similar in magnitude to gender differences and imbalances and subject to a similar set of attitudes and biases that support both discrimination and gender inequality.

This TA Knowledge Product addresses three central questions concerned with Gender conscious CSA in Bua Yai and the Thai Highlands.

(1) First, what are we being conscious of when referring to "Gender Conscious Climate-Smart Agriculture"? Gender consciousness is typically expressed as an understanding of the social relationships and dynamics between women and men, compared with gender viewed through the lens of biology. Identifying a concise operational framework of gender relations specific to CSA, balanced against excessive gender relational detail is a central theme of the TA. A concise framework needs to be sufficiently detailed to identify effective intervention points to promote CSA adoption. In contrast, excessive relational detail, and the accompanying cost of high resource demands, is likely to compromise the motivation and capacity of District management and extension agencies to develop and sustain a CSA enabling environment.

(2) Second, how is gender consciousness evaluated and what is the purpose or objective of gender conscious Climate-Smart Agriculture in the highlands? International studies on gender and CSA/agriculture evaluate gender relations in terms of gender equality across multiple dimensions, such as individual decision making, educational and health opportunities, distributional fairness of income and assets and access to information. The primary objective of the TA then is promoting a CSA enabling environment that systematically addresses the dimensions of Bua Yai gender inequality identified through empirically based qualitative and quantitative evaluation.

(3) And third, having evaluated the level of gender consciousness in Bua Yai, expressed as gender equality across multiple dimensions, what gender inequalities need to be addressed by the TA that are likely to delay or limit the implementation of CSA practices and compromise the TA objective of facilitating a CSA enabling environment?

The **Gender Conscious CSA for Highlands** Knowledge Product connects and compares recent gender in agriculture/climate change/CSA findings conducted in Thailand, South Asia, and Sub-Saharan Africa with TA field results in Bua Yai.

Global analyses consistently reveal that women in agriculture lack access to and control over resources, such as land and capital, agricultural inputs and technology, training and extension services and are subject to unmanageable workload compared with their male counterparts, lack access to credit and are poorly represented in agricultural and non-agricultural decision-making groups and organizations.

[3] Cheewinsiriwat, P. (2009) Journal of Humanities Regular, 12 (2), 19–30; Thailand National Statistics Office 2020

The report sections on gender relations, the dimensions of gender equality and gender empowerment are introduced as background to the three questions posed above.

In contrast to gender interpreted as biology, gender in this report refers to the social roles and identities associated with what it means to be a man or a woman in a given society or context. Gender roles may be shaped by ideological, religious, ethnic, economic, and cultural factors and are a key determinant of the distribution of responsibilities, entitlements and resource endowments between men and women.

Technically-sound agricultural innovations and interventions often fail because of adverse and asymmetric power and empowerment relations and structures. Power is understood to be the ability of an actor within a social relationship, regardless of gender, to independently achieve their goals and ambitions, even when faced with coercion, resistance, or domination.

Equality does not mean "the same as" – and promoting gender equality does not mean that women and men will become the same. Equality ensures that the perceptions, interests, needs and priorities of women and men (which can be very different because of the differing roles and responsibilities of women and men) will be given equal weight in planning and decision-making.

In the report, we rely on three classes of factors affecting equality applied to gender (Linh et al., 2021):

(1) Distributional equality refers to the allocation of resources, costs and benefits among individuals, communities, and groups.
(2) Recognitional equality refers to the acknowledgment of and respect for identity, values and associated rights of individuals, communities, and groups; and
(3) Procedural equality highlights participation in the decision-making process, the asymmetries of power and influence and the capacity to be legally recognized and represented during disputes and conflict resolutions.

Gender in agriculture typically refers to multiple descriptive dimensions, for example:

(1) Land rights and entitlements
- Formal land rights
- Customary rights

(2) Productive resources
- Access (water)
- Credit and finance
- Training and extension

(3) Labor and unpaid work
(4) Employment
- Temporary and wage disparity
- Migration

(5) Decision making
- Household: food, education, health
- Land-use and agriculture
- Farmer groups and investments

Main Findings

The qualitative results from the TA focus group discussions, workshop responses and interviews with key Bua Yai respondents combined with the quantitative gender disaggregated results from the CSA multi-criteria analysis and livelihood survey indicate that gender equality across a number of dimensions is the norm in the Bua Yai, compared with gender inequalities observed in South Asia and Africa.

A combination of baseline focus-group discussions with farmers and staff from district/provincial agricultural agencies and multi-criteria analysis ranked seven CSA practices: solar-powered irrigation, biochar, Keyline ploughing, agroforestry, traditional organic composting, mulching and soil cover and stress tolerant varieties. Traditional organic composting agroforestry, and solar-powered irrigation systems were ranked as the three most relevant CSA practices proposed for Bua Yai. Keyline ploughing was the lowest ranked practice. The reported ranking of CSA practices was consistent for both men and women in Bua Yai sub-district.

Savings of farm inputs, labor and water access were the highest ranked benefits aggregated across the seven proposed CSA practices, consistent for both Bua Yai women and men. Improved income/profitability was the lowest ranked benefit.

The Sufficiency Economy Philosophy (SEP) has significantly contributed to balanced and sustainable development in Thailand and represent a uniquely Thai conceptual framework that aligns with the principles of gender and ethnic equality in agriculture.

In contrast to findings in Africa and India, similar field-based gender studies in Thailand reveal gender relations of Thai rural women are more equitable (Akter et al., 2017). In the field sample, Thai women:

(1) have equal access to productive resources, such as land and inputs.
(2) have greater control over household income than men.
(3) farm-level equality is also mirrored in mutual asset ownership.
(4) have equal access to land and joint decision-making power about the purchase, sale, or utilization of land.
(5) have disproportionate control and concentration of household income.
(6) are predominantly involved in crop establishment, weeding, harvesting and postharvest activities whilst men take a lead role in land preparation and pesticide and fertilizer application; and
(7) women's workload is affected by the level of mechanization during peak seasons. Labor-saving technologies, such as combine harvesters, drum seeders and mechanical transplanters, have alleviated women's drudgery and workload in Thailand.

Focus group discussions, a baseline survey, and a livelihood survey of randomly selected households in Bua Yai were implemented to (a) establish baseline quantitative data and normative perceptions of gender and (b) compare gender asymmetries of Bua Yai women with those of Africa, South Asia, and other districts in Thailand.

Overall, the reported observations from Bua Yai households and community members correlate well with other results from Thailand and support the findings that the level of gender equality is higher than those reported in Africa and South Asia.

Focus group discussions revealed that women and men living in the Bua Yai Subdistrict are both involved in the decision-making process for their children's education, buying and selling land, participating in communities and agricultural cooperative and religious activities. Men predominately make crop cultivation decisions, while housework and household income allocation (health, education, food, housing, and household assets) are mainly women's decisions.

Analysis of quantitative household survey data focused on collating data for 3 household members: the main respondent and the 2nd and 3rd household member, the latter being significantly younger compared with the main respondent.

Livelihood activities of men and women were similar across the main, 2nd and 3rd household members; the main differences were observed between age cohorts not gender. That is the

younger 2nd and 3rd household members have more diverse livelihoods with a lower representation in farming.

There are statistical differences in the education levels of Bua Yai women and men only within the 2nd member class. Member 2 males had lower levels of primary education and higher levels of secondary, college and university education compared with their female counterparts. Younger men and women (members 2 and 3) are better educated than the main respondent.

Compared with gender relationships, the highest level of asymmetry in education and livelihood activities was observed between age classes.

The perceived impediments to farming and experiences of climate change were assessed and ranked across three age classes: less than 35 years, 36- 50 years, and 51-80 years of age. All age classes ranked low output prices as the most important impediment. The 35 years age class ranked poor soil fertility and the lack of markets as the next most important impediment. The 36-50 years class ranked water shortages and pest damage as the next most important impediment and the 51–80-year class ranked water shortages and unpredictable input prices.

All age classes ranked increased drought, higher temperatures, and changes to the wet season (either delayed start or changes in the number of rainy days) as the most common experiences of climate change.

Income, the ratio of farm to off-farm income, time spent on off-farm labor and debt to income levels were not significantly different (t-test, $p>0.05$) between women and men and between the three age classes (ANOVA, $p>0.05$).

Perceptions and experience of climate-related impacts were similar for women and men. The major climate change experiences include increased drought, higher temperatures, and changes in the number of rainy days and the beginning of the wet season. These effects are correlated with lower crop yields and more insect pests and diseases leading to uncertainty in income predictions. A total of 14% of respondents indicated no effect of climate change.

Ranked impediments to farming were similar for men and women in Bua Yai: low output prices, water shortages and insect pest and disease were ranked as the most important constraints to farming. Lack of collective marketing, storage facilities, access to affordable credit and a lack of arable land were the least important farming constraints for both men and women respondents.

Recommendations

The factors influencing gender bias and inequality also affect ethnic bias and inequality. Accounting for gender is a critical focus of CSA, given its centrality in the production and reproduction of poverty, its contribution to nutrition insecurity and gender-balanced household decision-making. The concept of gender as an overarching cross-cutting variable applies to other cross-cutting variables, such as race, class, age, and ethnicity. Qualitative and quantitative analyses conducted as part of the TA indicate that gender relations are relatively “equal” in Thailand and Bua Yai compared with Sub-Saharan Africa and South Asia, the sites of most international gender-CSA field studies.

Substantial disparities in education, poverty, nutritional security, and economic opportunities exist amongst the diverse highland ethnic minorities. An equal focus on highland ethnic disparities and the attitudes, which support discrimination, may yield CSA implementation pathways with positive impacts similar to or greater in magnitude to pathways that singularly address gendered imbalances.

The difference in the ranking of the three age classes evaluated from the Bua Yai livelihood survey suggests that facilitating a CSA enabling environment will require tailored communication and extension messages geared to age. The benefits of CSA practices to improve soil fertility such as mulching, biochar and potentially Keyline, and access to higher value markets align with the highest ranked impediments of the younger 35 years age class. Solar irrigation to access water, coupled with the water saving properties of biochar and residue management/mulching are CSA practices that correspond to the 36-50 years age class's most important farming impediments.

Adopt an agreed and consistent definition of gender that reflects the relations between men and women and is relevant to CSA in highland areas. Gender roles can be shaped by ideological, religious, ethnic, economic, and cultural factors and are a key determinant of the distribution of responsibilities, entitlements and resource endowments between men and women.

A definition of gender for the highland regions of Thailand that is consistent with international CSA approaches enables bi-directional knowledge exchange between international and CSA highland development initiatives.

Studies of gender in agriculture and CSA have focused on four main themes. First, the need to identify men as allies for gender equality and involve them more actively. Second, the recognition that gender equality is not possible unless men change their attitudes and behavior in many areas, for example concerning reproductive rights, balanced household decision making, income autonomy and health. Third, that gender systems in place in many contexts are negative for men as well as for women – creating unrealistic demands on men and requiring men to behave in narrowly defined ways. Fourth, gender is cross cutting and multi-dimensional.

Adopt a consistent and coherent definition of equality. Like notions of gender relations and gender conscious CSA, equality, parity, inclusiveness, and equity are frequently interchanged terms but subject to variable interpretation. Equality revolves around substantive rights and ensures that the perceptions, interests, needs and priorities of women and men are given equal weight in planning and decision-making. In this report we propose that factors affecting levels of gender equality can be classified into *Distributional equality*; *Recognitional equality*; and *Procedural equality*.

