YANGON UNIVERSITY OF ECONOMICS
DEPARTMENT OF APPLIED ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME

A STUDY ON AGRICULTURAL RESILIENCE IN CLIMATE-AFFECTED VEGETABLE FARMERS IN MYANMAR (A CASE OF YANGON REGION, HLEGU TOWNSHIP)

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EMPA – 45 (20th BATCH)

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A STUDY ON AGRICULTURAL RESILIENCE IN CLIMATE-AFFECTED VEGETABLE FARMERS IN MYANMAR (A CASE OF YANGON REGION，HLEGU TOWNSHIP)

A thesis submitted as a partial fulfillment towards the requirement of the Degree of Mater of Public Administration (MPA)

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ABSTRACT

This study investigates the agricultural resilience of vegetable farmers in *Hlegu* Township, Yangon Region, Myanmar, under the combined pressures of climate change and rising farming costs. Using a descriptive mixed-methods approach, primary data were collected from 93 households across *Haing Ku, Kyoet Kone*, and *U Yin Wa* villages via Kobo Toolbox, complemented by secondary sources. Quantitative analysis employed descriptive statistics and correlation to identify key resilience factors. Farmers were predominantly middle-aged, cultivated small plots (less than 5 acres), and relied heavily on farming for income. Major climate stressors included irregular rainfall, heatwaves, pest outbreaks, and flooding, with *U Yin Wa* being most vulnerable. Rising input costs and unstable markets intensified economic stress, often leading to debt. Adaptation strategies such as crop diversification, adjusted planting schedules, soil conservation, and improved irrigation were common, though infrastructure gaps particularly in storage persisted. Institutional support was limited, and barriers to technology adoption were widespread. Findings highlight the need for targeted climate-smart interventions, improved market stability, and strengthened institutional support to enhance resilience among smallholder vegetable farmers.

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
CA	Conservation Agriculture
CSA	Climate-Smart Agriculture
DMH	Department of Meteorology and Hydrology (Myanmar)
EMPA	Executive Master of Public Administration
EWS-KT	East-West Seed Knowledge Transfer
FAO	Food and Agriculture Organization of the United Nations
FSIN	Food Security Information Network
GAD	General Administration Department (Myanmar)
GDP	Gross Domestic Product
GHG	greenhouse gas
ICIMOD	International Centre for Integrated Mountain Development
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
LIFT	Livelihoods and Food Security Fund
MOALI	Ministry of Agriculture, Livestock and Irrigation (Myanmar)
MPA	Master of Public Administration
NGO	Non-Governmental Organization
NUPI	Norwegian Institute of International Affairs
PIAs	Participatory Impact Assessments
RCCC	Regional Climate Change Consortium
RCP	Representative Concentration Pathway
RD	Resilience Design
RIMA	Resilience Index Measurement and Analysis
SIPRI	Stockholm International Peace Research Institute
UNDP	United Nations Development Programme
WFP	World Food Programme
WTO	World Trade Organization

CHAPTER I
INTRODUCTION

Myanmar's agricultural sector, a cornerstone of its economy and rural livelihoods, is currently navigating a complex and intensifying crisis driven by the dual pressures of climate change and rising input costs. This study examines the profound implications of these challenges, with a specific focus on the vulnerable vegetable farming subsector. Climate variability displaying as erratic rainfall, rising temperatures, and more frequent extreme weather events directly undermines agricultural productivity and exacerbates existing vulnerabilities.

At the same time, a severe economic downturn, largely triggered by socio-political instability, has led to unprecedented increases in the cost of essential agricultural inputs such as fertilizer, fuel, and labour. The convergence of these climate and economic stressors has significantly reduced farm incomes, threatened household food security, and weakened the profitability of vegetable farming.

Existing adaptation strategies, including Climate-Smart Agriculture (CSA) interventions, have demonstrated some success in enhancing dietary diversity. However, their short-term impact on overall food security is often limited, reflecting a disconnect between implemented measures and local perceptions of food sufficiency. Furthermore, while national policies and international aid initiatives aim to build resilience, their effective implementation is severely hampered by political instability, a breakdown in financial mechanisms, and persistent knowledge gaps.

Globally, climate change and rising farming costs pose significant challenges to agricultural systems, particularly for smallholder vegetable farmers who depend on stable environmental and economic conditions for their livelihoods. The increasing frequency of extreme weather events, such as droughts, floods, and unpredictable rainfall, disrupts production cycles, reduces yields, and threatens food security (IPCC, 2022). At the same time, escalating costs of inputs such as seeds, fertilizers, and labour further strain farmers' financial stability, making it difficult to sustain profitable operations (FAO, 2021).

This study investigates the agricultural resilience of vegetable farmers in the face of climate change and rising production costs. It examines the adaptive strategies farmers employ, the role of institutional support, and the barriers to resilience-building.

1.1 Rationale of the Study

Agriculture is the important part of Myanmar's economy, employing approximately 65% of the country's workforce and contributing nearly 25% to GDP (World Bank, 2022). Within this vital sector, vegetable production plays a particularly critical role by addressing three key development priorities: food security, nutritional adequacy, and rural income generation. Unlike staple crop cultivation, vegetable farming offers significantly higher economic returns per unit area generating three to five times the profits of rice cultivation while requiring only 20–30% of the land area (FAO, 2021).

Economically, the vegetable subsector demonstrates remarkable potential. Current estimates indicate that vegetable farming provides the primary source of income for more than 750,000 smallholder households nationwide, with total farm-gate sales exceeding USD 1.2 billion annually (LIFT, 2023). The labour-intensive nature of vegetable cultivation creates 50–70% more employment opportunities per hectare compared to cereal crops (ADB, 2022), making it particularly valuable for poverty reduction in rural communities, where 26% of the population still lives below the poverty line (World Bank, 2023). However, the proportion of farmers receiving extension advice has declined sharply from 41% in 2020 to only 32% during the 2022 monsoon season. Most advisory services now come from private dealers, while public sector and NGO involvement has decreased (MoALI, 2023), largely due to staff shortages, reduced budgets, and the effects of political instability on rural outreach capacity.

Hlegu Township, a major vegetable production hub supplying Yangon's markets. Recent climate data show a 15% decline in predictable rainfall patterns and a 1.2°C increase in average temperature over the past decade (DMH, 2023). At the same time, production costs have risen by 40–60% due to fertilizer price volatility and currency depreciation (FAO, 2023). Understanding the combined impacts of climate change and rising input costs is therefore essential for assessing the long-term viability of smallholder vegetable farming in Hlegu Township.

1.2 Objective of the Study

The objectives of this study are.

- To examine how climate change and rising farming costs jointly affect the agricultural resilience of vegetable farmers in Hlegu Township.
- To identify the coping and adaptive strategies employed by farmers to maintain livelihoods under climate and economic stress.

1.3 Method of Study

This study examines the agricultural resilience of vegetable farmers in the context of climate change and rising farming costs. A descriptive research design was applied, incorporating both qualitative and quantitative approaches. Primary data were collected through from 93 vegetable farming households from three villages in Hlegu Township: *Haing Ku, Kyoet Kone, and U Yin Wa*. Data collection was conducted using Kobo Toolbox, a digital survey platform.

Secondary data were collected from government reports, NGO publications, peer-reviewed academic literature, and online databases relevant to climate-resilient agriculture in Myanmar. Quantitative data were analysed using descriptive statistics to identify trends and patterns, while selected indicators were evaluated using correlation analysis to determine key factors influencing household resilience and livelihood sustainability. This methodological framework ensures an understanding of how smallholder vegetable farmers in Hlegu Township are coping with and adapting to the dual challenges of climate change and economic pressure.

1.4 Scope and Limitation of the Study

This study was conducted on a township-representative sample of 93 farming households in Hlegu Township, Yangon Region, focusing specifically on vegetable farmers. Primary data collection was limited to three villages within Hlegu Township. Although this area is an important vegetable-producing region, the findings may not be directly generalizable to other parts of Myanmar due to differences in agroecological conditions, socio-political contexts, and market access environments.

1.5 Organization of the Study

This study is organized into five chapters. Chapter 1 included an introduction to the study with rationale of the study, objective of the study, method of study, scope and limitation of the study and the organization of the study. Chapter 2 presented

literature review. Chapter 3 presented challenges and resilience in Myanmar's vegetable farming. Chapter 4 presented the survey profile, design and analysis of survey data based on the questionnaire. Chapter 5 concluded the study by summarizing key findings, and suggestions.

CHAPTER II
LITERATURE REVIEW

This chapter comprises five sections. They are Concepts of Agricultural Resilience, Measuring Agricultural Resilience, Climate Change Impact on Agriculture, Institutional and Policy Support for Agricultural Resilience and review on the previous studies.

2.1 Concepts of Agricultural Resilience

Agricultural resilience refers to the ability of agricultural systems from individual farms to entire food networks to withstand, adapt to, and transform in response to a range of disturbances while maintaining core functions such as food production, ecological balance, and rural livelihoods (Tendall et al., 2015). This concept moves beyond the traditional notion of simply "bouncing back" from shocks; rather, it encompasses the capacity of systems to persist under stress, adjust to evolving conditions, and undergo transformation when incremental changes are insufficient (Folke et al., 2010).

Three interrelated dimensions underpin agricultural resilience are absorption, adaptation, and transformation. Absorption involves the capacity to endure stressors such as droughts, floods, and price shocks while minimizing disruptions to essential functions (Bahadur et al., 2015). Adaptation refers to proactive changes in farming practices, such as diversifying crops or integrating new technologies, to manage emerging risks and enhance robustness (IPCC, 2022). Transformation denotes more fundamental shifts, including restructuring farming systems or transitioning to alternative livelihoods, particularly when existing approaches can no longer cope with systemic challenges (Walker et al., 2004).

Resilient agricultural systems are ecologically sound, socio-economically stable, and institutionally supported. Ecological strategies include agroecological approaches, soil and water conservation, and integrated pest management, all of which

contribute to sustainability and system health (Altieri et al., 2015). Socio-economic resilience is enhanced by strengthening farmer networks, promoting income diversification, and integrating traditional knowledge with modern innovation (Barrett & Constas, 2014). Institutional and policy-level efforts play a critical role, emphasizing anticipatory planning, early warning systems, and investment in resilience-building infrastructure before crises emerge (FAO, 2017).

Practical examples of resilience in action include transitioning from monoculture to diversified crop rotations to reduce pest and market risks, adopting conservation agriculture practices such as reduced tillage and cover cropping to retain soil moisture, and initiating community-based water management systems to ensure reliable irrigation during erratic weather events. Additionally, developing off-farm income-generating activities such as agro-processing or the sale of value-added products can buffer households from agriculture income volatility (Scoones et al., 2007).

2.2 Measuring Agricultural Resilience

Agricultural resilience is increasingly recognized as a dynamic, multidimensional concept that requires both quantitative and qualitative approaches to assess how farming systems absorb, adapt to, and transform in response to environmental, social, and economic stresses (Tendall et al., 2015). A range of tools and frameworks have been developed to operationalize and measure resilience across different levels—individual farms, households, and communities—capturing ecological, socio-economic, and institutional dimensions.