Consider adopting the principles enshrined in the Sufficiency Economy Philosophy as a uniquely Thai framework for guiding gender and ethnically equitable CSA in Thailand, including the highlands, and translation into CSA operational actions and processes.

Report Structure

In acknowledging literature-based insights, contributions and field observations, the Bua Yai Sub-District study area is described in Section 1 of the Knowledge Product, followed by a synthesis of CSA and CSA practices specific to Bua Yai and the highland regions of Thailand in Section 2.

Three aspects of gender consciousness are summarized in Section 3 of the Knowledge Product:

(1) variable interpretations of "gender" focusing on gender as a social construct, the social roles and identities associated with what it means to be a man or a woman in a society or context and the role of gender in agriculture and CSA.
(2) how concepts of power and empowerment apply to gender.
(3) concepts of equality across three dimensions: procedural, distributional and recognitional equality.

Examples of gender focused conceptual and analytical frameworks are briefly discussed in Section 4. Additional reviews and details of gender concepts, empowerment, equality, and analytical frameworks can be found in the Annex.

Rigorous gender studies in Africa and South Asia consistently reveal that women lack access to and control over resources, such as land and capital as well as agricultural inputs and technology, such as improved crop varieties, training, information, and marketing services. Women are more likely to have an unmanageable workload than their male counterparts, they lack access to credit or have no decision-making power over credit and are poorly represented in agricultural and non-agricultural groups and organizations. The results of field studies conducted in Thailand that applied the same multi-dimensional approach, which suggests that gender equality approaches comparative parity, conclude Section 4.

The application of His Majesty King Bhumibol Adulyadej's Sufficiency Economy Philosophy initiative to CSA, gender and ethnicity is summarized in Section 5. The Sufficiency Economy Philosophy represents a uniquely Thai framework for guiding gender equitable CSA in Thailand, including the highlands and translation into operational processes.

CSA practices, preferences and community understanding in Bua Yai are described in section 6, including a summation of a multi-criteria analysis of CSA practices. The results of gender focus group discussions, baseline and livelihood surveys conducted in Bua Yai as part of the TA are also summarized in Section 6.

The qualitative and quantitative analysis and evidence complied as part of TA field research suggest that gender relationships, constraints and opportunities in Bua Yai correlate with equality metrics with other studies in Thailand and approach relative gender parity compared with Sub-Saharan Africa and South Asia.

Summary Section 7 concludes the main report.

Contents

Tables

Figures

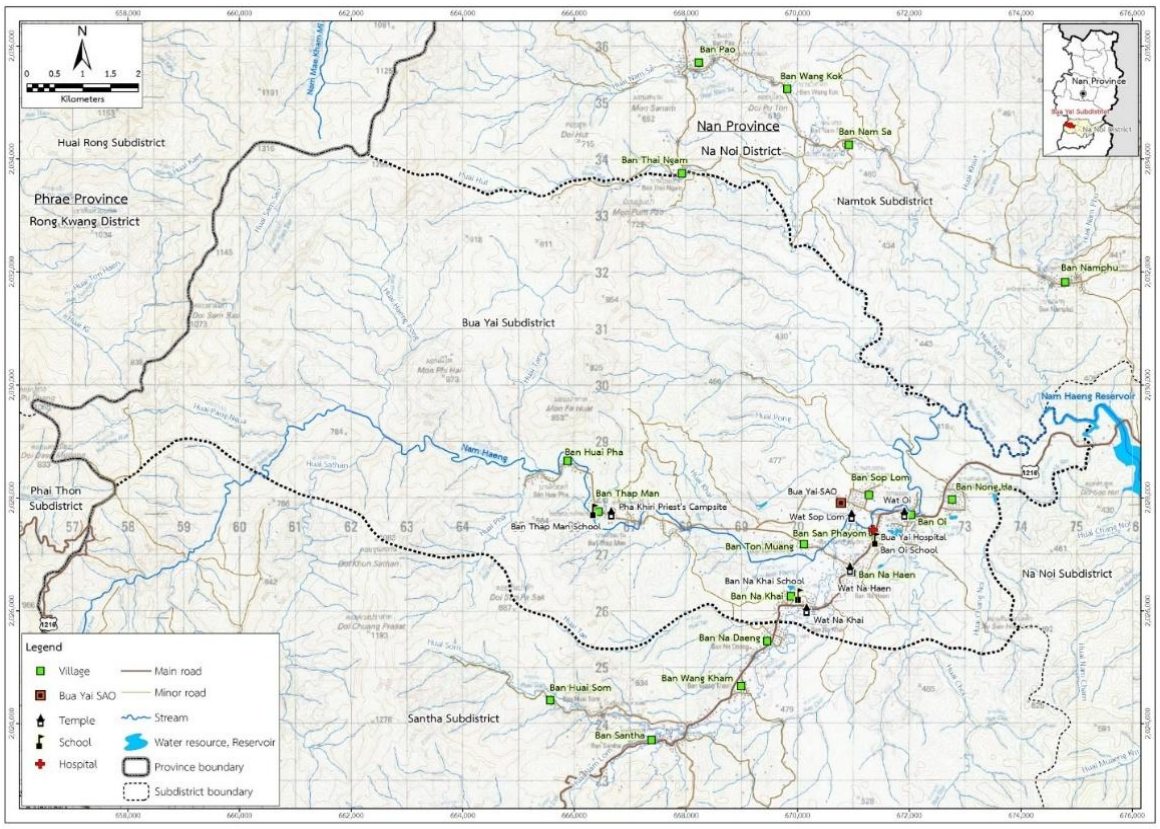
Abbreviations

ADB	Asian Development Bank
AFD	Agence Française de Développement
ANOVA	Analysis of Variance
CDD	Community Development Department
CGIAR	Consultative Group on International Agricultural Research
COVID	Coronavirus Disease
CSA	Climate-Smart Agriculture
DOAE	Department of Agriculture Extension
FAO	Food and Agriculture Organization
GCAN	Gender, Climate, Agriculture, and Nutrition
GHG	Green House Gases
IFAD	International Fund for Agricultural Development
JFPR	Japan Fund for Prosperous and Resilient Asia and the Pacific
MOAC	Ministry of Agriculture and Cooperatives
OAE	Office of Agricultural Economics
PDR	People's Democratic Republic
SDG	Sustainable Development Goals
SEP	Sufficiency Economy Philosophy
USD	United States Dollar
WEAI	Women's Empowerment in Agriculture Index

1. The TA Study Area

Nan Province is situated in northern Thailand, covering approximately 12,000 km^2 (Figure 1). Neighboring Provinces are (from the south clockwise): Uttaradit, Phrae and Phayao and to the north and east, it borders Sainyabuli Province of Lao PDR. Bua Yai Subdistrict is located to the west of Na Noi District. Bua Yai Subdistrict has an area of 131.1 km^2 or 81,939 rai (1 rai = 1,600 m^2).

Figure 1:
Map of the project area showing Bua Yai Subdistrict in Na Noi District and Bua Yai Subdistrict villages.



Source: Royal Thai Survey Department, 1999 (base map); Department of Local Administration, 2016 (administrative boundary)

Nan Province represents one-third of the Nan River Basin, which flows from north to south and joins the Ping, Wang, and Yom Rivers to form the Chao Phraya River in Nakhon Sawan Province. The Luang Prabang and Phi Pan Nam Mountain ranges vary from 600–1,200 m above mean sea level representing approximately 40% of the Provincial area. Almost 85% of the province is characterized by steep slopes exceeding 30°[4]. The highest point in Nan Province is located in Doi Phu Kha National Park at an altitude of 1,980 m above mean sea level.

Nan Province has a tropical savanna climate. According to the observations at the Nan meteorological station[5], the summer monsoon climate is dominant from May to October (the wet

[4] http://www.nan.doae.go.th/genaral/ 7-19.pdf
[5] Nan Meteorological Station, 2020

or rainy season). The mean monthly rainfall (from 1951–2017) is 181 mm and ranges from 125–231 mm. The monthly mean temperature ranges from 26.7–29.3°C, with a mean of 27.9°C. The dry season lasts from November to April and monthly mean rainfall ranges from 8–67 mm, with a mean of 30 mm. The monthly mean temperature in the dry season ranges from 23.0–26.2°C, with a mean of 24.7°C. Long-term climate projections derived from the TA indicate rainfall trends are changing (decreasing), a shorter wet season and longer duration dry season and average monthly and annual temperatures are increasing.

Table 1:
Population characteristics of 8 villages of Bua Yai Subdistrict.

Village Name	No. of Households	No. of males	No. of females	Total
Ban Oi	205	330	323	653
Ban Mai Mongkol	150	228	247	475
Ban Na Haen	214	302	293	595
Ban Tabman	186	272	276	548
Ban Nakai	199	293	293	586
Ban Tong Muang	83	114	129	243
Ban San Phayom	94	106	113	219
Ban Nong Ha	214	327	327	654
	1,345	**1,972**	**2,001**	**3,973**

Source: Registration Administration Office, Department of Provincial Administration, April 2019

The 2019–2020 population of Nan Province was 478,227 persons[6], comprised of approximately 170,000 households across 924 villages/communities and an average of three members per household. About 55% of households were engaged in agriculture. The mean population density was 39 persons/km^2, compared with the national population density of 130 persons/km^2 due to the mountainous topography. Poverty remains an important social problem in the province. In 2015, 28.8% of Nan's population lived under the poverty line (USD 1,057 per person per year in 2015), considerably greater than the national proportion of 8.6%[7]. An increased density of households living in poverty is found in steeper terrains, inclusive of Bua Yai Subdistrict, because of low agricultural incomes and a lack of job opportunities.

Nan Province is ethnically diverse, comprised of 13 recognized ethnic groups: Maung, Lue and Mui are the most prevalent[8]. The Khon Maung ethnic group comprises more than 97% of the population of Nan Noi District and Bua Yai Subdistrict. As of April 2019, the total population in Bua Yai Subdistrict was 3,973, comprised of 1,346 households, an average of 3 persons/household (Table 1) and a gender ratio of 1.01 (women to men).

Agriculture remains a key sector in Thailand's economy, with over 48% of the population living in rural areas and over 30% employed in agriculture[9]. In northern Thailand, monocropping (especially maize) has become the dominant economic activity following the conversion of large tracts of forests into agricultural land. Unsustainable farming practices and overexploitation of natural resources led to severe resource degradation, low productivity, negative health impacts and unstable incomes.

[6] Official statistics registration systems, 2019
[7] Office of National Economic and Social Development Board, 2015
[8] Cheewinsiriwat, P. (2009) Journal of Humanities Regular, 12 (2), 19–30
[9] https://www.statista.com

Key challenges facing highland agriculture in Provinces, such as Nan Province, include: (i) severe soil erosion due to crop cultivation on sloping areas without adequate soil conservation measures; (ii) soil degradation resulting from monoculture; (iii) soil and water pollution due to sloping topographies and overuse of fertilizers and pesticides; (iv) high sedimentation in water bodies, leading to low carrying capacity; (v) lack of secure land ownership or user rights; and (vi) limited collaboration and cooperation of local ethnic groups living in upstream areas with local government agencies[10].

[10] TA Inception Report (2021) Main Report, AIT Bangkok

2. Climate-Smart Agriculture in Bua Yai

The productivity of smallholder agriculture in Thailand and its contribution to food security depends on the services provided by well-functioning landscapes and agro-ecological conditions. Smallholder farming practices affect ecosystem functions and integrity, through landscape modifications, overextraction of water and nutrients, use of pesticides and degradation due to inappropriate agricultural practices and soil management.

Enhancing food security while contributing to climate change adaptation/mitigation and preserving the natural resource base requires the transition to more productive agricultural production systems. CSA based transitions focus on using inputs more efficiently, promoting less variability and greater stability in farm outputs that are more resilient to risks, shocks, and long-term climate variability. More productive and resilient agriculture requires a major shift in the way land, water, soil nutrients and genetic resources are managed to ensure that these resources are used more efficiently.

Integrated strategies and measures to address land degradation and cope with and adapt to climate change in Thailand are, thus, imperative to enhance the resilience of crop production systems and associated socio-ecological landscapes, ensuring the maintenance of Thailand's food security and the livelihoods of millions of rural farming families. Climate-smart agriculture (CSA) is gaining increasing attention as a key response to climate change, supporting the transformation and protection of the Thai agricultural sector. CSA aims to increase sustainable agricultural production by adapting to and building resilience to climate change. Technologies and practices are considered climate-smart when they contribute to the three pillars of CSA: increased productivity and incomes, adapting and building resilience to climate change; and reducing and/or sequestering greenhouse gas emissions.

CSA offers an opportunity to implement these strategies, contingent on empirical evidence to identify and overcome adoption barriers and adjust strategies to the new realities of climate change. Hence, scaling up CSA practices among highland smallholder farmers can support enhanced food/nutrition security, protection of the ecosystems and services that food security is dependent on and contribute to poverty reduction. CSA practices in Bua Yai and the highlands are increasingly endorsed as farming systems with the potential to maintain the natural resource base and support future food/nutrition security.

Box 1

CSA is an approach that helps guide actions needed to transform and reorient agricultural systems to effectively support development, improve rural livelihoods and incomes and ensure food security in a changing climate.

CSA aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible.

CSA practices are geared to reduce the effects and impacts of climate-related change on both ecosystems and agricultural communities.

CSA approaches and practices include developing stress-tolerant and high-yielding crop varieties, developing innovative technologies consistent with changing climate, establishing enabling policy environment towards farmers, climate forecasting, accessible early warning systems, building capacity on adaptation and mitigation to climate change and exploring employment opportunities for the communities in both farming and non-farming livelihood activities.

CSA is a knowledge-intensive process that requires substantial planning, intuition, and a willingness to experiment and learn. Conventional agricultural practices may also be tightly woven and entrenched into local Thai culture. While information is a powerful tool for enhancing the adoption of CSA, many Thai smallholder farmers either do not have access to appropriate information or are unable or unwilling to fully utilize existing information. Designing and implementing a suite of “smart” practices, geared to local conditions and context, is central to CSA approach.

CSA adopts a portfolio of smart interventions that cover the spectrum of farm household activities. These include:

Water-smart practices -- rainwater harvesting, laser land levelling, micro-irrigation, raised-bed planting, crop diversification, alternate wetting and drying in rice, direct-seeded rice.

Weather-smart activities -- ICT-based agromet services, index-based insurance, stress-tolerant crops, and varieties.

Nutrient-smart practices -- precision fertilizer application using Nutrient Expert decision support tools, Green Seeker, and Leaf Colour Chart (LCC), residue management, legume catch-cropping.

Carbon-smart practices -- legume integration, agroforestry, zero tillage, residue management, land-use system, livestock management.

Energy-smart practices -- zero tillage, residue management, legumes integration, direct-seeded rice, precision water management; and

Knowledge-smart activities -- farmer-farmer learning, capacity enhancement on CSA, community seed banks and cooperatives.

A combination of literature-based insights and expert opinions from Bua Yai District extension officers and agricultural agencies identified the climate risks and constraints affecting farm livelihoods and the potential mitigating contribution of seven CSA practices.

Climate risks, farming systems and constraints were identified as:

(1) Climatic risks: high rainfall variability, rising temperatures, greater frequency of extreme weather events (droughts and floods).
(2) Agricultural systems: rainfed as opposed to irrigated production, maize monoculture; and
(3) Key agricultural constraints: severe water scarcity, low soil fertility, severe soil erosion, high soil degradation, high soil and water pollution, lack of land ownership or user rights

Through a process of participatory-based engagement with agricultural agencies and key informants, seven CSA practices were evaluated as potential CSA demonstrations based on the capacity to contribute to the three CSA pillars and alignment with the agricultural and social characteristics of Bua Yai Subdistrict.

(1) Solar-Powered Irrigation Systems
(2) Biochar
(3) Keyline Approach
(4) Traditional Organic Composting
(5) Mulching and Soil Cover
(6) Stress (drought)-Tolerant Crop Varieties, especially rice and maize
(7) Agroforestry

Solar-powered irrigation systems are suitable for areas which are expected to experience climate change-driven adverse impacts on water availability and supply. Using solar energy for irrigation water pumping could be a promising alternative to conventional electricity and oil-based pumping systems. Solar-powered irrigation systems can increase the length of the cropping season and protect crops from drought stress, increasing household incomes particularly for remote producers. Solar-powered irrigation systems require significant initial investment costs and innovative financing models, especially for highland small-scale farmers, to ‘promote wider adoption.

Biochar application has the potential to jointly mitigate GHG emissions and sustain food/nutrition security. Biochar can be used for environmental management in four ways: soil improvement, GHG mitigation, waste management and energy generation. The positive effect of biochar on crop yield is mainly understood through its potential for direct nutrient supply and indirect soil conditioning. As a soil fertilizer, biochar is an important source of K, P, Ca, and Mg. Biochar is a natural recalcitrant and its alkalinity can improve soil pH and reduce the rate of nutrient leaching.

The Keyline approach can improve farming and grazing lands by reducing the rate of anthropogenic deterioration of land to make it more permanent and stable. Keyline management focuses on improving agricultural soils regardless of their inherent fertility status (poor or rich). One of the main aims of the Keyline approach is to conserve as much soil water from each rainfall event through a modified tillage system and specialized plough. Managed and designed according to farm-specific topography and slope, the Keyline tillage system slows, sinks, and spreads rainwater by reducing soil compaction, opening-up pore space in compacted soil and distributing excess water toward drier parts of the landscape. The Keyline water management practice has the potential to enhance water use efficiency.

The quantities, composition, and characteristics of organic waste are crucial factors of farm waste management methods and climate protection. Subject to the applied technology, organic waste represents both a resource and a source of GHGs (e.g., CO2, CH4, and N2O), emitted during biological degradation and conversion of organic matter. The use of organic compost is a sustainable and climate-smart approach to increasing soil fertility. Composting refers to the natural

process of decomposition of organic matter by microorganisms under controlled conditions, transforming waste into a nutrient-rich organic product to enhance soil fertility.

Mulching is a traditional practice that involves the covering of the soil surface with organic vegetation and occasionally with inorganic substances to conserve soil moisture, maintain plant tolerant soil temperature, reduce soil erosion, improve soil structure, and minimize nutrient loss and soil salinity. Mulching is a cheap and affordable, and sustainable agricultural technology readily adopted by highland farmers.

Climate-resilient crop varieties can assist in adapting to heat, cold, drought, salinity, and changing production management in places where climate changes will adversely affect crop production. Stress-tolerant varieties can deliver co-benefits for nutrition, by combining traits associated with climate variability (e.g., drought and heat stress) and nutrition (pro-vitamin A, iron, zinc, or quality protein).

Agroforestry is a widely promoted land use practice combining agriculture and forestry for delivering not only the main food security objective of CSA but also increasing resilience and mitigating the negative impacts of climate change. As a paradigmatic example of CSA, agroforestry plays a major role in mitigation of climate change impacts, conservation of biodiversity and source of commercially important raw materials like timber and gums. Agroforestry practices have been recognized as a solution to a wide range of environmental problems, such as land degradation, fertility and carbon loss from the soil, deforestation, loss of biodiversity, long-term water scarcity and GHG emissions, along with its role as a solution to numerous social problems, such as rural exodus, increasing malnutrition, increasing risk to climate change, and concentration of power among only few agribusiness corporations.

The potential contribution of the seven practices to the CSA pillars and suitability for Nan Province and Bua Yai Sub-district are summarized in Table 2.

Table 2:
Contribution of CSA practices to CSA pillars and suitability in the highlands of Nan Province.

CSA practice	Contribution to CSA pillars			Suitability for the highlands of Nan Province
	Productivity	Adaptation	Mitigation	
Solar-powered irrigation systems	Increases crop yield due to year-round availability of water	Increases water availability during the dry period	Reduces GHG emissions by replacing diesel irrigation pumps	Highly suitable for commercial vegetable production
	Improves family nutrition by diversifying products			
	Enhances crop diversification and increases income; thus, contributing to food security			
Biochar	Increases crop yield by improving nutrient supply and soil water holding capacity	Increases soil water holding capacity and water availability during the dry period	Reduces GHG emissions by sequestering carbon	Highly suitable for commercial vegetable production
Keyline approach	Increases crop yield by retaining more rainwater locally in the soil profile, thus enhancing water availability	Increases water availability during the dry period by improving rainwater infiltration	Keyline increases groundwater recharge; Keyline can reduce pumping energy required and act as a mitigation measure	Evaluated during TA demonstrations
Traditional organic composting	Increases crop yield by enhancing soil organic matter, soil fertility, water holding capacity, soil microbial diversity and soil aeration	Increases soil water holding capacity and water availability during the dry period	Increases soil carbon sequestration and reduces GHG emissions	Highly suitable for commercial vegetable production
Mulching and soil cover	Increases crop yield by improving soil water retention and reducing soil and nutrient losses through runoff	Increases water availability during the dry season by enhancing water infiltration, regulating soil temperature and activation of soil microbial activity	Increases soil carbon sequestration and reduces GHG emissions of stubble burning	Highly suitable for commercial vegetable production: reduced labour for straw/stubble management
Stress (drought)-tolerant crop variety	More production and stable yields despite changing climatic patterns	Crop diversification and yield predictability	Reduces the use of external inputs, reduces irrigation water use and reduces GHG emissions	Highly suitable for commercial maize production
	Less susceptibility to field crop losses, reduced damage to food production systems and fewer chances of total crop failures	Withstand drought, flooding, heat stress, among others		
Agroforestry	Increases productive portfolio of small-scale farmers by harvesting tree products, supplementing their diets, and developing additional income streams	Increases resilience to natural hazards (trees on farms can be used as shelterbelts and windbreaks and play a vital role in protecting against landslides, floods, and avalanches)	Increases soil carbon sequestration through increased biomass both above and below ground	Highly suitable as it provides a variety of ecosystem services, such as food, fuel, water, carbon sequestration, biodiversity, among others
		Reduces runoff velocity and soil erosion caused by heavy rainfall	Acts as an important carbon sink	
	Enhances and stabilizes crop yields by improving soil quality	Increases the absorptive capacity of soil	Reduces GHG emissions	
		Reduces soil temperature for crops planted underneath		

3. Gender Definitions and Propositions

The TA Knowledge Product set out to address three central questions concerning Gender Conscious CSA in the Highlands.