A useful resource is the Resilience Design (RD) Measurement Toolkit, created by Mercy Corps in 2019. This participatory toolkit evaluates farm-level resilience through multiple indicators related to soil health, biodiversity, water and pest management, energy efficiency, and local resource use. Key components include the Farm Resilience Assessment, Farm Production Assessment, and Soil Health Assessment. The toolkit applies a structured scoring system (low, medium, high, and star) to rate resilience performance based on farmer practices and observed conditions, with assessments conducted at baseline and throughout the agriculture season to track improvements. This approach emphasizes agroecological integration, resource efficiency, and community-based learning.

The Food and Agriculture Organization (FAO) has developed the Resilience Index Measurement and Analysis (RIMA), a method that is widely used to assess resilience. RIMA provides a quantitative framework to assess household resilience to food insecurity, using core determinants such as asset ownership, access to basic services, livelihood diversification, and the occurrence of shocks (FAO, 2023). This model is both context- and shock-specific and incorporates a cause-effect logic to evaluate resilience outcomes. It has been applied globally in development projects and policy evaluations to assess program effectiveness and resilience-building efforts.

In addition, the Resilience Measurement Principles proposed by the Food Security Information Network (FSIN, 2019) offer a broader framework for food system resilience. This includes measurement of three core capacities—absorptive, adaptive, and transformative—alongside multidimensional indicators encompassing natural resource management (e.g., soil fertility, water access), socio-economic resilience (e.g., income sources, financial stability), institutional support (e.g., governance quality, infrastructure), and social capital. The framework advocates for the integration of Participatory Impact Assessments (PIAs) to incorporate farmers' knowledge, perceptions, and local coping mechanisms alongside statistical methods such as factor analysis and multivariate modelling.

These approaches emphasize that measuring agricultural resilience is not a one-time process but requires repeated data collection over time to capture changes, feedback loops, and long-term transformations. Integrating both farmer-led assessments and rigorous analytical models ensures a more accurate, context-sensitive understanding of resilience dynamics (IISD, 2019).

2.3 Climate Change Impact on Agriculture

Climate change significantly affects farmers by altering essential environmental factors critical for agriculture productivity. Rising temperatures, shifting rainfall patterns, and an increased frequency of extreme weather events such as droughts and floods collectively undermine crop yields, degrade soil health, and damage agricultural infrastructure (IPCC, 2023). Elevated temperatures shorten growing seasons, accelerate crop maturation, and reduce yields by increasing evapotranspiration and causing soil moisture deficits, especially in regions already experiencing heat stress. For example, projections indicate yield declines exceeding 20–30% under high emissions scenarios

for key staple crops like wheat, maize, soybean, and rice across regions including the USA, China, Africa, and South Asia (Nature, 2025; Sarwary et al., 2023).

In addition to temperature effects, altered precipitation patterns disrupt water availability essential for irrigation and cultivation. Changes in the timing, intensity, and distribution of rainfall increase drought and flood events, leading to soil erosion, fertility loss, and damage to farming assets. These impacts diminish production capacity and exacerbate the vulnerability of smallholder farmers who often lack adequate risk management tools (NASA, 2020). Climate-related stresses directly affect rural economies by limiting input access, destabilizing markets, and reducing labor availability, thereby weakening overall economic resilience among farming communities.

Addressing these challenges necessitates proactive adaptation strategies, including adopting heat- and drought-resistant crop varieties, enhancing water use efficiency, diversifying cropping systems, and strengthening early warning and weather advisory services. Such measures help farming households cope with ongoing climate variability and future shocks, ensuring food security and rural livelihoods remain viable amid changing climatic conditions (IPCC, 2023).

2.4 Institutional and Policy Support for Agricultural Resilience

Institutional and policy frameworks are essential for strengthening agricultural resilience, as they provide the enabling conditions necessary for farming systems to withstand shocks, adjust to evolving circumstances, and undergo transformational change when incremental adjustments are insufficient. Strong governance structures, coordinated planning, stakeholder involvement, and effective allocation of resources are all central to implementing resilience-enhancing strategies (FAO, 2013).

Institutional support mechanisms include capable leadership and responsive institutions that promote sustainable agriculture practices like conservation agriculture (CA). These efforts are often supported by farmer cooperatives and agriculture extension services that offer technical guidance, training, and knowledge dissemination (FAO, 2013). Policies that integrate resilience into agricultural development prioritize proactive planning, incentivize climate-resilient approaches, and encourage the incorporation of ecosystem services—such as biodiversity protection, soil and water

management, and the use of climate-smart technologies into farming systems (FAO, 2013).

At the policy level, promoting resilience involves adopting a long-term, systems-based perspective that recognizes the importance of balancing the abilities to absorb disturbances, adapt to change, and transform systems where needed. Policies should foster inclusive and participatory processes that involve diverse stakeholders in identifying risks, sharing responsibilities, and generating locally appropriate solutions (OECD, 2020).

Institutional and policy measures to enhance agricultural resilience can involve establishing frameworks that promote sustainable intensification, embedding resilience concepts into agricultural training and extension services, and applying economic tools such as incentives for ecosystem conservation or sanctions for environmentally damaging practices (FAO, 2013). Additionally, regional and national collaborative platforms can play a critical role by fostering partnerships among government bodies, civil society organizations, and private sector stakeholders, thereby reinforcing collective resilience efforts (FAO, 2013).

Moreover, institutional initiatives such as social protection schemes, disaster preparedness programs, and gender-sensitive interventions help rural populations build resilience by stabilizing incomes and enhancing their capacity to cope with climate-induced risks (UNDP/FAO, 2016). By improving access to financial services, markets, and essential inputs, institutional support enhances both agriculture productivity and supply chain stability. Institutional and policy support is a cornerstone of agricultural resilience, fostering adaptive governance, innovation, and systemic transformation in response to complex and long-term challenges, including those posed by climate change.

2.5 Reviews on Previous Studies

One study in Rajasthan, India found that farmers prioritize technologies that help them directly manage climate-related risks, such as crop insurance, weather advisories, rainwater harvesting, and contingent crop planning. These were especially favoured in areas with lower rainfall, where climate shocks are more intense. The

research also showed that while many farmers recognize the benefits of certain technologies, their willingness to adopt them decreases when costs are considered. For instance, more expensive options like drip irrigation or laser land levelling where less preferred once financial constraints were factored in. Gender, farm size, and farming experience also influenced preferences—female and smallholder farmers leaned toward low-cost, knowledge-based tools, while more experienced farmers preferred insurance and nutrient management (Khatri-Chhetri et al., 2017)

Institutional constraints represent a major barrier to agricultural resilience in Myanmar. Tun Oo et al. (2023) evaluated the disjunction between national climate adaptation policies and local realities. Using policy analysis and focus group discussions, the study found that over 80% of farmers were unaware of subsidized climate-smart agriculture (CSA) technologies. Fertilizer costs were also found to consume up to 60% of farmers' annual revenue, reflecting a severe input affordability crisis. More critically, the study revealed a mismatch between input subsidy programs and broader adaptation strategies, resulting in poorly coordinated and ineffective support mechanisms. The research concludes that institutional reform and improved policy coherence are necessary to enhance farmers' adaptive capacity.

Agroecological practices have shown promise in enhancing both environmental and economic resilience, as demonstrated in a comparative study by Altieri et al. (2019) involving 320 farms in Latin America. The study found that agroecological farms achieved 40% greater yield stability during droughts compared to conventional farms. They also reported 58% lower input costs and 25% higher net incomes. However, the transition period required to adopt agroecology—typically 3 to 5 years—was marked by yield volatility, posing risks for indebted or financially vulnerable farmers. While agroecology offers long-term resilience benefits, the study underscores the need for transitional support mechanisms to mitigate short-term economic risks.

Barrett and Constas (2018) evaluated the role of financial instruments, particularly credit and insurance, in enhancing household resilience in Tanzania through a randomized control trial involving 1,200 smallholders. Results indicated that insured households were 2.5 times more likely to avoid distress asset sales during shocks. Access to credit also increased investments in irrigation technologies by 22% and in income diversification by 35%. However, the study also highlighted a limitation:

insurance contracts typically did not cover losses stemming from climate-induced price shocks. This points to the need for financial tools that address both production and market-related risks to support comprehensive resilience.

CHAPTER III
CHALLENGES AND RESILIENCE IN MYANMAR'S VEGETABLE FARMING

This chapter covers the overview of Agriculture Sector in Myanmar, Climate Change in Myanmar, Climate Characteristics and Trends in Myanmar, Economic Challenges for Myanmar's Farmers and Institutional and Policy Support for Agricultural Resilience in Myanmar.

3.1 Overview of Agriculture Sector in Myanmar

Aagriculture including the sectors of forestry and fishing contributed 20.83% to Myanmar's Gross Domestic Product (GDP), according to data from the (World Bank, 2024). This sector remains critically important to the country's economy and the livelihoods of its population. Regarding employment, a huge portion of Myanmar's workforce continues to depend on agriculture. According to 2023 data, approximately 45.2% of Myanmar's labor force was employed in the agricultural sector, which includes a wide range of activities such as crop cultivation covering staple cereals, maize, pulses, and vegetables along with livestock rearing, fisheries, and agroforestry (FAO, 2023). While paddy rice cultivation covers the largest area, there is an increasing emphasis on diversifying into maize and vegetables, driven by both internal market demand and export opportunities (FAO, 2025). In 2022, Myanmar's agriculture exports totaled USD 5.17 billion, with Thailand, China, and Vietnam being the main destinations (WTO, 2024). However, the sector is vulnerable by persistent challenges such as fragmented markets, underdeveloped rural infrastructure, insecure land tenure, and ongoing political instability (WTO, 2024). More than 750,000 smallholder households depend on vegetable cultivation, with annual farm-gate sales surpassing $1.2 billion (LIFT, 2023).

The sown, harvested, and production data of vegetables in Myanmar between 2013 and 2022 provides critical insights for agriculture planning, food security policy, and climate adaptation strategies. The overall stability in the total cultivation area masks

the nuanced shifts in production levels of individual crops. For example, while cabbage and cauliflower remained stable in acreage, their productivity declined in recent years, possibly due to environmental stressors. In contrast, watermelon showed a remarkable increase in production in 2021–2022, hinting at its growing importance in Myanmar's horticultural economy. These patterns underscore the importance of data-driven interventions to support farmers in maintaining both productivity and economic resilience (Department of Agricultural Land Management and Statistics, 2023).

Table 3.1 Sown Area, Harvested Area and Production of Vegetables (2013-2017)

(In Thousand)

Crop	Unit	2013-2014	2014-2015	2015-2016	2016-2017
(1)	(2)	(3)	(4)	(5)	(6)
Total Sown	Acre	1366	1395	1403	1412
Harvested	Acre	1365	1394	1399	1411
1. Cabbage Sown	Acre	75	78	77	79
Harvested	Acre	75	77	77	79
Production	Viss	288752	292098	299664	303807
2. Cauliflower Sown	Acre	65	67	70	68
Harvested	Acre	65	67	70	68
Production	Viss	226324	237402	241612	254003
3. Lettuce Sown	Acre	28	26	29	32
Harvested	Acre	28	26	29	32
Production	Viss	48085	45322	55343	60499
4.Mustard (Leaf) Sown	Acre	91	85	88	89
Harvested	Acre	91	84	88	89
Production	Viss	183711	146711	167903	189706
5. Tomato Sown	Acre	279	272	281	278
Harvested	Acre	279	272	280	278
Production	Viss	845028	822552	808335	812768
6. Carrot Sown	Acre	7	6	5	5
Harvested	Acre	7	6	5	5
Production	Viss	13257	10165	9413	9278
7. Radish Sown	Acre	52	54	56	57
Harvested	Acre	52	54	56	57
Production	Viss	154740	167095	167184	164894

8. Watermelon Sown	Acre	45	51	53	60
Harvested	Acre	45	51	53	60
Production	Viss	141337	144664	165737	177190
9. Gourd Sown	Acre	56	57	58	57
Harvested	Acre	56	57	58	57
Production	Viss	172886	163568	165841	162840
10. Asparagus Sown	Acre	2	1	2	2
Harvested	Acre	2	1	2	2
Production	Viss	2269	2041	1968	3425
11. Others Sown	Acre	666	698	684	685
Harvested	Acre	665	698	681	684

Source :Department of Agricultural Land Management and Statistics (2023)

Table 3.2 Sown Area, Harvested Area and Production of Vegetables (2017-2022)

(In Thousand)

Crop	Unit	2017-2018	2018-2019*	2019-2020*	2020-2021*	2021-2022 (Apr-Mar)
(1)	(2)	(7)	(8)	(9)	(10)	(11)
Total Sown	Acre	1364	1349	1532	1378	1362
Harvested	Acre	1362	1349	1532	1377	1360
1. Cabbage Sown	Acre	75	77	75	75	77
Harvested	Acre	75	77	75	75	76
Production	Viss	282151	281838	272702	278939	283111
2. Cauliflower Sown	Acre	64	66	67	65	67
Harvested	Acre	63	66	67	65	67
Production	Viss	215718	218227	222957	216873	208859
3. Lettuce Sown	Acre	29	29	29	30	32
Harvested	Acre	29	29	29	30	31
Production	Viss	64934	62491	58635	58464	61936
4. Mustard (Leaf) Sown	Acre	89	90	89	89	90
Harvested	Acre	89	90	89	89	90
Production	Viss	183936	188811	178581	183364	192040
5. Tomato Sown	Acre	257	255	246	243	240
Harvested	Acre	257	255	246	243	240

Production	Viss	733286	708406	657529	704396	699326
6. Carrot Sown	Acre	6	7	6	8	8
Harvested	Acre	6	7	6	8	8
Production	Viss	10991	13677	11488	13803	16486
7. Radish Sown	Acre	55	55	55	51	52
Harvested	Acre	55	55	55	51	52
Production	Viss	164899	155734	155350	145568	146889
8. Watermelon Sown	Acre	64	64	64	59	56
Harvested	Acre	64	64	64	59	56
Production	Viss	198136	204836	210734	179388	315917
9. Gourd Sown	Acre	59	59	59	58	57
Harvested	Acre	59	59	59	58	57
Production	Viss	170424	162134	160811	172383	166945
10. Asparagus Sown	Acre	2	2	2	2	2
Harvested	Acre	2	2	2	2	2
Production	Viss	2242	2923	3112	2397	3765
11. Others Sown	Acre	664	645	660	698	681
Harvested	Acre	663	645	660	697	681

Source :Department of Agricultural Land Management and Statistics (2023)

3.2 Climate Characteristics and Trends in Myanmar

Myanmar's tropical monsoon climate features three distinct seasons: a hot summer from March to April, a rainy period from May to October, and a cooler winter from November to February. Temperature patterns vary widely across regions. The Central Dry Zone—which includes Mandalay, Magway, and Sagaing experiences the most extreme heat and dryness, receiving only 500–1,000 mm of annual rainfall, with summer temperatures frequently climbing to 40–43°C. In contrast, winter temperatures in much of the country range from 10–15°C, while highland areas such as Shan and Kachin States can see temperatures drop below freezing. Southern coastal areas, including Tanintharyi, maintain relatively stable temperatures year-round

Over the past sixty years, Myanmar has witnessed a noticeable warming trend, with the national average temperature rising by approximately 0.08°C per decade. Rainfall patterns have also changed, marked by increased total precipitation and shortened monsoon durations with more intense rainfall events. Sea levels are rising,

and extreme weather events such as droughts, floods, and cyclones have become more frequent and severe (MOALI & FAO, 2020; IPCC, 2023).

From 1981 to 2010, coastal areas experienced a temperature increase of about 0.14°C per decade, while inland regions saw a rise of 0.35°C per decade. During this same period, coastal rainfall increased by 157 mm per decade, compared to 37 mm inland (WFP, 2020). Between 2000 and 2010, the range of temperature anomalies became more pronounced, with maximum temperatures rising by up to 1.158°C and minimum temperatures increasing by 0.162°C. Post-2010 data reveal a continued upward trend, with minimum temperatures increasing by 0.467°C and maximum temperatures climbing as high as 1.552°C.

Droughts and floods, exacerbated by erratic rainfall patterns and shifting monsoon behavior, are the most common and destructive natural disasters in the country. Myanmar's average annual rainfall is approximately 1,630 mm, with over half the land area receiving between 1,500–2,000 mm. Intense rains in the dry zones frequently lead to flash floods and landslides.

Future climate projections suggest further warming and intensified climate variability. According to climate projections, Myanmar will experience significant temperature and precipitation changes by the end of the 21st century. Under the moderate-emission scenario (RCP 4.5), minimum temperatures are projected to increase by approximately 0.8–2.7°C, while maximum temperatures may rise by 0.8–2.6°C. In the high-emission scenario (RCP 8.5), these increases could reach 0.9–4.6°C for minimum temperatures and 0.8–4.4°C for maximum temperatures. Moreover, annual precipitation is expected to rise by around 36% under RCP 4.5 and up to 40% under RCP 8.5 (NUPI, 2024; IPCC, 2023).

Other anticipated climate impacts include a higher frequency of extremely hot days, more intense rainfall events during the monsoon, increased variability in seasonal rainfall, and a heightened risk of floods and droughts. The north of Myanmar is expected to face particularly unstable precipitation patterns, with reduced rainfall during the dry season and excess during the rainy season. The country is also projected to be increasingly exposed to cyclones, storm surges, sea level rise, and other extreme events.

3.2.1 Climate Change Conditions in Myanmar

Myanmar is experiencing significant climatic transformations, with these changes anticipated to become more severe in the years ahead. Historical data indicate that the mean annual temperature has risen by approximately 0.2°C per decade between 1961 and 2015, with inland regions experiencing a faster rate of warming compared to coastal areas. Climate projections suggest that by mid-century (2040–2060), mean annual temperatures could increase by 1.5–2°C under a high-emissions scenario. Such warming is likely to be accompanied by a significant rise in the number of extremely hot days (above 35°C), resulting in more frequent and prolonged heatwaves (World Bank, 2022). Concurrently, precipitation patterns have become more erratic, with the monsoon season tending to start later and end earlier yet producing heavier rainfall events. While some northern areas have experienced increases in annual rainfall, key agricultural regions such as the Ayeyarwady and Yangon have recorded declines, amplifying the risks of both severe flooding and prolonged droughts (MIMU, 2022). The frequency and severity of extreme weather events, including cyclones, floods, and droughts, have also intensified. For example, Cyclone Mocha in 2023 caused extensive flooding and displaced hundreds of thousands of people (UN-Habitat, 2024). Coastal areas, particularly the Ayeyarwady Delta, are highly vulnerable to sea level rise, which threatens to submerge low-lying lands, accelerate coastal erosion, and exacerbate saltwater intrusion into freshwater resources and farmlands (World Bank, 2022).

The impacts of these climate changes are extensive and multidimensional, affecting Myanmar's society, economy, and environment. Agriculture—which sustains nearly two-thirds of the population—faces heightened vulnerability due to increased flooding, recurrent drought, and salinity intrusion. These factors contribute to crop losses, yield reductions, and heightened risks to food security, thereby deepening rural poverty (MIMU, 2022). Climate-related disasters are also a leading driver of internal displacement, as extreme events damage housing and infrastructure, compelling communities to relocate. These displacement pressures are compounded by ongoing armed conflicts, which undermine resilience and restrict humanitarian access (ReliefWeb, 2023). Furthermore, ecosystems face severe stress; mangrove forests—critical natural barriers against storm surges—are being degraded by human development, while higher temperatures and unpredictable rainfall patterns are weakening terrestrial forests, increasing their vulnerability to wildfires (Bank, 2022).

These converging climate risks underscore the urgency for integrated adaptation and mitigation strategies aimed at safeguarding livelihoods, conserving biodiversity, and enhancing resilience in the face of a rapidly changing climate.

3.2.2 Climate Change Impacts on Myanmar's Vegetable Production

Myanmar's agriculture sector, particularly smallholder vegetable growers, is facing heightened vulnerability due to climate change. Over the past decade, average temperatures in the country have risen by approximately 1.2 °C, while the predictability of monsoon rainfall has declined by nearly 15% (DMH, 2023). These shifts have disrupted traditional planting schedules and exacerbated water scarcity in key agriculture regions.Moreover, extreme weather events are occurring with increasing frequency and severity. For instance, consecutive floods in the Bago region during 2023 and 2024, coupled with recurring droughts in central Myanmar, have directly affected crop performance and yields (DMH, 2023).

Table 3.3 Projections for Annual and Seasonal Temperature Change in Myanmar

	Model baseline" (1980 to 2006)	**Warming by 2011-2040**	**Warming by 2041-2070**
Annual	23.6 °C	0.7-1.1°C	1,3-2.7°C
Hot Season	25.1°C	0.8-1.2°C	1.4-2.9°C
Wet Season	25.1°C	0.6-1.1°C	1.1-2.4°C
Cool Season	20.5°C	0.7-1.2°C	1.3-2.8°C

Source: NASA NEX GDDP, 2015

Table 3.4 Projections for Annual and Seasonal Precipitation Change in Myanmar

	Model baseline* (1980 to 2006)	**Precipitation range (2011-2040)**	**Precipitation range (2041-2070)**
Annual	2000 mm	+1% to +11%	+6% to +23%
Hot Season	300 mm	-11% to +12%	-7% to +19%
Wet Season	1700 mm	+2% to +12%	+6% to +27%
Cool Season	100 mm	-23% to +11%	-12% to +11%

Source: NASA NEX GDDP, 2015

Climate-induced stressors also impose tangible health and economic impacts on vegetable crops. Prolonged high temperatures lead to heat stress, which damages plant physiology and reduces harvestable produce by an estimated 20–30% during peak heat (LIFT, 2023). Variability in rainfall contributes to both drought and waterlogging, inhibiting growth, disrupting fruit formation, and heightening susceptibility to diseases

affecting roots (FAO, 2023). Moisture fluctuations further foster pest outbreaks, including whitefly infestations and fungal infections, driving up pesticide dependency and increasing input expenses (WFP, 2024). In addition, limited irrigation infrastructure—particularly in rainfed production systems—constrains farmers' ability to manage drought conditions effectively (NUPI, 2024).