(1) First, what are we being conscious of when referring to "Gender Conscious Climate-Smart Agriculture"? Gender consciousness is typically expressed as an understanding of the social relationships and dynamics between women and men, compared with gender viewed through the lens of biology.
(2) Second, how is gender consciousness evaluated and what is the purpose or objective of gender conscious Climate-Smart Agriculture in the highlands? International studies on gender and CSA/agriculture often evaluate gender relations in terms of gender equality or parity across multiple dimensions, such as individual decision making, educational and health opportunities, distributional fairness of income and assets and access to information. The primary objective of the TA then is promoting a CSA enabling environment that systematically addresses the dimensions of Bua Yai gender inequality identified through empirically based qualitative and quantitative evaluation.
(3) And third, having evaluated the level of gender consciousness in Bua Yai, expressed as gender equality across multiple dimensions, what gender inequalities need to be addressed by the TA that are likely to delay or limit the implementation of CSA practices and compromise the TA objective of facilitating a CSA enabling environment?

The following sections combined with the empirical results of Bua Yai focus group discussions, interviews with key informants, participatory workshop observations, gender disaggregated multi-criteria analysis, and a randomized household livelihood survey underpin what "Gender conscious in the Highlands" means to CSA adoption and practice.

The meaning and interpretation of gender vary across a diverse range of groups and organizations at different times and in different contexts. Gender parity, inclusion, equity, and equality are scattered throughout an extensive portfolio of international, Southeast Asian, and Thai literature, agreements, and development proposals. The terms are regularly interchanged and similarly subject to variable implied meaning and interpretation.

Quisumbing et al. (2014 p4) argue that "The Food and Agriculture Organization (FAO) of the United Nations *The State of Food and Agriculture 2010–2011, Women in agriculture: Closing the gender gap for development* had a clear message: agriculture is underperforming because half of its farmers—women—do not have equal access to the resources and opportunities they need to be more productive". The 2010–2011 report had a long gestation from the special section of the 1983 *State of Food and Agriculture: Women in developing agriculture*[11], in contrast to several UN initiatives concerned with the status and inequalities affecting women. The adoption of gender equality and women's empowerment as Sustainable Development Goal 5 and as one of the eight United Nations Millennium Development Goals (2000) have signaled that gender issues continue to gain traction within the international community.

As of 2010, there were substantial deficits in the relevant empirical data about gender in agriculture, resulting in a reliance on "stylized facts…. such as women produce 50–60% of food in the developing world" (Quisumbing et al., 2014). The 2010–2011 State of Food and Agriculture focused on gender gaps in key agricultural inputs, plus additional material on data and methods,

[11] FAO (1983) The Sate of Food and Agriculture, FAO, Rome. https://doi.org/10.18356/8d5377a4-en

the gender asset gap and institutional changes toward more responsive agricultural research, development, and extension systems in an attempt to close the knowledge gap on gender in agriculture.

There have been substantial advances in understanding and addressing gender imbalances and inequalities since: for example the Global Alliance for Climate-Smart Agriculture, the FAO's CSA initiatives and the International Food and Policy Research Institute (Alkire et al., 2013; Quisumbing et al., 2014; World Bank Group et al., 2015; Bryan et al., 2017; Kristjanson et al., 2017).

However, the lack of specificity of what gender means and what is "equality" limits comparative analysis and reliable evidence-based policy support. More precise definitions allow reliable comparative analysis of gender-specific endeavors involving CSA, avoids claims of gender "inclusiveness" as a panacea and identifies evidence-based opportunities for aligning CSA engagement processes with agricultural problems of varying complexity.

Without workable definitions translating into operational CSA frameworks and alignment processes to match field engagement with problem attributes, claims of gender studies can act as a panacea or suffer from 'panacea proneness' (Ackoff, 2001). Panacea proneness occurs in turbulent, increasingly complex environments, characterized by uncertainty, discontinuities, and unpredictability. Panaceas are created when frameworks are either overly simplistic or overly specified and burdened with long lists of variables and exacting conditions (Ostrom, 2007). Panaceas are about doing wrong things right, not doing the right thing (Ackoff, 2001).

To address this risk, more precise and nuanced definitions of gender in agriculture have been proposed (Alkire et al., 2013; Quisumbing et al., 2014; Bryan et al., 2017; Kristjanson et al., 2017; Sexsmith et al., 2017).

There are three main conceptual interpretations of "gender": gender as biology (the presence or absence of a Y chromosome); gender as a social construct; and gender as identity (where an individual's gender identity may contrast with both the biological reality and social expectations of gender).

The concepts of "sex" and "gender" are often used inconsistently and interchangeably, when, in fact, they refer to two distinct concepts. Sex refers to the innate biological categories of male or female and is thus a category rooted in biological differences. On the other hand, gender refers to the social roles and identities associated with what it means to be a man or a woman in a given society or context (Quisumbing et al., 2014).

This report focuses on gender as a social construct (conceptual interpretation 2) and the role of gender in agriculture and CSA.

Gender roles may be shaped by ideological, religious, ethnic, economic and cultural factors and are a key determinant of the distribution of responsibilities, entitlements and resource endowments between men and women (Quisumbing et al., 2014; Akter et al., 2017; Varua et al., 2018). Because gender roles are socially, rather than biologically, determined, they are fluid and subject to change based on changing norms, resources, policies, and contexts. Gender differences mark every society, but these vary widely by culture and can change dramatically—within or between cultures—over time.

A further complication is that "gender" and "women" are often used interchangeably. Gender refers to both women and men, not an exclusive focus on women and the relations between them. The promotion of gender equality should concern and engage men as well as women. In much of early agricultural development, the focus was primarily on men. Achieving gender equality requires rebalancing by paying greater attention to women.

Three main approaches were taken in the increased focus on women in agriculture. Firstly, the need to identify men as allies for gender equality and involve them more actively in this work. Secondly, the recognition that gender equality is not possible unless men change their attitudes and behavior in many areas, for example, concerning reproductive rights, balanced household decision making, income autonomy and health. And thirdly, gender systems and disparities can be negative for both men and women – creating unrealistic demands on men and requiring men to behave in narrowly defined ways.

However, the importance of relations between women and men and the differential roles, resources and responsibilities of women and men of different ages, ethnicity and social class need to be kept in mind.

Gender systems are established in different socio-cultural contexts, which determine what is expected, allowed, and valued in a woman/man and girl/boy in these specific contexts. Gender roles are learned through socialization processes; they are not fixed but dynamic and changeable. Gender systems are institutionalized through education systems, political and economic systems, legislation, culture and traditions, norms, rituals, and taboos. In utilizing a gender approach, the focus is not on individual women and men but on the cultural, political, and economic systems, which determines gender roles, responsibilities, and access to and control over resources and decision-making.

3.1 Gender and Empowerment

Experience suggests that technically-sound agricultural innovations and interventions fail because of adverse and asymmetric power and empowerment relations and structures (Akter et al., 2017; Bryan et al., 2017; Kristjanson et al., 2017). Understanding and addressing differences in power and empowerment, including gender, are a major focus of most UN development agencies, banks, donors, and international agricultural research institutions, including the ADB, FAO and CGIAR. Definitions of empowerment focus on issues of gaining power and autonomous control over decisions and resources that determine one's quality of life.

Power is one of the factors that structure the interactions of people. Paraphrasing Weber (1922), Power' is understood to be the ability of an actor within a social relationship, to achieve their goals and ambitions, independently even when faced with coercion, resistance, or domination[12]. Social relationships manifest as gender bias that negatively affect women's autonomy and "power" act as potent forms of coercion and resistance.

This definition, hence, rests upon an actor's capacity or 'agency', 'autonomy' and opportunity context. Agency corresponds to asset endowment and entitlements, including psychological, informational, organizational, material, social, financial and human assets. Opportunity is measured by the rules, laws, regulatory frameworks, culture, norms and behavior of the formal and informal institutions of society (Akter et al., 2017).

Alternatively, 'Influence' is a close friend of power, defined as the ability of Actor 1 to get Actor 2 to do what Actor 1 wants[13].

The empowerment of women concerns women gaining power, being able to translate choices into desired actions and gaining autonomy and control over their own lives. It involves awareness-raising, building self-confidence, expanding choices, and increasing access to and control over

[12] Weber (1922) Economy and Society: An Outline of Interpretive Sociology (1978 ed.). Berkeley, CA: University of California Press. Cited in Schiffer. E. (2007) The power mapping tool: a method for the empirical research of power relations. IFPRI Discussion paper 00703
[13] Derived from Dahl, R. (1957). The Concept of Power. *Behavioral Science* 2 (3): 201–215

resources and actions to transform the structures and institutions that reinforce and perpetuate gender discrimination and inequality.

The process of empowerment is as important as the goal. Inputs to promote the empowerment of women should facilitate women's articulation of their needs and priorities and a more active role in promoting these interests and needs. Empowerment of women cannot be achieved in a vacuum; men must be brought along in the process of change and should not be viewed as a zero-sum game where gains for women automatically imply losses for men.

3.2 Gender and (In)equality

Gender equality is the preferred terminology within the United Nations, rather than gender equity. Gender equity denotes an element of interpretation of social justice, usually based on tradition, custom, religion, or culture, which is most often to the detriment of women. According to the United Nations, gender equality means that individuals' rights, responsibilities, and opportunities will not depend on whether they are born male or female.

Equality does not mean "the same as" – and the promotion of gender equality does not mean that women and men will become the same. Equality between women and men has both a quantitative and a qualitative aspect. The quantitative aspect refers to the desire to achieve equitable representation of women – increasing balance and parity, while the qualitative aspect refers to achieving equitable influence on establishing development priorities and outcomes for women and men. Equality involves ensuring that the perceptions, interests, needs and priorities of women and men (which can be very different because of the differing roles and responsibilities of women and men) will be given equal weight in planning and decision-making.

There is a dual rationale for promoting gender equality. Firstly, that equality between women and men – equal rights, opportunities, and responsibilities - is a matter of substantive human rights and social justice. And secondly, greater equality between women and men is also a precondition for (and an effective indicator of) sustainable, people-centered development. The perceptions, interests, needs and priorities of both women and men must be taken into consideration not only as a matter of social justice but because they are necessary to enrich development processes.

Sustainable Development Goals (SDGs) have been widely endorsed as an aspirational blueprint for national development. The SDG Goal 5 specifies the conditions of gender equality: absence of violence, exploitation and harm, full and active participation in decision making, recognition of unpaid work, equal rights to economic and land resources and access to information and technology.

There are, however, variable interpretations and implied meanings of "equality" contained in the Sustainable Development Goals (SDGs). Apart from goals 11–14, the remaining SDGs refer to equitable access, sharing or opportunities as an outcome of sustainable development. A clear understanding of what equality entails is not immediately evident from the SDG framework and language. Variable interpretations and the interchangeability of equity, parity, justice, and equality have compromised the formulation of a coherent framework and comparative analysis of efforts to correct gender inequalities.

Linh et al. (2021) have proposed a clearly defined and tractable working definition of equality, including gender, by classifying economic, political, social, cultural, environmental, spatial, and knowledge-based inequalities into three distinct classes. These "equality classes" can also be applied to gender inequalities.