Farmers' perceptions and local climate parameters reveals a clear consensus that climate change is intensifying across multiple dimensions, leading to significant socio-economic and environmental consequences. Farmers consistently report rising temperatures, which they associate with reduced agricultural yields, decreased household income, and diminished food availability. Changes in precipitation patterns—characterized by erratic rainfall and shorter monsoon periods are perceived to cause crop losses, damage to properties, and declines in aquatic animal populations. Extreme events such as hailstorms, tropical cyclones, and floods are observed to occur with increasing frequency and intensity, resulting in extensive destruction of crops, farm equipment, household assets, and, in severe cases, loss of human lives and draught animals (Tun Oo, A, et al. 2023).

The impacts extend beyond immediate physical damage. Saltwater intrusion, exacerbated by rising sea levels and storm surges, is increasingly reported to degrade paddy fields and threaten certain fish species. Shifts in agro-ecological conditions, altered ocean currents, and worsening soil degradation manifested through prolonged drought, surface cracking, and groundwater depletion are contributing to water scarcity and further crop damage. Farmers also perceive a rise in pest infestations and crop diseases, driving up pesticide costs and lowering productivity. These environmental stresses have cascading effects on human health and well-being, increasing absenteeism from work and school, reducing labor capacity, and undermining community resilience (Tun Oo, A, et al. 2023).

3.3 Institutional and Policy Support for Agricultural Resilience in Myanmar

Various public institutions, international development agencies, and NGOs have implemented initiatives aimed at strengthening climate-resilient agriculture across Myanmar. The Ministry of Agriculture, Livestock and Irrigation (MoALI), in partnership with organizations like the FAO, UNDP, and ADB, has led programs focused on drought resilience, enhanced irrigation, climate-resilient crop varieties, and

community-based early warning systems (FAO, 2023). Key projects have supported water infrastructure development, agroforestry practices led by farmers, and watershed restoration. These efforts often include capacity building for rural communities and farmer-based organizations.

NGOs and alliances such as the Livelihoods and Food Security Fund (LIFT) and Mercy Corps have taken a market-based approach by enhancing agriculture value chains and promoting climate-smart farming practices. These programs also offer training for youth and marginalized groups in sustainable agriculture and environmental leadership (LIFT, 2023).

3.3.1 Myanmar Agriculture Policy

MOALI has prepared an Agricultural Policy (2016) to guide implementation of the Second Five-Year Plan. The policy includes the following objectives:

- To improve food security and safety and balance diet intake during the period of the second five-year plan.
- To ensure farmers fully enjoy their rights and benefit from the emerging economic growth.
- Small scale farmers, livestock keepers and fisher folks, gathered into groups or cooperatives (in which women's participation is mandated), modernize and improve the performance of the entire sector based on transferred knowledge.
- Smallholder farmer's socio-economic status improves though a target program of investment in rural road construction, rural infrastructures development, land use management and small-scale production industry development.
- To secure needed technology and financial assistance from local and external sources for further improvement of crop, livestock and fish production as well as cooperative development.
- To enhance production of high-quality grain, meat and fish products for external markets.
- To develop an efficient agro-based industry, including small scale industries, and associated vocational education.

- To increase access to local and external investment for the agriculture sector; and
- To actively ensure full participation of all stakeholders involved in poverty alleviation, agriculture sector development, and sustainable rural development programs

Myanmar's Climate-Smart Agriculture (CSA) Policy is guided by the Myanmar Climate-Smart Agriculture Strategy (2015–2030), developed by the Ministry of Agriculture and Irrigation in collaboration with international organizations. The strategy aims to achieve sustainable agricultural development for food security and nutrition through climate-resilient and sustainable farming. It is designed to be socially, culturally, and politically appropriate, environmentally friendly, and economically feasible.

Key elements of Myanmar's Climate-Smart Agriculture Policy

- Food Security and Productivity: Increase agriculture productivity and ensure food security by integrating climate-resilient practices, especially for rice-based systems.
- Resilience through Adaptation: Adapt farming systems to cope with changing climate patterns such as erratic rainfall, droughts, floods, and temperature extremes. This includes using stress-resistant crop varieties, improved water use and irrigation, soil and water conservation, and better pest and weed control.
- Mitigation: Reduce greenhouse gas (GHG) emissions from agriculture by encouraging practices such as conservation agriculture, alternate wet and dry rice irrigation, organic farming, crop diversification, and afforestation to enhance carbon sequestration.
- Institutional and Policy Measures: Develop necessary technical, policy, and investment conditions to support climate-smart agricultural development.
- Community and Stakeholder Participation: Involve local communities, academic institutions, and international partners in implementing climate-smart practices and research, including Climate-Smart and Nutrition-Smart Villages for field-level innovation and demonstration.

- Disaster Risk Management: Strengthen disaster risk reduction and crop/income risk management to build resilience among smallholder farmers.
- Knowledge and Capacity Building: Community awareness and extension services to promote adoption of CSA practices, including farmer field schools and integration of CSA in agricultural curricula.

3.3.2 Support Mechanisms and Farmer Participation

Climate-smart agriculture (CSA) practices are promoted using demonstration plots and farmer field schools facilitated by the FAO in collaboration with national partners. These techniques are progressively being incorporated into the country's formal agricultural education curricula (FAO, 2023). Government and donor programs provide limited support for inputs such as seeds, fertilizers, and small equipment. However, such assistance remains constrained by budget limitations and shifting political priorities (World Bank, 2024). New initiatives in digital finance and agribusiness training aim to expand financial access and build farmer business capacity. Some programs have also distributed micro-irrigation kits and small-scale machinery to vulnerable groups (UNDP, 2024). Despite these measures, many smallholders remain outside the reach of formal support systems due to low awareness, procedural complexity, and inadequate outreach infrastructure (LIFT, 2023).

3.3.3 Strategic Intervention Points for Agricultural Resilience

Farmers widely emphasize the need for localized accurate weather forecasts. While tools like the *Htwet Toe* mobile app are expanding access to agro-climatic advisories, their coverage remains limited (MoALI, 2023). Small-scale, low-cost irrigation is crucial for expanding dry-season production and managing risk. Development agencies highlight the strong return on investment from improved irrigation access (ADB, 2024). Inclusion in higher-value markets, adherence to food safety standards, and access to real-time market data are essential for increasing income stability (Mercy Corps, 2024). Access to financial services is still a major barrier. High collateral requirements, complex loan procedures, and elevated interest rates limit farmers' ability to invest.

3.4 Economic Challenges for Myanmar's Farmers

Smallholder vegetable farmers in Myanmar are grappling with considerable economic pressures, a key aspect of the dual challenges they face. Producers are contending with sharply rising input costs, especially for fertilizers, seeds, and labor. Disruptions in global supply chains and the depreciation of the local currency have caused fertilizer prices to surge by 40–60%, severely eroding the profitability of small-scale farms (FAO, 2023). Labor shortages and wage inflation further inflate production expenses, while restricted access to credit limits farmers' ability to invest in adaptive technologies. Concurrently, market volatility, often worsened by climate-induced production shocks and inadequate infrastructure, results in unstable prices, putting additional financial strain on these smallholders (WFP, 2024).

The steep depreciation of the Myanmar kyat has increased the country's existing economic difficulties (World Bank, 2023). This currency devaluation drives up the local cost of crucial imported agriculture inputs, such as hybrid seeds and agrochemicals, thereby squeezing profit margins for smallholders who typically purchase these necessities with cash. Reduced earnings restrict vital investments in resilient farming practices and technology adoption, perpetuating a cycle of vulnerability (FAO, 2023). While vegetable production can offer higher profitability per unit area compared to staple crops like rice and maize, it is also more susceptible to weather fluctuations and spoilage, leading to greater post-harvest losses and market risks (LIFT, 2023). This dual vulnerability to both climate and economic pressures highlights the urgent need for targeted support mechanisms. These should prioritize improvements across the value chain, promote climate-smart inputs, and establish robust risk management strategies to bolster the resilience of smallholder vegetable farmers.

3.5 Economic and Climate Pressures on Vegetable Farmers in Yangon Region

Vegetable farmers in the Yangon Region face significant economic pressures from rising production costs, unstable markets, and limited access to finance. The cost of agriculture inputs like fertilizers, seeds, and labor has increased substantially, cutting into farmers' profits, with input inflation notably surpassing general inflation, especially for fertilizers and labor since 2023. This situation is worsened by political unrest and supply chain disruptions (World Bank, 2025), forcing many farmers to reduce production or use cheaper, lower-quality inputs, which negatively impacts crop yields and quality (EWS-KT, 2023).

Smallholder farmers frequently face challenges in securing affordable credit. Due to the scarcity of formal financial services and the complexity of loan application processes, many depend on informal lenders or input suppliers who charge exorbitant interest rates and enforce rigid repayment schedules (UNDP, 2025). These financial constraints hinder timely farming operations and limit investments in essential inputs such as quality seeds and irrigation systems, ultimately diminishing farmers' capacity to respond effectively to unpredictable conditions.

Additionally, market instability poses a significant obstacle for smallholder vegetable producers. Price volatility is driven by fluctuating supply levels, seasonal surpluses, and transportation difficulties, especially during the monsoon season when damaged infrastructure restricts access to markets. For example, sharp drops in tomato prices have occasionally pushed selling prices below production costs, forcing farmers to leave crops unharvested. At the same time, inefficiencies in logistics and the perishable nature of produce can trigger sudden price hikes for consumers, further disrupting market balance (Hanthar Hein, 2024).

Farmers try to manage this volatility by diversifying crops, timing planting to avoid oversupply, selling directly to consumers, or making informal agreements with buyers. However, limited access to market information and weak farmer organizations hinder their ability to negotiate fair prices and increase their exposure to market risks (EWS-KT, 2023). Additionally, post-harvest losses, often exceeding 30%, further reduce earnings, highlighting the need for better storage, transport, and marketing infrastructure. The financial viability of vegetable farming in Yangon is undermined by these rising costs, credit restrictions, unstable markets, and insufficient institutional support, which collectively reduce smallholder resilience and threaten their livelihoods (World Bank, 2025).

Climate change is severely impacting vegetable farming in Myanmar's Yangon Region. Since 2013, average temperatures have increased by approximately 1.2°C (DMH, 2023). This warming particularly harms heat-sensitive vegetables like lettuce, spinach, and watercress. Sustained exposure to temperatures over 35°C causes these crops to wilt, flower prematurely, and lose leaf quality, drastically reducing their market value. Farmers report significant yield losses of 20–30% during hot periods, demonstrating the clear economic cost of rising heat (LIFT, 2023).

The reliability of monsoon rainfall in Yangon has dropped by about 15% (World Bank, 2022), disrupting traditional planting calendars for key vegetables such as tomatoes, long beans, and gourds. Delayed rains force farmers to incur extra costs for replanting seeds and labor. Conversely, unexpected heavy rainfall leads to waterlogged fields, promoting root diseases and decreasing productivity. Furthermore, dry spells during critical fruit-setting stages for crops like tomatoes result in lower yields and misshapen fruits. Together, these patterns create unpredictable farming cycles and greater vulnerability for smallholder farmers (FAO, 2023).

Table 3.5 Rainfall, Temperature and Percentage of Humidity Yangon Region (2013-2022)

Station Location (Yangon)	Annual Rainfall in Millimetre	Temperature °C		Mean Relative Humidity Percent
		Mean max.	Mean min.	
2013 Actual	2774	33.5	21.5	77
2014 Actual	3136	33.8	21.0	76
2015 Actual	2662	33.9	22.5	76
2016 Actual	2605	33.7	22.1	76
2017 Actual	3262	33.1	22.1	76
2018 Actual	3144	33.2	20.3	76
2019 Actual	3084	33.8	21.9	77
2020 Actual	2394	34.1	22.4	74
2021 Actual	2738	33.9	21.9	77
2022 Actual	2664	33.5	22.7	73

Source: Department of Meteorology and Hydrology (2023)

CHAPTER IV
SURVEY ANALYSIS

This chapter presents the survey profile, survey design and survey results. A survey was conducted to study agricultural resilience in climate-affected vegetable farmers in Hlegu Township, Yangon region and the results are presented in the following sections.

4.1 Survey Profile

Hlegu Township, located in the Yangon Region, lies between latitudes 16°59' N and 17°19' N and longitudes 96°13' E and 96°25' E. Encompassing 576.918 square miles, the township extends approximately 13.5 miles east-west and 35 miles north-south. It shares borders with Bago Region's Bago and Kawhmu Townships to the east, while its southern boundary adjoins Yangon's Dagon Myothit, Thanlyin, and North Okkalapa Townships. To the west, it neighbors Hmawbi, Taikkyi, and Mingaladon Townships, and its northern edge meets the forested ridges of the Bago Yoma Mountain range in Bago Region. Climatically, Hlegu experiences a stable monsoon-influenced weather pattern, with temperatures ranging from a peak of 41°C to a low of 20°C, maintaining moderate conditions year-round (GAD, 2023). Hlegu Township primarily relies on agriculture as its main economic activity, supplemented by livestock farming, horticulture, and trade. The township exports its local produce to nearby townships, maintaining a stable and balanced economy.

Table 4.1 Crops Cultivation and Production in Hlegu Township

No.	Type of Agriculture Land	Area (Acres)	Harvested Acre	Total Yield
1.	Paddy Fields	83629 (Monsoon)	83324	5322418 (Bsk)
		29706 (Summer)	29706	2469355 (Bsk)
2.	Vegetable Farms	1907	1907	7139808 (Viss)
3.	Rubber	24888	3305	393922.95 (Viss)

Source: Department of Agriculture, Hlegu Township (2018).

This study concentrated on Hlegu Township, which serves as the primary vegetable supplier for Yangon. Specifically selected three villages within Hlegu Township—*Haing Ku, Kyoet Kone,* and *U Yin Wa* all of which are part of the *Haing Ku* village tract. Most vegetable producers in these villages operate as smallholder farmers. The study area shown in following figure 1.

Table 4.2 Numbers of Household and Population in Survey Villages

No.	Village	Households	Population
1	Haing Ku	198	1045
2	Kyoet Kone	563	3007
3	U Yin Wa	871	2814
Total		1632	6866

Source: Survey Data June 2025

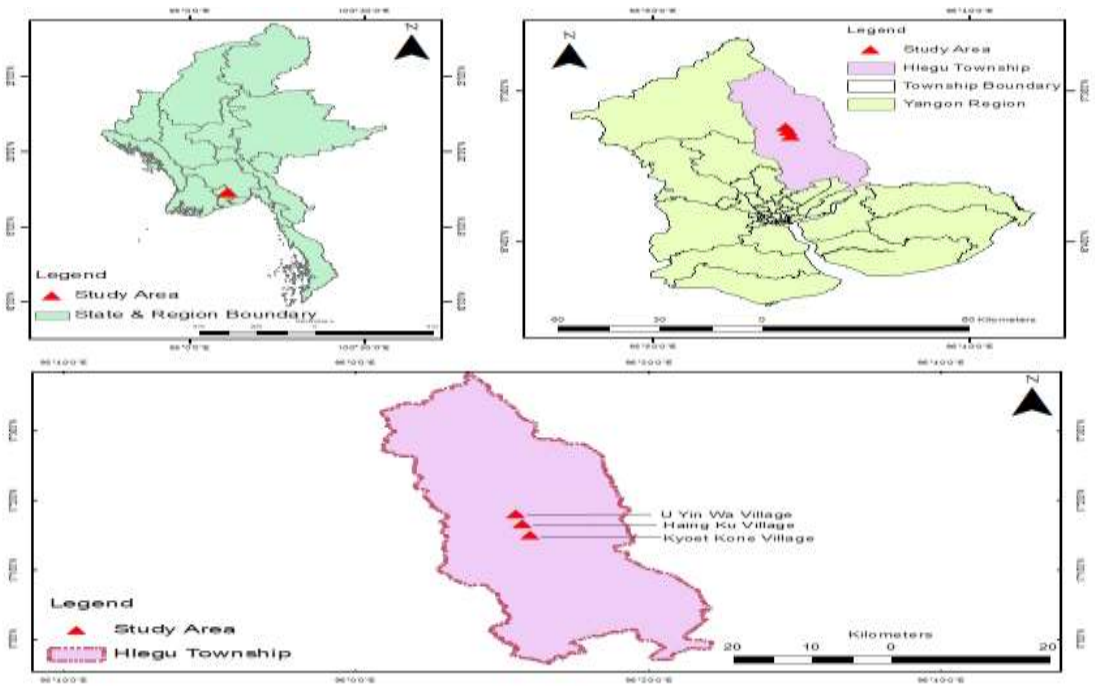

Figure4.1 Study Area Map

4.2 Survey Design

This study employed a mixed-methods approach, integrating descriptive statistics with qualitative insights, based on primary data collected through structured household surveys. A total of 93 vegetable farming households were selected from three

villages in Hlegu Township: 26 respondents from *Haing Ku* Village, 31 from *Kyoet Kone* Village, and 36 from *U Yin Wa* Village.

The selection of survey respondents was conducted through a stratified random sampling method to ensure adequate representation across key vegetable-producing areas of Hlegu Township. Three major vegetable farming villages *Haing Ku, Kyoet Kone, and U Yin Wa* were identified in consultation with local agricultural officers and village administrators, based on their production scale, diversity of crops, and relevance to the township's vegetable supply chain. Within each village, a household list of active vegetable farmers was obtained from local authorities. From these lists, respondents were randomly selected proportionate to the total number of vegetable farming households in each village, ensuring that the final sample of 93 households reflected the relative population size of each location. This approach minimized selection bias, maintained representativeness, and allowed for meaningful comparison of climate and economic resilience patterns between villages.

The survey was structured into seven sections to comprehensively capture the experiences and perspectives of vegetable farmers. Section 1, *Demographic and Farm Profile*, gathered basic information on farmers' personal and farm characteristics, including village, age, gender, education level, land size, farming experience, land tenure, household labor, main crops cultivated, and reliance on farming for income. Section 2, *Perceptions and Experiences of Climate Change* examined farmers' observations of climate indicators such as temperature and rainfall patterns, challenges including droughts, floods, and pest infestations, as well as the impacts of these changes on crop yields and planting schedules. Section 3, *Economic Challenges*, focused on the effects of rising input costs on farming operations, difficulties in accessing credit, the stability of market prices, and strategies for coping with price fluctuations. Section 4, *Adaptation and Resilience Strategies* investigated the techniques used to cope with climate change, their perceived effectiveness, approaches to income diversification, barriers to adopting innovative methods, confidence in future coping capacity, and sources of information and training. Section 5, *Institutional and Policy Support*, assessed farmers' awareness of and participation in government and NGO support programs, satisfaction with available services, desired additional support, accessibility of extension services, and perceptions of policy adequacy. Section 6, *Community Resilience and Collaboration* evaluated the extent of community support during

hardships, participation in farmer groups or cooperatives, the importance of social support networks, and the role of local customs and indigenous knowledge in adaptation efforts. Finally, Section 7, *Outlook and Resilience of Vegetable Farmers*, measured the overall impact of climate change and economic costs on livelihoods, identified farmers' main future concerns, and prioritized key needs for achieving long-term sustainability in vegetable farming.

4.3 Survey Results

As questionnaire composed of 7 aspects which are Demographic Characteristics and Farm Profile, Impacts of Climate Change on Smallholder Farming, Economic and Climatic Stress in Agriculture, Adaptation and Resilience Strategies, Institutional and Policy Support, Community Resilience and Collaboration and Outlook and Resilience of Vegetable Farmers, the results are presented for each aspect.

4.3.1 Socio-Economic Characteristics

In this section, demographic characteristic and farm profile of the respondents from the sample survey included gender, age group, education level, size of agriculture land, farming experience, land tenure, household members in farming and household income from farming. A total of 93 farmers from Hlegu Township participated in this survey. There were 93 respondents providing single responses in most of the questions, with multiple responses potentially numbering more than 93 in some of the questions.

Table 4.3 Socio-Economic Characteristics

Socio-Economic Characteristics		**Respondents**	**Percentage (%)**
1. Village	Haing Ku Village	26	28%
	Kyoet Kone Village	31	33%
	U Yin Wa Village	36	39%
2. Age	26–35 years	11	12%
	36–45 years	39	42%
	46 years and above	43	46%
3. Gender	Male	51	55%

Socio-Economic Characteristics		Respondents	Percentage (%)
	Female	42	45%
4. Education Level	No formal education	7	8%
	Primary school	30	32%
	Middle school	35	38%
	High School	10	11%
	Diploma/Certificate	4	4%
	Bachelor's degree or higher	7	8%
5. Size of Agriculture Land	Less than 1 acre	27	29%
	1–5 acres	59	63%
	6–10 acres	7	8%
6. Farming Experience	Less than 1 year	3	3%
	1–5 years	34	37%
	6–10 years	34	37%
	More than 10 years	22	24%
7. Land Tenure	Owned	69	74%
	Rented	20	22%
	Sharecropped	4	4%
8. Household Members contribute to farming activities	1 Member	18	19%
	2-3 Members	57	61%

Socio-Economic Characteristics		Respondents	Percentage (%)
	4-5 Members	16	17%
	More than 5 Members	2	2%
10. Household Income from Farming	25-50%	21	23%
	51-75%	44	47%
	More than 75%	28	30%

Source: Survey Data June 2025

Table 4.3 shows Socio-Economic Characteristics. The surveyed households were distributed across three major vegetable-producing villages in Hlegu Township, with the largest proportion from *U Yin Wa* Village (39%), followed by *Kyoet Kone* Village (33%) and *Haing Ku* Village (28%). Most respondents were middle-aged or older, with 42% aged between 36–45 years and 46% aged 46 years or above, while only 12% were in the 26–35 age range. Male respondents slightly outnumbered females (55% and 45%, respectively).