(1) Distributional equality refers to the allocation of resources, costs and benefits among individuals, communities, and groups.

(2) Recognitional equality refers to the acknowledgment of and respect for identity, values and associated rights of individuals, communities, and groups; and
(3) Procedural equality highlights participation in the decision-making process, the asymmetries of power and influence and the capacity to be legally recognized and represented during disputes and conflict resolution.

The typology improves analytical sensitivity by describing the equality "of what" and "between whom", which also resonates with practical notions of vulnerability: that is the vulnerability of "whom" (e.g., communities and-or ecosystems) to "what hazards and stressors", for example, uncertain water access, reduced nutrient and sediment loads, global warming, price volatility, or political decisions[14].

The concept of gender needs to be understood clearly as a cross-cutting socio-cultural variable. It is an overarching variable in the sense that gender can also be applied to all other cross-cutting variables focused on social inclusiveness, such as race, class, age, and ethnicity. Substantial disparities in education, poverty, nutrition security and economic opportunities exist amongst the diverse highland ethnic minorities (Thailand National Statistics Office 2020). Ethnic disparities are similar in magnitude to gender differences and imbalances and subject to a similar set of attitudes and biases that support both discrimination and gender inequality.

[14] GMS Roundtable on Climate Adaptation (2018) Watershed Vulnerability and Adaptation Assessments in the Greater Mekong Subregion: Guidelines for Climate Change Practitioners. Bangkok, Thailand

4. Conceptual Frameworks of Gender in Agriculture

Two multi-dimensional frameworks to evaluate gender parity and equality are detailed in the Annex of the TA Knowledge Product. The first is a five dimension framework comprised of land rights and entitlements, access to productive resources, labour and unpaid work, employment including migration and decision making (Sexsmith et al., 2017).

The second evaluative framework integrates gender, climate, agriculture, and nutrition (GCAN) to describe the relationships of gender attributes, absorptive and adaptive responses given a specific climate shock or stressor and livelihood options and pathways. Decisions and responses made today feedback and influence the decision context of future climate stressors and shocks (Bryan et al., 2017). The authors note that "*although the framework focuses on climate shocks and stressors, it could also be adapted to assess other sources of livelihood risk, such as food price shocks, political instability, and conflict. It can also be adapted to illustrate the intersection of climate, gender and nutrition issues within a given local context, development program, or set of response options (for example, on-farm climate-smart practices or technologies)*".

The Women's Empowerment in Agriculture Index (Alkire et al., 2013) has been implemented with rural communities in Thailand (Akter et al., 2017). The following section summarizes the WEAI and the results of the Thai study.

4.1 "Women's Empowerment in Agriculture Index" (WEAI)

Alkire et al. (2013) reported the pilot testing of the diagnostic five-dimensional "Women's Empowerment in Agriculture Index" (WEAI), designed to detect, and measure the level of women's empowerment, agency, inclusion, and decision-making parity in the agricultural sector of developing countries. Field interview responses of men and women in the same household were aggregated to derive a country level WEAI, based on similar methods to measure multi-dimensional poverty. The six non-correlated dimensions of the WEAI and sub-themes used to guide focus group discussions and interviews are:

(1) Production
- Participation in rice farming and specific roles
- Collaboration in the field
- Decision making in the field
- Decision making about inputs
- Reason for decisions made

(2) Resources
- Ownership of land and house
- Ownership of assets (livestock, equipment, durables)
- Decision making about purchase and sales of land, house, and assets
- Official registration of assets
- Household decision making
- Credit: Access, reason, and decision making

(3) Income
- Sources of income
- Control overuse of income
- Management of family budget

- Expenditure posts

(4) Leadership
- Overview of different organizations
- Membership/Leadership
- Organizational structure and influence
- Public speaking

(5) Time and drudgery
- Daily activities
- Workload
- Seasonal workload
- Health-related risks
- Leisure activities
- Balance workload/leisure

(6) Access to extension service
- Access to training
- Access to agricultural information
- Access to agricultural technologies

Quisumbing et al. (2014) and Akter et al. (2017) reported that gender research and women's empowerment in agriculture has mainly focused on Africa (59% of reviewed studies) and South Asia (22% of reviewed studies) with a limited number focused on Southeast Asia (6% of reviewed studies).

The WEAI studies consistently reveal that women lack access to and control over resources, such as land and capital as well as agricultural inputs and technology, such as improved crop varieties, training, information, and marketing services. Women are more likely to have an unmanageable workload compared with their male counterparts, they lack access to credit or have no decision making power over credit and are poorly represented in agricultural and non-agricultural groups and organizations (Alkire et al., 2013; Quisumbing et al., 2014; Varua et al., 2018).

The gender difference in access and ownership to resources and income reported by Alkire et al. (2013) is likely to be specific to the farming systems of Sub-Saharan Africa and South Asia, where men and women grow different crops in demarcated plots, or the agricultural production system is heavily male dominated, and women's role is limited to postharvest activities (Akter et al., 2017). In contrast, in the small-scale rice-based farming systems that predominate in Thailand, where husbands and wives work together in the same fields and agricultural inputs are a family's most important source of income, Akter et al. (2017) argue that there is limited opportunity for gender inequalities to emerge.

In light of the limited number of "gender in agriculture" studies in Southeast Asia, Akter et al. (2017) questioned whether the different family farming systems common in Thailand might tell a different story of gender relations. "*If region-specific information on gender gaps and gender needs and constraints remain unknown and unaccounted for, the commonly utilized gender intervention frameworks – designed based on existing knowledge and conventional narratives – will be incompatible with realities in less studied regions and ineffective to bridge the gender divide*" (Akter et al. 2017, p 271).

The structured qualitative data collection implemented by Akter et al. (2017) revealed that Thai women in rural communities:

(1) Have equal access as their male counterparts to productive resources, such as land and inputs
(2) Greater control over household income compared with men
(3) Farm-level quality is also mirrored in mutual asset ownership

(4) Although formal land ownership by women is uncommon, women have equal access to land and joint decision-making power about the purchase, sale, or utilization of land to a point where formal land titles become irrelevant

(5) Control over Thai household income is disproportionately concentrated among women. Women make the majority of household expenditure decisions alone and men only occasionally take part in decision-making on major expenditures. This finding reinforces women's crucial role in managing household budgets and, thus, underscores their potential to act as catalysts to achieve food security, health, and education

(6) Due to the importance of family farming in Southeast Asia, special attention was paid to collaboration between husband and wife in the field: task division between husband and wife in the field is similar, although the intensity of the role played by men and women to perform each task varied. Men take a lead role in land preparation and pesticide and fertilizer application, while women are predominantly involved in crop establishment, weeding, harvesting and postharvest activities

(7) Women's workload in rice farming varies between the lean and peak seasons and across farming practices. While peak seasons, such as planting and harvesting periods, are characterized by heavy workloads both on the farm and in the house, women lack sufficient economic activities during the lean season

(8) The level of mechanization also affects women's workload during peak seasons. Labour-saving technologies, such as combine harvesters, drum seeders and mechanical transplanters, have alleviated women's drudgery and workload in Thailand.

5. Sufficiency Economy Philosophy: Aligning CSA and Gender with Thai Buddhism

Sufficiency Economy Philosophy[15]. The Twelfth National Economic and Social Development Plan (2017–2021) was formulated during a period of rapid change and global integration, whilst Thailand was undergoing reforms. The principles of the "Sufficiency Economy Philosophy" have been and continue to be a vital element of Thai development strategies as they underpin the promotion of moderation, reasonableness, and resilience.

The Sufficiency Economy Philosophy (SEP) has significantly contributed to balanced and sustainable development in Thailand and represent a uniquely Thai conceptual framework that aligns with the principles of gender and ethnic equality in agriculture. The Thai Government adheres to the principle of SEP in developing development plans at all levels.

Sufficiency Economy is one of His Majesty King Bhumibol Adulyadej's initiatives, a philosophy for leading a life with moderation, reasonableness, and self-immunity. Sufficiency Economy Philosophy (SEP) is a guideline to solve problems associated with globalized connectivity and continuous change to secure sustainable livelihoods. The philosophy stresses the Buddhist middle path as an overriding principle for appropriate conduct by all Thai citizens, regardless of gender, race, and ethnicity.

"Sufficiency" means moderation, reasonableness and the need for self-immunity mechanisms contributing to sufficient protection from the impacts arising from internal and external changes. To achieve this, an application of knowledge with due consideration and prudence is essential. Great care is needed in the utilization of theories and methodologies for planning and implementation in every step. As a first step, everyone, particularly public officials, academics and businesspeople adhere first and foremost to the principle of honesty and integrity. In addition, a way of life based on patience, perseverance, diligence, wisdom, and prudence is indispensable to creating balance and coping appropriately with critical challenges arising from extensive and rapid socioeconomic, environmental, and cultural change.

The SEP is a sustainable development tool consisting of three principles:

(1) Moderation: avoiding extremes and overindulgence and conveying the idea of people living their lives on the middle path, not the extremes.
(2) Reasonableness: a causal connection between actions and consequences along with accumulated knowledge and experience, analytical capability, self-awareness, foresight, compassion, and empathy; and
(3) Self-immune or resilience: sufficient protection to cope with the likely impact of internal and external changes.

There are also two preconditions attached to these principles: virtues (positive values of a person or positive norms of a group) and knowledge (what is known or empirical evidence).

By practicing these three principles with the two underlying conditions, people could live securely in harmony in a sustainable society and environment. Such a way of living does not signify self-

[15] Bergsteiner, H. and Dharmapiya, P. (2016). Sufficiency economy philosophy process. In G.C. Avery and H. Bergsteiner (Eds.), Sufficiency Thinking: Thailand's gift to an unsustainable world (pp. 1023–1343). Sydney: Allen & Unwin

sufficiency; rather, it reflects self-reliance—the ability to tolerate and cope with all kinds of malign impacts and stresses. SEP also helps increase resilience or an ability to adapt in the face of threat, adversity, or significant stress, which is a critical survival element to assimilate to ongoing change.

For the agriculture sector and farming community, the concept of the sufficiency economy can be applied based on three stages of "The New Theory" as follows:

(1) First Stage: Being sufficient to rely on oneself, based on being economical (prudent) and reducing expenses.
(2) Second Stage: Joining hands by forming cooperative groups on production, marketing, management, welfare, education, and social development.
(3) Third Stage: Creating connections among occupations and expanding various economic activities by cooperating with the business sector, private development organizations and public sector regarding funds, marketing, production, management, and information.

6. Gender Analysis in Bua Yai

Qualitative and quantitative gender analysis in Bua Yai comprised a reconnaissance baseline survey (n = 167; 73 women and 94 men); focus group discussions with village chiefs and elders; and a livelihood survey of randomly selected households (n = 320; 90 women and 230 men). The 320 households represent 1051 household members.

The focus group discussions, baseline survey and livelihood survey of randomly selected households in Bua Yai were convened to (a) establish baseline quantitative data and normative perceptions of gender and (b) compare observed gender asymmetries of Bua Yai women with those of Africa, South Asia, and other Districts in Thailand.