Education levels among respondents were relatively low, with 70% having only primary or middle school education, 8% having no formal education, and just 15% attaining high school or higher qualifications. In terms of agricultural resources, most farmers (63%) cultivated between 1–5 acres of land, while 29% operated on less than 1 acre and only 8% had between 6–10 acres. Farming experience was generally high, with 61% of respondents having more than six years of experience and only 3% having farmed for less than one year.

Regarding land tenure, the majority (74%) owned their farmland, 22% rented, and 4% practiced sharecropping. Household labor participation was typically moderate, with 61% reporting 2–3 family members engaged in farming activities, 19% with only one member, and few households (2%) involving more than five members. Farming constituted a significant share of household income, with 47% of households deriving

51–75% of their income from farming, 30% earning more than 75%, and 23% earning between 25–50%.

Table 4.4 Vegetable Cultivation by Village

Type of Vegetable	Haing Ku Village	Kyoet Kone Village	U Yin Wa Village	Total Household Cultivation	Percentage %
Tomatoes	5	11	8	24	5%
Chili	6	23	14	43	9%
Cabbage	10	12	15	37	8%
Water Spinach	4	11	9	24	5%
Mustard Greens	16	6	12	34	7%
Eggplant	21	16	18	**55**	**12%**
Gourds	22	23	17	**62**	**13%**
Long Beans / Green Beans	11	26	25	**62**	**13%**
Okra/Lady's Finger	11	20	23	**54**	**11%**
Pumpkin	8	10	20	38	8%
Cucumber	11	12	21	44	9%

Source: Survey Data June 2025

Across the three surveyed villages, gourds and long beans/green beans emerged as the most widely cultivated vegetables, each accounting for 62 instances (13% of total cultivation events). They were closely followed in popularity by eggplant (55 cases, 12%) and okra/lady's finger (54 cases, 11%). In contrast, tomatoes and water spinach were the least commonly grown types, each recorded only 24 times (5%). Mustard greens (34 cases, 7%) and pumpkin (38 cases, 8%) also demonstrated relatively lower overall cultivation frequencies.

Different village-level cultivation patterns were observed, *Haing Ku* Village showed a pronounced preference for eggplant (21 cases) and gourds (22 cases), with mustard greens (16 cases) also being notably more popular here than elsewhere.

Kyoet Kone Village led in the cultivation of chili (23 cases), long beans/green beans (26 cases), and okra/ lady's finger (20cases), while also demonstrating high gourd production (23 cases). *U Yin Wa* Village was the primary cultivator of cabbage (15 cases), pumpkin (20 cases), and cucumber (21 cases), alongside strong representation in long beans/green beans (25 cases) and okra/lady's finger (23 cases).

4.3.2 Impacts of Climate Change on Vegetable Farming

Table 4.5 revealed that irregular rainfall was the most widely experienced climate-related challenge, reported by all respondents in *Haing Ku* (26), the majority in *Kyoet Kone* (21), and almost all in *U Yin Wa* (28). Heatwaves were the second most frequently cited event, affecting 19 farmers in *Haing Ku*, 15 in *Kyoet Kone*, and 13 in *U Yin Wa*. Increased pest outbreaks were also a common issue, with 13, 10, and 12 respondents reporting this problem in *Haing Ku, Kyoet Kone*, and *U Yin Wa,* respectively.

Flooding affected 11 farmers in *Haing Ku* and 9 in both *Kyoet Kone* and *U Yin Wa*, while drought occurrences were more prevalent in *Kyoet Kone* (9) and *U Yin Wa* (11) compared to *Haing Ku* (4). Strong winds or storms were the least frequently reported event overall, though they were more common in *U Yin Wa* (8) than in *Haing Ku* (5) or *Kyoet Kone* (3). These variations suggest that while irregular rainfall is a township-wide concern, the intensity and type of other climate events vary by village, potentially reflecting differences in topography, cropping systems, and microclimatic conditions.

Table 4.5 Farmers' Experiences of Climate Change Events

Climate Event	Haing Ku	Kyoet Kone	U Yin Wa	Total Respondents
Drought	4	9	11	24
Irregular rainfall	26	21	28	75
Flooding	11	9	9	29
Heatwaves	19	15	13	47
Increased pest outbreaks	13	10	12	35

Climate Event	Haing Ku	Kyoet Kone	U Yin Wa	Total Respondents
Strong winds/storms	5	3	8	16
Total	78	67	81	226

Source: Survey Data June 2025

(1) Temperature Impacts on Crop Vulnerability

Following table 4.6 reveal that reduced yield is the most reported consequence of rising temperatures, affecting 82 respondents across the three villages, with the highest number in *U Yin Wa* (31), followed by *Haing Ku* (26) and *Kyoet Kone* (25). Poor crop quality emerged as the second most frequently reported impact, with 67 respondents citing this issue; notably, *U Yin Wa* again recorded the highest cases (30), suggesting heightened sensitivity to temperature-related quality degradation in this area.

Wilting or stunted growth was reported by 50 respondents, distributed evenly across the villages, though slightly higher in *U Yin Wa* (19). Increased water demand was less frequently mentioned, with 29 respondents indicating this challenge, while earlier or later maturity was the least reported impact, affecting 27 respondents.

Table 4.6 Rising Temperature Impacts on Crops Productivity

Temperature Impact	Haing Ku	Kyoet Kone	U Yin Wa	Total
Wilting/stunted growth	14	17	19	50
Reduced yield	26	25	31	82
Poor crop quality	21	16	30	67
Increased water demand	8	9	12	29
Earlier/later maturity	11	8	8	27
Total	80	75	100	255

Source: Survey Data June 2025

Overall, the data suggest that rising temperatures primarily threaten both the quantity and quality of vegetable production, with *U Yin Wa* consistently showing higher incidence rates across most impact categories.

(2) Rainfall Variability Impacts on Agriculture Practices

The following table 4.7 indicates that rainfall variability has had diverse effects on agricultural practices across the three study villages. Delayed planting was most frequently reported in *Kyoet Kone* (14 farmers), followed by *U Yin Wa* (9) and *Haing Ku* (7), suggesting that late or unpredictable rains have disrupted optimal sowing times, particularly in *Kyoet Kone*. Reduced growing season, while less common overall, was more prevalent in *Kyoet Kone* (6) compared to *U Yin Wa* (3) and was not reported at all in Haing Ku, indicating location-specific climatic conditions and cropping patterns.

Increased risk of crop failure emerged as the most critical rainfall-related impact, with the highest number of reports from *U Yin Wa* (20), followed by *Haing Ku* (12) and *Kyoet Kone* (7). This suggests that *U Yin Wa* farmers are particularly vulnerable to rainfall fluctuations, possibly due to higher dependence on rainfall-sensitive crops or less access to irrigation infrastructure. Shifts in the cropping calendar were reported by a smaller proportion of farmers, with similar numbers in *Haing Ku* (7), *Kyoet Kone* (4), and *U Yin Wa* (4), reflecting adaptive adjustments to changing rainfall patterns. Overall, the data highlights that while all villages experience negative impacts from rainfall variability, the severity and nature of these impacts vary significantly between locations.

Table 4.7 Rainfall Variability Impacts on Agriculture Practices

Rainfall Impact	Haing Ku	Kyoet Kone	U Yin Wa	Total
Delay Planting	7	14	9	30
Reduced Growing Season	0	6	3	9
Increased Crop Failure Risk	12	7	20	39
Shifted Cropping Calendar	7	4	4	15

Source: Survey Data June 2025

4.3.3 Economic Challenge in Agriculture

The survey results indicate that rising farming costs have significantly affected smallholder vegetable farmers, though the specific impacts vary by village. In *U Yin Wa*, farmers reported the highest levels of negative outcomes, with 23 respondents each experiencing increased debt burden and reduced profitability, and 21 reporting delayed planting seasons. This suggests that *U Yin Wa* farmers are particularly vulnerable to cost pressures, potentially due to smaller access to credit or higher input dependence. In *Haing Ku*, delayed planting (15 respondents) and increased debt (14) were the most frequently reported effects, while reductions in farm size and profitability were reported by 10 farmers each. *Kyoet Kone* exhibited a different pattern, with a majority (20) shifting to cheaper inputs and another 20 experiencing reduced profitability, indicating that farmers there are more likely to adapt through cost-reduction strategies rather than cutting farm scale see (Table 4.8). Overall, the data highlights that rising costs affect both farm management decisions and economic outcomes, with variability among villages reflecting differences in resource access, farm size, and adaptive capacity.

Table 4.8 The Effect of Farming Cost Increases on the Agriculture Sector

Village Name	Reduced Farm Size/ Scale	Shifted to Cheaper Inputs	Delayed Planting Seasons	Increased Debt Burden	Reduced Profitability	Total
Haing ku	10	8	15	14	10	57
Kyoet Kone	10	20	8	9	20	67
U Yin Wa	20	9	21	23	23	96
Total	40	37	44	46	53	220

Source: Survey Data June 2025

Following table 4,9 reveals that farmers' adaptation strategies were strongly influenced by their perceptions of market price stability. Among those perceiving highly unpredictable market prices (21), a majority diversified crops (14) and sold directly to consumers (15) as immediate coping strategies, while fewer engaged in contract farming (8) or cost reduction measures (13). For farmers experiencing unstable market conditions (n=58), diversification was the predominant strategy (42), followed by direct sales (37), contract farming (21), and cost reduction (20), reflecting broader use of adaptive approaches in moderately volatile markets. Those perceiving moderately stable prices (n=14) employed fewer strategies overall, with 12 diversifying crops, 7 selling directly, and only 5 using contract farming or reducing production costs.

In total, crop diversification (68) and direct-to-consumer sales (59) emerged as the most common strategies, indicating that smallholder farmers prioritize maintaining income security and market access underprice uncertainty.

Table 4.9 Adaptation strategies by perceived stability of local vegetable market prices

Perceived Market Price Stability	Diversifying Crops	Selling Directly to Consumers	Contract Farming	Reducing Production Costs
Highly Unpredictable (n=21)	14	15	8	13
Unstable (n=58)	42	37	21	20
Moderately Stable (n=14)	12	7	5	5
Total (n=93)	68	59	34	38

Source: Survey Data June 2025

4.3.4 Adaptation and Resilience Strategies

The implementation of climate adaptation strategies varied considerably across the three study villages, reflecting differences in resource availability, local agro-ecological conditions, and farmer awareness. Crop diversification was the most widely implemented strategy overall, particularly in *U Yin Wa* (16 farmers), followed by *Kyoet Kone* (8) and *Haing Ku* (7), indicating its importance as a risk-spreading measure against climate and market uncertainties. Soil conservation practices were also relatively common, especially in *U Yin Wa* (11) and *Haing Ku* (9), suggesting a shared recognition of the need to maintain soil fertility under changing climatic conditions.

Improved irrigation methods were notably more prevalent in *U Yin Wa* (9) compared to *Haing Ku* (3) and absent in *Kyoet Kone*, possibly reflecting differences in access to irrigation infrastructure or water sources. Similarly, the use of pest- and disease-resistant crop varieties was most frequent in *U Yin Wa* (11), followed by *Haing Ku* and *Kyoet Kone* (7 and 8, respectively). Adjustments to planting and harvesting schedules were moderately practiced, with the highest uptake in *Haing Ku* (7), indicating a localized adaptation to shifting rainfall patterns.

Less common strategies included agroforestry or intercropping, practiced by only a small number of farmers in *Haing Ku* (3) and *U Yin Wa* (3) and absent in *Kyoet Kone*, and water harvesting or storage, reported by 5 farmers in *Haing Ku*, 4 in *Kyoet Kone*, and 3 in *U Yin Wa*. The overall pattern suggests that while all villages have

adopted some form of adaptation, *U Yin Wa* demonstrates broader and more intensive use of multiple strategies, potentially due to greater exposure to climate risks or more proactive adaptation planning.

Table 4.10 Implementation of Adaptation Strategies by Villages

Practice	Haing Ku (n)	Kyoet Kone (n)	U Yin Wa (n)	Total (n)
Crop diversification	7	8	16	31
Improved irrigation methods	3	0	9	12
Soil conservation	9	5	11	25
Pest/disease-resistant crop varieties	7	8	11	26
Adjusting planting/harvesting schedules	7	3	6	16
Agroforestry/intercropping	3	0	3	6
Water harvesting/storage	5	4	3	12
Total	41	28	59	128

Source: Survey Data June 2025

(1) Alternative Livelihood for Income Diversification

Facing severe economic and climate pressures, vegetable farmers require alternative livelihoods for essential income diversification, risk reduction, and resilience enhancement. The distribution of alternative livelihood strategies across three villages, revealing distinct patterns of economic diversification. The data suggests that reliance on certain livelihoods, such as livestock/poultry farming and wage labor (non-farm), is widespread, but with notable village-specific differences. Livestock/poultry farming is most prevalent in *Kyoet Kone* (20 respondents), while non-farm wage labor is a dominant strategy in *Haing ku* (16 respondents) and *U Yin Wa* (16 respondents). Conversely, reliance on family remittance is highest in *Haing ku* (9 respondents) and lowest in *U Yin Wa* and *Kyoet Kone* (7 respondents each). The adoption of other strategies, such as small business/trading and particularly handicrafts/artisan work, appears to be far less common across the board. The near absence of handicrafts/artisan work in the villages suggests this is not a viable or preferred alternative income source for the majority of the population. Overall, the findings indicate that while farmers in all three villages are diversifying their income streams, their preferred methods differ, likely influenced by local economic opportunities, social networks, and access to resources.

Table 4.11 Alternative Livelihoods for Income Diversification by Villages

Alternative Livelihood	Haing ku (N)	Kyoet Kone (N)	U Yin Wa (N)
Livestock/poultry farming	19	20	18
Wage labor (non-farm)	16	11	16
Small business/trading	5	5	6
Remittances from family	9	7	7
Handicrafts/artisan work	0	2	0

Source: Survey Data June 2025

(2) Barriers to new farming technologies

The Vegetable farmers face multiple barriers to adopting modern agricultural technologies such as high-tech greenhouses, sensor-based irrigation systems, farm management software, bio-stimulants, bio-pesticides, cold chain facilities, and autonomous robots for planting, weeding, and harvesting (e.g., tomatoes or lettuce). Analysis of these barriers across three villages shows that, while some challenges are common, their intensity varies considerably by location. The most frequently reported obstacles are a lack of financial resources and the high cost of inputs and technologies, with *U Yin Wa* consistently recording the highest number of affected respondents indicating a particularly acute economic constraint in this area. Limited access to training and information is another major barrier, again most prevalent in *U Yin Wa* (21 respondents), suggesting a gap in outreach and educational resources. Conversely, the unavailability of improved seeds and tools is primarily reported in *Haing Ku* (18 respondents), pointing to a localized supply chain issue. Climate uncertainty also emerges as a notable challenge in *Haing Ku* (10 respondents), whereas resistance to change is relatively rare across all villages. These findings indicate that while financial and informational constraints are systemic, technological adoption barriers are highly localized, requiring tailored, village-specific interventions.

Table 4.12 Barrier to New Farming Technologies

Barrier to New Farming Technologies	Haing ku (N)	Kyoet Kone (N)	U Yin Wa (N)
Lack of financial resources	23	21	28
Limited access to training/information	14	13	21
High cost of inputs/technology	23	25	27
Unavailability of improved seeds/tools	18	6	12
Resistance to change (traditional practices)	7	2	2

Climate uncertainty makes planning difficult	10	7	12

Source: Survey Data June 2025

(3) Receiving Information Sources for Agriculture

Farmers in the three villages obtain information and training on climate adaptation and farming practices from a variety of sources, with preferences differing by location. Fellow farmers and community knowledge are the most widely used source overall (46 respondents), particularly in Kyoet Kone (17) and Haing Ku (16). Government extension services play a key role in Kyoet Kone (10 respondents), whereas U Yin Wa farmers rely more on NGOs or farmer cooperatives (14) and radio/TV programs (16) for guidance. The use of mobile apps and the internet is relatively consistent across all villages, providing a modern channel for agricultural updates. In contrast, workshops and formal training programs are the least accessed source (12 respondents in total), indicating limited engagement in structured learning. These patterns suggest that strategies for delivering climate adaptation and farming practice information should be tailored to each village's communication habits and access channels.

Table 4.13 Receiving Information Sources for Agriculture

Information Source	Haing ku (N)	Kyoet Kone (N)	U Yin Wa (N)	Total (N)
Government agricultural extension services	6	10	15	31
NGOs/farmer cooperatives	16	13	14	43
Radio/TV programs	4	9	16	29
Fellow farmers/community knowledge	16	17	13	46
Mobile apps/internet	8	13	13	34
Workshops/training programs	6	0	6	12

Source: Survey Data June 2025

4.3.5 Institutional and Policy Support

Institutional support for climate-resilient farming was available to varying degrees among respondents, with the most common form being subsidized seeds and fertilizers, received by 74% of those who received assistance. Low-interest loans or credit were provided to 63% of supported farmers, helping them manage input costs

and cash flow constraints. Climate-smart agriculture training, which equips farmers with knowledge and techniques for adapting to climate variability, was received by 26% of respondents, while irrigation equipment support was the least common, benefiting only 9%. The relatively low access to irrigation-related assistance highlights a potential gap in support for water management, despite its importance in climate adaptation.

Table 4.14 Receiving Support from Institutions

Support Type	participants	Percentage of Respondents
Climate-smart agriculture training	9	26%
Subsidized seeds/fertilizers	26	74%
Low-interest loans/credit	22	63%
Irrigation equipment support	3	9%

Source: Survey Data June 2025

Only 38% of farmers surveyed participated in any institutional support program, while the majority (62%) reported no participation. Among those who participated, satisfaction levels were generally high—71% expressed satisfaction, 15% were very satisfied, and only 14% reported a neutral stance, with no respondents indicating dissatisfaction. This suggests that while institutional programs are well-received by those who access them, participation rates remain low, potentially due to limited outreach, awareness, or eligibility barriers. The results indicate a clear opportunity to expand the coverage of effective programs, particularly in under-served areas and in support types such as irrigation infrastructure, to strengthen the resilience of smallholder vegetable farmers.

Table 4.15 Institution Support Program Participation and Satisfaction

Program Participation / Support Type	Number of Respondents	Percentage of Respondents
-Participated in Support Program	35	38%
Did not participate	58	62%
Satisfaction Levels		
- Neutral	13	14%
- Very satisfied	14	15%
- Satisfied	66	71%

Source: Survey Data June 2025

Additional Support Options in Mitigating Climate and Economic Challenges

This analysis examines the perceived needs for additional support among farmers across three villages *Haing ku, Kyoet Kone*, and *U Yin Wa* to enhance their farm's resilience against climate and economic challenges.

Table 4.16 The Distribution of Support Option Across the Three Villages

Support Option	Village Name	No. of Respondents (Did Not Select)	No. of Respondents (Selected)	Total Respondents in Village
Better access to weather forecasts	Haing ku	12	14	26
	Kyoet Kone	15	16	31
	U Yin Wa	20	16	36
Affordable irrigation technology	Haing ku	11	15	26
	Kyoet Kone	18	13	31
	U Yin Wa	23	13	36
More training on climate-smart practices	Haing ku	17	9	26
	Kyoet Kone	23	8	31
	U Yin Wa	21	15	36
Improved access to markets	Haing ku	8	18	26
	Kyoet Kone	13	18	31
	U Yin Wa	7	29	36
Government price stabilization policies	Haing ku	12	14	26
	Kyoet Kone	14	17	31
	U Yin Wa	18	18	36

Easier loan/credit processes	Haing ku	6	20	26
	Kyoet Kone	10	21	31
	U Yin Wa	10	26	36

Source: Survey Data June 2025

The respondent reveals patterns in support priorities. Better access to weather forecasts shows consistent demand across villages. Affordable irrigation technology is slightly more prioritized in *Haing ku*. More training on climate-smart practices sees higher interest in *U Yin Wa*, with 15 respondents selecting it compared to 8 in *Kyoet Kone*. Improved access to markets is highly sought after, particularly in *U Yin Wa* (29 respondents). Government price stabilization policies and Easier loan/credit processes also demonstrate widespread and significant demand across all three villages, with the latter being a universal concern. Overall, the data indicates a broad consensus on the importance of these six support mechanisms for enhancing farm resilience.

4.3.6 Community Resilience and Collaboration

The analysis of perceived benefits from collective action and group participation across the three villages highlights the critical role of community resilience and collaboration in supporting farmers during climate or economic challenges. The findings show that the type and prominence of these benefits vary considerably by location. For instance, better market prices are reported in *U Yin Wa*, with 56% of respondents recognizing this advantage, compared to only 19% in *Kyoet Kone*. Reduced input costs are particularly valued in *Haing Ku*, where 58% of farmers reported this benefit, while only 26% in *Kyoet Kone* perceived it. Access to training and resources, as well as increased bargaining power, are recognized by a smaller proportion of farmers overall, with *U Yin Wa* and *Haing Ku* showing similar rates and *Kyoet Kone* reporting the lowest. These patterns indicate that collective participation can provide multiple advantages, but the specific benefits that matter most are highly localized. This underscores the importance of fostering community-based collaboration tailored to local needs, enabling farmers to enhance resilience, share knowledge, reduce economic vulnerability, and improve adaptive capacity under climate and market pressures.

Table 4.17 Village-Level Responses on the Benefits of Group Participation

Perceived Benefit	Haing ku	Kyoet Kone	U Yin Wa	Total
Better market prices	10	6	20	36
Reduced input costs	15	8	12	35
Access to training/resources	3	1	4	8
Increased bargaining power	3	2	4	9

Source: Survey Data June 2025

Correlations between Social Support and the Benefits of Group Participation

The correlations output examines the relationships between the perceived importance of social support and the benefits of group participation. The results show that the perceived importance of social support has a significant negative correlation with all four listed benefits of group participation. This means that farmers who consider social support from family and neighbours to be more important tend to perceive the benefits of joining formal groups, such as better market prices or reduced input costs, as less important. There are significant positive correlations among the benefits themselves. For example, a farmer who reports getting better market prices from group participation is also likely to report reduced input costs, access to training, and increased bargaining power.