6.1 Gender responsibilities and roles in the community

Data derived from baseline in-depth interviews with Bua Yai villagers, staff from Nan Province and Bua Yai District Government agencies and village chiefs of 8 villages indicate that men and women living in the Bua Yai Subdistrict are involved in the decision-making process for their children's education, buying and selling land, participating in communities and religious activities. Men predominately make crop cultivation decisions, while cooking and other housework, including purchasing assets, are mainly women's decisions.

In-depth interviews with two women in Ban Oi who grow organic pumpkin revealed that men and women decide on crop diversification together. Men have the lead role in land preparation, while men and women work together on other activities, such as planting, herbicide application, fertilizer application, harvesting and selling.

Women in Na Noi and Bua Yai have established organizations with support from the Department of Agricultural Extension (DOAE) and Community Development Department (CDD). Of the 17 DOAE supported women's groups, three groups are located in Bua Yai Subdistrict. Of the 71 CDD supported groups, five groups are located in Bua Yai Sub-district.

6.2 Multi-criteria analysis of CSA practices

A multi-criteria analysis was conducted to objectively establish the selection of CSA practices in Bua Yai and calibrate farmer preferences and perceptions with those of experts and the staff of agriculture agencies.

Fifty-one farmers (28 women and 23 men) from eight Bua Yai villages were interviewed to elicit their preferences and perceptions of the seven CSA practices. The CSA practices were numerically scored and rated for the potential benefits across 10 variables: contribution to (i) input cost saving, (ii) water saving, (iii) labour saving, (iv) soil improvement, (v) increased production, (vi) increased income (profitability), (vii) sustainability in the long run, (viii) prior knowledge, (ix) adaptation potential and (x) mitigation (GHG emissions) potential.

CSA practices were rated on a scale of 0 to 3, where: 1 = Low, 2 = Medium, 3 = High and 0 = Not sure.

The numerical scores of CSA practices recorded by the 51 farmers were aggregated across the set of benefit variables and ranked from the highest to the lowest. The scores for potential benefits were aggregated across the set of CSA practices and ranked from the highest to the lowest (Table 3).

The rankings of CSA practices and the aggregate benefits were consistent for the female and male respondents.

Traditional organic composting, agroforestry and solar-powered irrigation were the three highest ranked CSA practices proposed for Bua Yai. Keyline ploughing was the lowest ranked practice. Savings of farm inputs, labour and water were the highest ranked benefits aggregated across the seven CSA practices. Surprisingly improved income/profitability was the lowest ranked benefit (the most beneficial for traditional composting and solar irrigation).

Table 3:
Ranked CSA practices and aggregated total benefits.

CSA practice	Rank	Potential benefits of CSA practice	Rank
Traditional organic composting	1	Input cost saving	1
Agroforestry	2	Labour saving	2
Solar-powered irrigation systems	3	Water saving	3
Mulching and soil cover	4	Soil improvement	4
Stress (drought)-tolerant crop variety	5	Increased production	5
Biochar	6	Long-run sustainability	5
Keyline approach	7	Adaptation potential	5
		Prior knowledge	6
		Mitigation (GHG emissions) potential	7
		Increased income – profitability	8

6.3 Gender disaggregated results from the livelihood survey

There are significant differences in the distribution of education levels for household member #2 across gender (Mann-Whitney = 5575, asymp. sig (2 tailed = 0.00) and no significant differences in the distribution of education levels between female and male household members 1 and 3 (Table 4). Household member 2 males had lower levels of primary education and higher levels of secondary, college and university education compared with their female counterparts. The distribution of education levels for the main respondent by age groups is presented in Table 4.

The education levels of younger household members (median age of 35) were also higher compared with the main respondent (median age 61 years), with higher relative levels of university and college (Table 4). Of note, female household members (3rd household member) had higher proportions of university education compared with their male counterparts.

Table 4:
Education levels of household members 1–3 by gender.

Education level	Gender 1st member		Gender 2nd member		Gender 3rd member	
	Female	Male	Female	Male	Female	Male
	Column %	Column %	Column %	Column %	Column %	Column %
No education	2%	0%	0%	1%	1%	0%
Primary	70%	74%	77%	47%	15%	18%
Basic secondary	2%	5%	7%	13%	8%	9%
Completed secondary	13%	14%	12%	15%	18%	17%
College	6%	2%	3%	14%	9%	18%
University	7%	4%	1%	4%	29%	18%
None of the above	0%	0%	0%	6%	20%	19%

Working on their own farm is the most common livelihood for both female (68%) and male (72%) main respondents, followed by household work for women (19%) and farm plus household work for men (14%). Five percent of female respondents reported managing their own business compared with 2% reported by male main respondents (Figure 2).

Figure 3 highlights the increased diversity of both female and male livelihoods reported for household member 2. Working on their own farm remained as the main livelihood for both men (57%) and women (56%), with 16% of the male members nominated “none of the above” representing unemployed and/or handicapped. A total of 15% of men reported household work as their main activity compared with women (3%) and 13% of women reported both farm and household work as their main activity compared with 9% for men. Five percent of women reported the non-farm private sector employment and study as their main livelihood.

Figure 4 illustrates the increasing livelihood diversification for household member 3 who reported a median age of 37 years for females and 32 years for males. Twenty nine percent of women reported working on their own farm as their main livelihood compared with 30% for men, followed by study (13% and 22%, respectively), farm and household work (10% and 4%, respectively), the non-agricultural public sector (12% and 10%, respectively) and household work (8% and 6%, respectively). Seventeen percent of females reported being unemployed compared with 10% of males. Six percent of men reported non-agricultural casual labour as their main activity compared with 2% for women.

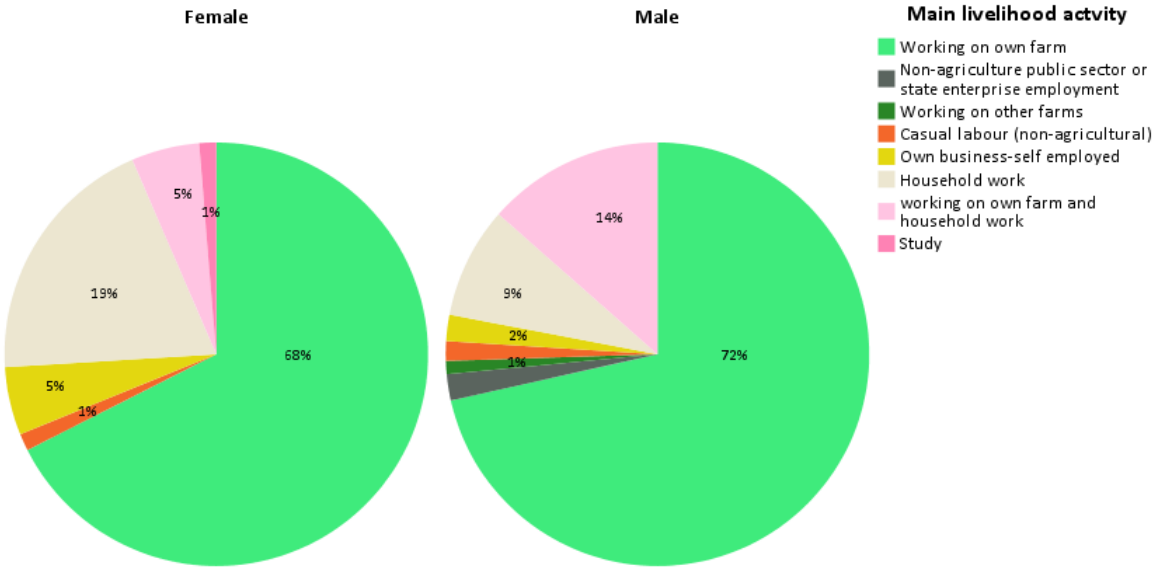
Between 80% and 88% of respondents indicated that their current household income will be at least the same or more than 2021 and 75% indicated household income was sufficient to meet expenses. The Bua Yai responses to income losses are substantially less than the 50% of households experiencing reduced incomes reported in other rural Districts in Thailand. The responses to income stability were consistent for women and men in Bua Yai.

Reported incomes from off-farm work were aggregated for all household members. Approximately 45% of female and 43% of male respondents reported income from off-farm work, evenly distributed across 12 months. Similar proportions of off-farm work were reported for 2nd and 3rd household females and males.

The gender disaggregated mean and median of incomes comprised of off-farm, remittances and farm income for the main respondent and 2nd and 3rd household members indicate no significant differences between the mean farm and off-farm incomes of men and women for the main respondent and 2nd and 3rd household members (t-test; $p>0.05$ in all cases). Levene’s test ($F =$

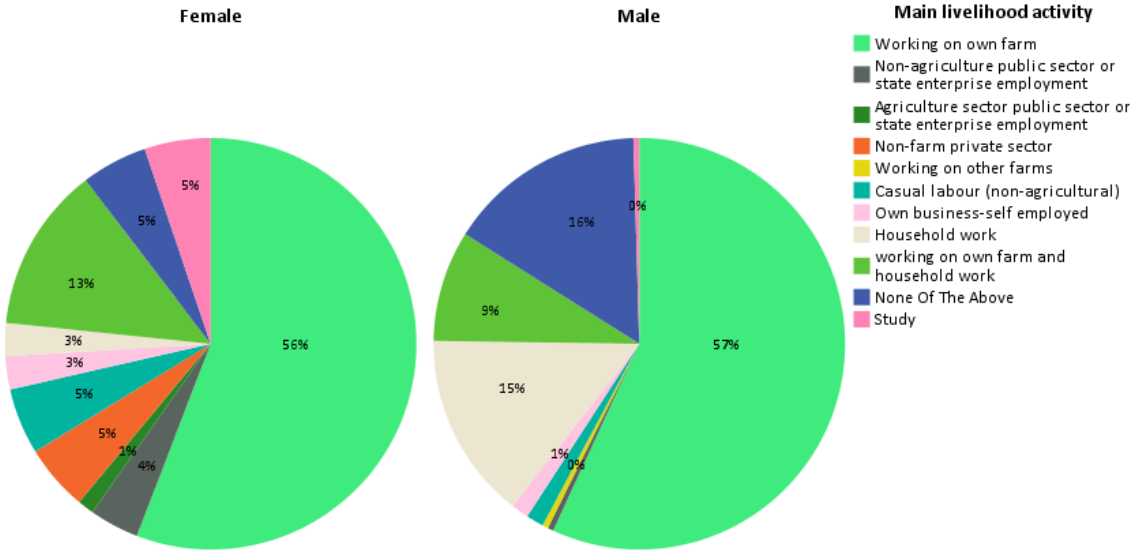
1.76; p>0.05) indicates equality of variance of the income sources for men and women respondents (Table 5).

Figure 2:
Main livelihood activities for main respondent by gender.



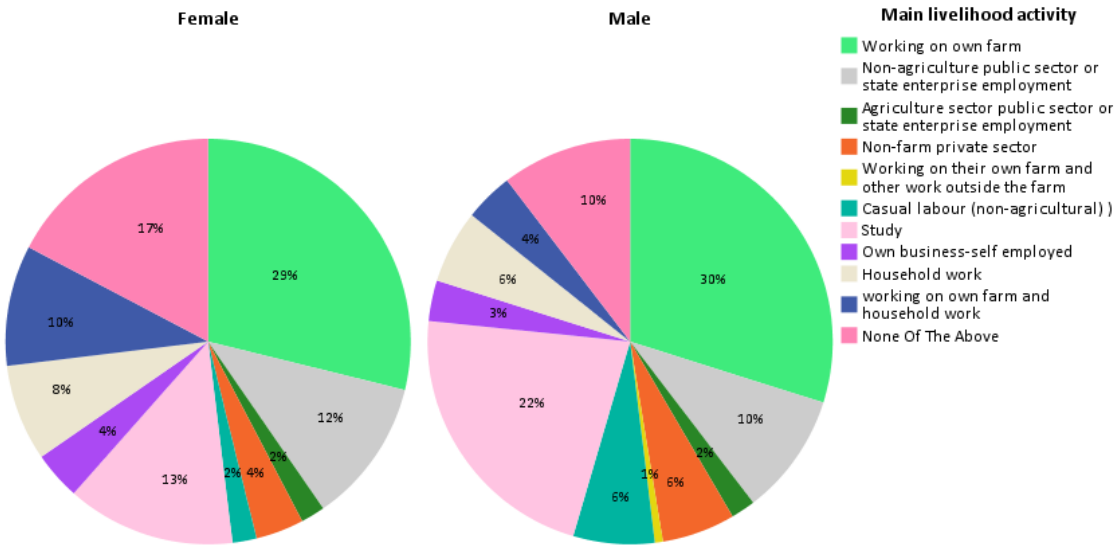
Source: TA livelihood survey 2021

Figure 3:
Main livelihood activities for household member 2 by gender.



Source: TA livelihood survey 2021

Figure 4:
Main livelihood activities for household member 3 by gender.



Source: TA livelihood survey 2021

Table 5:
Median and mean incomes for women and men in Bua Yai.

Income	Main respondent gender					
	Female			Male		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Off-farm income (Baht)	75,668	13,800	146,059	86,355	14,400	177,747
Remittance (Baht)	9,897		54,303	5,138	0	19,881
Farm income (Baht)	137,432	90,900	223,012	164,521	105,000	210,860

Income	Second household member gender					
	Female			Male		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Off-farm income (Baht)	94,415	14,499	185,137	70,517	15,850	135,035
Remittance (Baht)	5,425		20,135	10,482	0	60,432
Farm income (Baht)	163,718	108,000	206,218	165,504	95,000	259,034

Income	Third household member gender					
	Female			Male		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Off-farm income (Baht)	115,949	27,699	203,844	88,024	15,000	157,195
Remittance (Baht)	4,533		16,718	6,742	0	24,389
Farm income (Baht)	178,077	108,241	250,305	172,581	121,500	210,814

Respondents were invited to answer the question "If you have experienced a changing climate, how has this affected you"? The survey questions were intended to elicit responses that reflect local experiences and perceptions of climate change-related consequences. The major climate change experiences comprised of increased drought, higher temperatures, and changes in the number of rainy days and the beginning of the wet season (Table 6). These effects are correlated with lower crop yields and more insect pests and diseases, leading to uncertainty in income predictions. A total of 14% of respondents indicated no effect of climate change.

Table 6:
Female and male respondent's perceptions of climate change effects.

Climate Experience	Women	Men
No effect	21%	12%
Increased drought	56%	63%
Increased floods	2%	3%
Higher temperatures	49%	66%
Change in the number of rainy days	43%	66%
Change in the beginning of the wet season	39%	60%
More insect pests and diseases	30%	44%
More intense storms	9%	10%
Lower crop yields	29%	30%
I cannot predict my annual income	18%	20%
More people are leaving the village for the cities	0%	0%

Access to credit is one factor assisting households to improve household livelihoods and stabilize incomes through seasonal fluctuations and agricultural price volatility. More than 30% of respondents selected credit access as "easy" or "neutral" and 12% selected "difficult" as their response. A total of 81% of female respondents reported access to credit was either "neutral" or "easy" compared with 75% of male respondents. A total of 15% of male respondents reported "very easy" access to credit compared with 5% of women.

Increasing debt levels incurred by rural households has been a consistent observation during the Covid-19 pandemic. Median household debt reported by respondents ranged from 30,000 Baht (B. Nakai) to 250,000 Baht (B. Nong Ha). Referencing household debt relative to household income provides important context of the household debt burden. Debt to income ratio was calculated as reported debt (including bank and informal money lenders) divided by total household income (the aggregate of farm, off-farm, and remittance income). High debt to income ratios generally refers to higher debt burdens and potential debt stress. Women reported lower levels of mean debt to income (1.98) compared with male respondents (3.97). Median ratios were 0.54 for both men and women.

Farming systems were defined as the number of reported crops produced. Farming systems were relatively consistent across female and male respondents. A total of 38% of male and female respondents reported a one crop farm system. A total of 52% of men reported two and three crop systems compared with 54% of their female counterparts.

Respondents were asked to identify the main problems they are experiencing limiting their agricultural practices and productivity. Respondents were asked to respond to a set of 14 possible binary adaptation, mitigation responses, by entering a value a 1–14 across the alternative impediments/constraints, where 1 represented "the most important" and 14 represented the "the least important" impediment. The responses reported by women and men for each farm

impediment were calculated and ranked from the lowest score to the highest where the lowest aggregate score was ranked as the most important impediment (Table 7).

The ranked impediments to farming were evaluated across three age classes: less than 35 years old; 36-50 years and 51-80 years of age.

The difference in the ranking of farming impediments across the three age classes suggest facilitating a CSA enabling environment will require tailored communication and extension messages. The benefits of CSA practices to improve soil fertility such as mulching, biochar and potentially Keyline, and access to higher value markets align with the highest ranked impediments of the 35-year age class. Promoting solar irrigation to access water coupled with the water saving properties of biochar and residue management/mulching are CSA practices that correspond with the 36–50-year age class highest ranked impediments (Table 8).

Table 7:
Ranked impediments to farming.

Impediments to farming	Female	Male
Low output prices	1	1
Water shortage	2	2
Product damage by insect pests and disease	3	4
Unpredictable input prices	4	3
Farm debts	5	7
Poor soil fertility	6	5
Lack of markets or buyers	7	10
Ageing of farmers	8	6
Lack of access to extension services	9	9
Labour shortage	10	8
Lack of collective marketing	11	13
Lack of access to cheap credit	12	11
Lack of storage facilities	13	12
Not enough arable land	14	14

Table 8:
Ranked impediments to farming across age classes.

Impediments to farming	Less than 35 years	36-50 years	51-80 years
Low output prices	1	1	1
Water shortage	5	2	2
Product damage by insect pests and disease	4	4	3
Unpredictable input prices	7	3	4
Farm debts	2	6	5
Poor soil fertility	6	5	7
Lack of markets or buyers	12	9	6
Ageing of farmers	2	11	10
Lack of access to extension services	9	13	9
Labour shortage	10	7	8
Lack of collective marketing	12	8	14
Lack of access to cheap credit	11	10	11
Lack of storage facilities	8	12	13
Not enough arable land	14	14	12

7. Summary

Gender conscious CSA is described in the report by three main principles:

(1) gender is a cross cutting variable that refers to the social relations between men and women, the social roles and identities associated with what it means to be a man or a woman and the role of gender in agriculture and CSA.
(2) gender relations manifest as degrees of distributional, procedural and recognitional equality amongst men and women; and
(3) equality is partly a function of power/empowerment, which is understood to be the ability of an actor within a social relationship, regardless of gender, to independently achieve their goals and ambitions, even when faced with coercion, resistance, or domination.

The qualitative results from the TA focus group discussions, workshop responses and interviews with key Bua Yai respondents combined with the quantitative gender disaggregated results from the CSA multi-criteria analysis and livelihood survey indicate that gender equality across a number of dimensions is the norm in the Bua Yai compared with gender inequalities observed in South Asia and Africa.

The multi-criteria analysis established the ranking of seven CSA practices in Bua Yai and calibrated farmer preferences and perceptions with those of experts and the staff of agriculture agencies. The seven potential Bua Yai CSA practices were:

(1) Solar-Powered Irrigation Systems
(2) Biochar
(3) Keyline Approach
(4) Traditional Organic Composting
(5) Mulching and Soil Cover
(6) Stress (drought)-Tolerant Crop Varieties, especially rice and maize
(7) Agroforestry

The CSA practices were numerically scored and rated for the potential benefits across 10 variables: contribution to (i) input cost saving, (ii) water saving, (iii) labour saving, (iv) soil improvement, (v) increased production, (vi) increased income (profitability), (vii) sustainability in the long run, (viii) prior knowledge, (ix) adaptation potential and (x) mitigation (GHG emissions) potential.

The rankings of CSA practices and the aggregate benefits were consistent across female and male respondents. Traditional organic composting, agroforestry and solar-powered irrigation were the three highest ranked CSA practices proposed for Bua Yai. Keyline ploughing was the lowest ranked practice. Savings of farm inputs, labour and water were the highest ranked benefits aggregated across the seven CSA practices. Surprisingly improved income/profitability was the lowest ranked benefit (the most beneficial for traditional composting and solar irrigation).

Focus group discussions, a baseline survey, and a livelihood survey of randomly selected households in Bua Yai were implemented to (a) establish baseline quantitative data and normative perceptions of gender and (b) compare gender asymmetries of Bua Yai women with those of Africa, South Asia, and other districts in Thailand.

Overall, the reported observations from Bua Yai households and community members correlate well with other results from Thailand and support the findings that the level of gender equality across multiple dimensions is higher than those reported in Africa and South Asia.

Focus group discussions revealed that women and men living in the Bua Yai Subdistrict are both involved in the decision-making process for their children's education, buying and selling land, participating in communities and agricultural cooperative and religious activities. Men predominately make crop cultivation decisions, while housework and household income allocation (health, education, food, housing, and household assets) are mainly women's decisions.

Analysis of quantitative household survey data focused on collating data for 3 household members: the main respondent and the 2nd and 3rd household member, the latter being significantly younger compared with the main respondent.

Livelihood activities of men and women were similar across the main, 2nd and 3rd household members; the main differences were observed between age cohorts not gender. That is the younger 2nd and 3rd household members have more diverse livelihoods with a lower representation in farming.

There are statistical differences in the education levels of Bua Yai women and men only within the 2nd member class. Member 2 males had lower levels of primary education and higher levels of secondary, college and university education compared with their female counterparts. Younger men and women (members 2 and 3) are better educated than the older main respondent.

Compared with gender relationships, the highest level of asymmetry in education, livelihood activities and perceived farming impediments that can be mitigated through CSA practices can were observed between age classes.

Income, the ratio of farm to off-farm income, time spent on off farm labour and debt to income levels were not significantly different ($p>0.05$) for women and men.

Perceptions and experience of climate-related impacts were similar for women and men and across age classes. The major climate change experiences include increased drought, higher temperatures, and changes in the number of rainy days and the beginning of the wet season. These effects are correlated with lower crop yields and more insect pests and diseases leading to uncertainty in income predictions. A total of 14% of respondents indicated no effect of climate change.

Ranked impediments to farming were similar for men and women in Bua Yai: low output prices, water shortages and insect pest and disease were ranked as the most important constraints to farming. Lack of collective marketing, storage facilities, access to affordable credit and a lack of arable land were the least important farming constraints for both female and male respondents.

All age classes ranked low output prices as the most important impediment to their farming livelihoods. The less than 35 years age class ranked poor soil fertility and the lack of markets as the next most important impediment. The 36-50 years class ranked water shortages and pest damage as the next most important impediment and the 51–80-year class ranked water shortages and unpredictable input prices.

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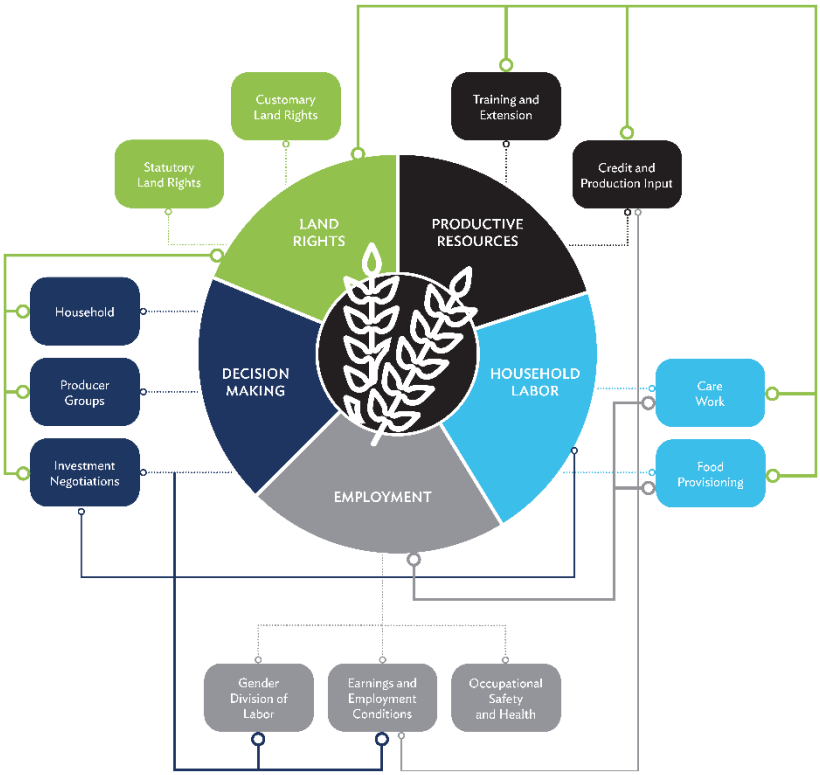
9. Appendix

9.1 The five-dimensional gender framework

A five-dimensional gender in agriculture framework (Figure 5) describing sources of gender inequality has been proposed by Sexsmith et al. (2017).

Figure 5:
Five-dimensional framework for gender inequalities in agriculture.



Source: adapted from Sexsmith et al. (2017 p1-2)

Five Dimensions of Gender Inequality

(1) Land rights and entitlements
- Formal land rights
- Customary rights

(2) Productive resources
- Access (water)
- Credit and finance
- Training and extension

(3) Labour and unpaid work

(4) Employment
- Temporary and wage disparity
- Migration

(5) Decision making

- Household: food, education, health
- Land-use and agriculture
- Farmer groups and investments

Women are less likely to hold statutory land rights and, when they do own land, their plots are often relatively small. Foreign investors in land tend to reinforce such inequality by dealing with those who do have formal rights to land—men. Women's access to common lands for household needs is also precarious, reinforcing the patriarchal land rights that underpin many customary land rights systems.

Credit markets can discriminate against women making it more difficult for women farmers to acquire labor-saving and innovative production inputs. Women also face access barriers to extension services, which creates a knowledge gap that prevents them from benefiting equitably from innovations.

Social development initiatives can improve women's household labour burden, but their existing livelihood activities are rarely considered, often resulting in additional unpaid work. Increased incomes can help women ensure their household is food secure, but the conversion of subsistence to cash or export crops can create novel food security risks for young girls.

Investment projects have tended to reproduce gender divisions of labour that relegate women to temporary, insecure employment. Contract farming schemes can raise women's earnings, but women have been largely left excluded. Investments that provide access to labor-saving technologies can reduce women's labour burden in contract farming, but in agro-processing and plantation agriculture, female waged laborers face longer working hours.

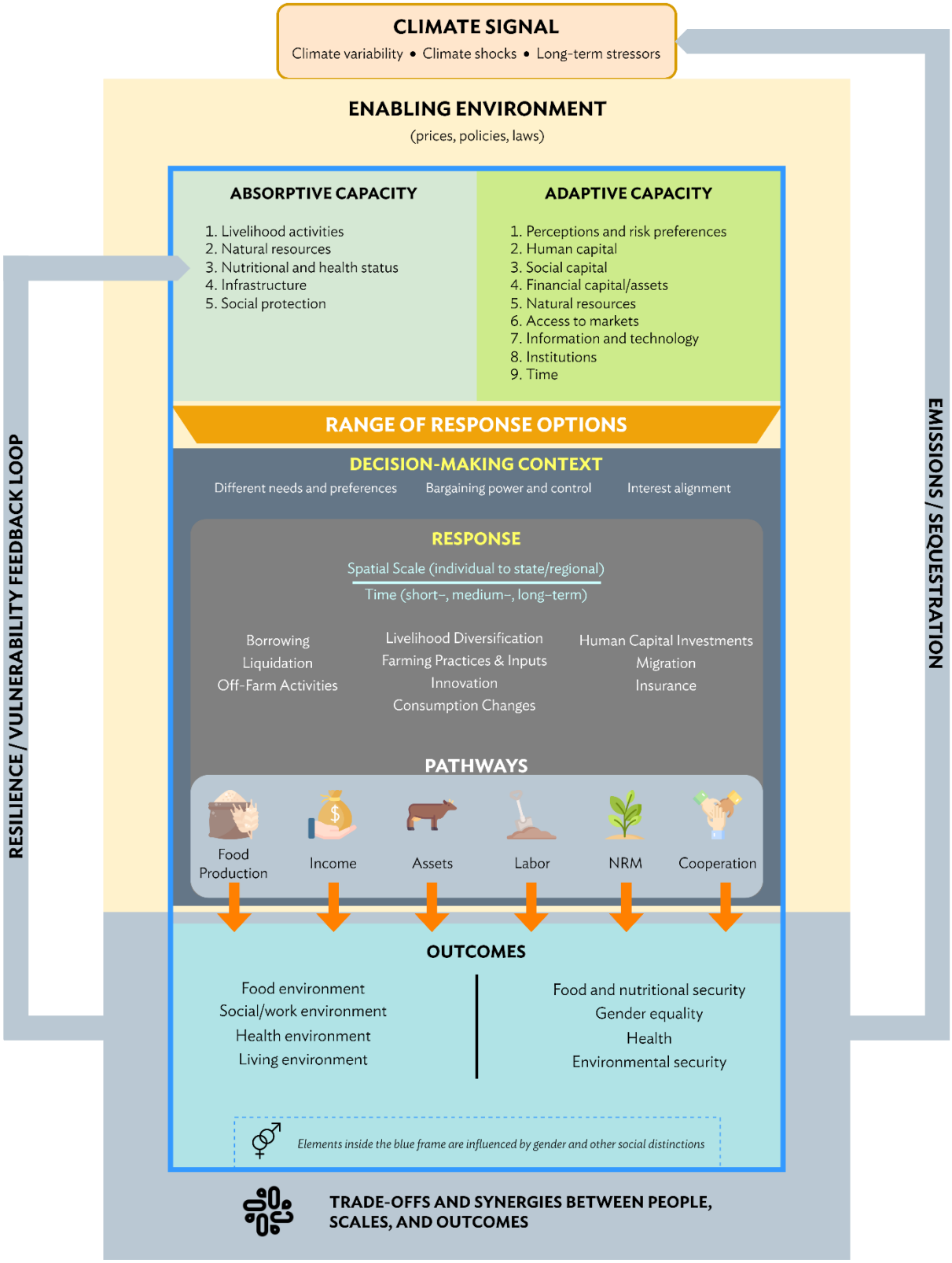
Where investment projects have raised women's earning power, they have sometimes helped to shift cultural constraints on women's decision-making power within the household. However, investment projects have rarely improved women's under-representation in producer cooperatives or worker groups, including participation in internal decision-making and dispute-resolution bodies, which remain male-dominated.

9.2 Gender, climate change and CSA

Bryan et al. (2017) proposed an integrated gender, climate, agriculture, nutrition (GCAN) framework to describe the relationships of gender attributes, absorptive and adaptive responses given a specific climate shock or stressor and livelihood options and pathways (Figure 6). Decisions and responses made today influence the decision context of future climate stressors and shocks.

The authors note that "although the framework focuses on climate shocks and stressors, it could also be adapted to assess other sources of livelihood risk, such as food price shocks, political instability, and conflict. It can also be adapted to illustrate the intersection of climate, gender and nutrition issues within a given local context, development program, or set of response options (for example, on-farm climate-smart practices or technologies)".

Figure 6:
Integrated framework for climate resilience, gender and nutrition (Bryan et al., 2017).



The climate signal represents the hazard or source of uncertainty, stressors, and shocks. Typically, long-term climate change is expressed as changes in rainfall patterns, temperature, wet season onset and duration and the frequency and amplitude of floods and droughts.

The enabling environment: the enabling environment influences how households and communities can absorb and adapt to change. Statutory laws, policies, subsidies, cultural norms, and traditions influence the enabling environment and how communities respond to shocks and stresses. Participatory research initiatives, like the TA, can also support a more responsive and resilient enabling environment.

Absorptive and adaptive capacity: absorptive capacity is defined as the sensitivity of individuals, groups, communities, countries, or regions to shocks and stressors and the extent of the changes they need to make to preserve or improve their well-being. For example, a smallholder farmer with a diversified livelihood that includes farm and non-farm income sources may not experience as great a loss of income upon delayed onset of rains as a neighboring farmer whose livelihood is dependent on a single rainfed crop. High absorptive capacity reduces the magnitude and urgency of adaptive capacity and vice-versa.

Adaptive capacity represents the ability of households or communities to respond to climate shocks and stressors, risks, or opportunities. Gender relations are an important factor influencing adaptive responses. At the household level, factors include the capacity of individuals to perceive and understand climate risks, their access to financial capital and assets, their social connections and support, access to information and technology and time constraints.

Response options: responses can take multiple forms, from reactive actions to manage an immediate threat to long-term strategies. Coping responses generally refer to strategies that utilize available resources, skills, and opportunities to address, manage and overcome adverse climate stresses and shocks in the short- to medium-term. Risk management involves planning, actions, and interventions to minimize the likelihood and exposure to climate shocks, avoid harm and exploit identified benefits. Combined the response options enable maintenance of the “agricultural system”.

Decision-making: decisions and responses to climate change and stressors are made after consultation and negotiation, within and between households. Individual choices, preferences and priorities can both align and diverge. Gender relations, relative bargaining power and the recognition and relative autonomy of women to make or influence decisions will affect the decision characteristics, with long-term consequences for levels of satisfaction, ongoing tensions, and response effectiveness. For example, divergent preferences can influence migration decisions (who migrates) affecting the circumstances of both source and target destinations and the prioritization of limited resources, such as water and land.

Pathways to change: Bryan et al. (2017) proposed six possible response pathways where CSA can have profound effects on gender equality and nutrition security:

(1) food production
(2) allocation and entitlement of income and assets
(3) asset dynamics
(4) labour allocation
(5) management of natural resources; and
(6) cooperation within and between communities.