Table 4.18 Correlations between Social Support and the Benefits of Group Participation

Variable 1	Variable 2	Pearson's r	Significance (p-value)	Interpretation
Social Support Importance	Better market prices	-0.369	<.001	Significant negative correlation: As social support importance increases, perceived market price benefits decrease.
Social Support Importance	Reduced input costs	-0.48	<.001	Significant negative correlation: As social support importance increases, perceived reduced input costs decrease.
Social Support Importance	Access to training/resources	-0.321	0.002	Significant negative correlation: As social support importance increases, perceived

				access to training decreases.
Social Support Importance	Increased bargaining power	-0.342	<.001	Significant negative correlation: As social support importance increases, perceived bargaining power decreases.
Better market prices	Reduced input costs	0.385	<.001	Significant positive correlation: These two benefits tend to be reported together.
Reduced input costs	Access to training/resources	0.395	<.001	Significant positive correlation: These two benefits tend to be reported together.
Reduced input costs	Increased bargaining power	0.421	<.001	Significant positive correlation: These two benefits tend to be reported together.
Access to training/resources	Increased bargaining power	0.808	<.001	Strongest significant positive correlation: These two benefits are highly associated.

Source: Survey Data June 2025

4.3.7 Outlook and Resilience of Vegetable Farmers

The analysis examined and compared the impacts of climate change and rising costs on livelihoods, as well as access to support mechanisms, across three villages *Haing Ku*, *Kyoet Kone*, and *U Yin Wa* based on responses from 93 smallholder households. Crosstabulation results indicate that most respondents in all villages reported their overall livelihood had moderately worsened over the past five years due to climate and economic pressures. Notably, *U Yin Wa* stood out, with 28% of respondents (10 out of 36) indicating that their livelihoods had significantly worsened, whereas *Haing Ku* had no such cases. This suggests that farmers in *U Yin Wa* are experiencing more severe environmental and economic challenges, while *Haing Ku* demonstrates relatively greater resilience. These findings highlight the variation in climate and cost-related vulnerabilities across villages, emphasizing the need for location-specific support interventions (see Table 4.19).

Table 4.19 Livelihood Impacts of Climate Change and Rising Costs by Village

Village	Significantly worsened	Moderately worsened	Total
Haing Ku	0	26	26
Kyoet Kone	2	29	31
U Yin Wa	10	26	36
Total	12	81	93

Source: Survey Data June 2025

To further understand the drivers of these impacts, a multiple-response analysis was conducted to assess the prevalence of specific climate stressors reported by respondents. The most cited stressors across all villages included unpredictable rainfall patterns (72%), rising input costs (68%), and market price instability (60%). Notably, *U Yin Wa* consistently reported higher counts across almost all stressors, reinforcing the earlier finding of heightened vulnerability. In contrast, *Haing Ku* demonstrated relatively lower exposure to many of the reported stressors, particularly in areas such as water scarcity and declining soil fertility (see Table 4.20).

Table 4.20 Climate and Economic Stressors Affecting Vegetable Farming

Stressor	Haing Ku	Kyoet Kone	U Yin Wa	Total (out of 93)
Unpredictable rainfall patterns	21	20	26	67 (72%)
Rising input costs	19	18	26	63 (68%)
Market price instability	19	20	17	56 (60%)
Pest/disease outbreaks	14	14	18	46 (49%)
Heat stress	17	12	24	53 (57%)
Lack of government support	12	7	14	33 (35%)
Declining soil fertility	11	5	7	23 (25%)
Water scarcity	8	3	2	13 (14%)
Total	121	99	134	354

Source: Survey Data June 2025

. Based on farmers' rankings of key factors for sustaining vegetable farming under changing climate and economic conditions, the descriptive statistics highlight clear priorities and gaps. Access to climate-resilient seeds and varieties ranked with a mean score of 1.48 (SD = 0.502), indicating its high importance among respondents, though actual availability remains insufficient. Affordable irrigation and water management ranked slightly lower in importance, with a mean of 1.78 (SD = 0.549), reflecting its essential role but also the presence of partial access. Financial support or credit access emerged as the top priority for improvement, showing the lowest mean score of 1.22 (SD = 0.463), which underscores farmers' acute need for funding to adopt

adaptive measures. Similarly, strong farmer cooperatives and marketing networks scored a mean of 1.20 (SD = 0.479), revealing limited institutional and market linkages that could otherwise bolster resilience. Training on sustainable farming techniques was ranked as a means of 1.76 (SD = 0.615), suggesting that while some farmers benefit from capacity-building efforts, many remain without adequate technical support. Overall, the results point to financial access and cooperative strengthening as the most pressing needs, alongside expanded provision of climate-resilient seeds and water management solutions, to enhance the long-term adaptability of smallholder vegetable farming systems.

Table 4.21 Farmers' Rankings Sustaining Vegetable Farming under Changing Climate and Economic Conditions

Rankings of Key Factors	N	Minimum	Maximum	Mean	Std. Deviation
Access to climate-resilient seeds/varieties	93	1	2	1.48	.502
Affordable irrigation/water management	93	1	3	1.78	.549
Financial support/credit access	93	1	3	1.22	.463
Training on sustainable farming techniques	93	1	3	1.76	.615
Strong farmer cooperatives/ marketing networks	93	1	3	1.20	.479

Source: Survey Data June 2025

CHAPTER V
CONCLUSION

This chapter presents key findings of the study and suggestions in this area through further research.

5.1 Findings

The survey revealed that the majority of vegetable farmers in Hlegu Township are predominantly middle-aged or older, with 88% aged 36 years and above. Education levels are generally low, as 38% have completed middle school and 32% primary school, while only a small proportion have attained higher education. Vegetable farming remains the primary livelihood, contributing over half of household income for 77% of respondents; however, most operate on small-scale landholdings, with 92% cultivating five acres or less. Farming experience is generally high, with 97% having more than one year of experience and 74% owning their land, suggesting a stable yet small-scale production base. Crop cultivation patterns show that gourds and long beans/green beans are the most widely grown crops, each accounting for 13% of total cultivation events, while tomatoes and water spinach are the least cultivated at 5% each. Variations in crop choices across villages reflect localized market demands and agro-ecological conditions.

Climate change impacts are widely acknowledged, with irregular rainfall identified as the most common challenge (75 cases), followed by heatwaves (47) and pest outbreaks (35). U Yin Wa village demonstrates greater vulnerability to temperature-related stressors, including reduced yields, poor crop quality, and wilting, while rainfall variability has led to increased crop failure risk (39 reports) and delayed planting (30 reports), with Kyoet Kone most affected by planting delays. Economic pressures are also significant, as 72% of farmers reported a rise in input costs of 26% or more over the past five years. The main consequences include reduced profitability (61%), increased debt (53%), and delayed planting (51%), compounded by market price instability perceived by 84% of respondents. Farmers have responded with coping

strategies such as produce storage and crop diversification, yet market volatility remains a critical concern.

Adaptation and resilience practices vary across villages. Crop diversification, pest/disease-resistant varieties, and soil conservation are the most common strategies, while agroforestry adoption is minimal (14%), suggesting potential knowledge or land-use constraints. U Yin Wa shows higher adoption of improved irrigation and soil conservation, whereas Kyoet Kone has no uptake of improved irrigation methods. Alternative livelihoods, such as livestock/poultry farming and non-farm wage labor, are common, though handicrafts are negligible. Kyoet Kone tends to favor livestock, while Haing Ku and U Yin Wa show greater reliance on wage labor. Farmers face multiple barriers to technology adoption, primarily lack of financial resources, high technology costs, and limited access to training and information. Haing Ku faces shortages of improved seeds and tools, whereas U Yin Wa reports the highest financial and informational constraints.

Institutional and policy support remains limited, with only 38% of farmers participating in government or NGO programs. Participation significantly correlates with satisfaction ($p=0.009$), and climate-smart agriculture training emerges as the most impactful intervention ($p=0.002$). Farmers identify key support needs, including better weather forecasts, affordable irrigation technology, easier access to credit, improved market access, and price stabilization policies. Community resilience benefits from group participation differ across villages: U Yin Wa values better market prices, while Haing Ku emphasizes reduced input costs. Notably, reliance on informal social support networks is negatively correlated with perceived benefits of group participation, suggesting that informal networks may substitute for formal organizational structures.

Overall, livelihoods have moderately worsened for most farmers over the past five years, with U Yin Wa having the highest proportion reporting significant decline (28%). The key stressors affecting farming livelihoods are unpredictable rainfall (72%), rising input costs (68%), and market price instability (60%). Farmers prioritize financial access (mean=1.22), strong cooperatives and marketing networks (1.20), climate-resilient seeds (1.48), and affordable irrigation (1.78) as critical for sustaining vegetable production under changing climatic and economic conditions.

5.2 Suggestions

Based on these findings, several recommendations are proposed. Climate-resilient farming should be strengthened by scaling up access to climate-resilient seeds and water-efficient irrigation systems, with priority given to U Yin Wa and Kyoet Kone, alongside the introduction of community-managed water harvesting and drought mitigation measures. Economic resilience can be improved through the establishment of low-interest credit facilities for smallholders, coupled with price stabilization mechanisms and cooperative marketing to mitigate market risks. Technical capacity should be enhanced by expanding climate-smart agriculture training, focusing on agroforestry, advanced irrigation, and pest management, as well as developing mobile-based advisory platforms for timely dissemination of weather and market information. Diversification efforts should include promoting livestock integration with vegetable farming and piloting value-added processing to enhance incomes. To reduce barriers to technology adoption, subsidies or lease-to-own schemes for farm equipment should be introduced, and private sector partnerships should be established for village-level input distribution hubs. Institutional reach should be expanded by increasing NGO and extension officer engagement in low-participation villages and utilizing farmer cooperatives as delivery channels for inputs, training, and finance. Community collaboration should be fostered through joint input purchasing, collective marketing, and the tailoring of activities to local needs. Finally, climate and market monitoring groups should be established at the village level, with annual resilience assessments conducted to evaluate intervention effectiveness and guide future strategies.

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APPENDIX

QUESTIONNAIRES

Dear Respondents,

My name is Maung Maung Myint, and I am a Master of Public Administration (MPA) student specializing in Executive Management (EMPA) at the Department of Applied Economic, Yangon University of Economics. As part of my thesis research, I am conducting a study to analyze the agricultural resilience in climate-affected vegetable farmers in Myanmar in Hlegu Township, Yangon region.

Your participation in this survey is essential for understanding these dynamics and will significantly contribute to the success of my research. The survey is designed to gather your valuable insights and experiences regarding the agricultural resilience in climate-affected vegetable farmers in Myanmar in Hlegu Township, Yangon region. Please be assured that all your responses will be kept confidential and used solely for academic purposes. You have the right to withdraw at any time. The survey should take approximately 10 minutes to complete.

I sincerely appreciate your valuable time and support. If you have any questions regarding this survey or the research, please do not hesitate to contact me.

Email: maungmyint.mki@gmail.com, Phone +959798102647.

YANGON UNIVERSITY OF ECONOMICS

MASTER OF PUBLIC ADMINISTRATION PROGRAMME

Questions about the Agricultural resilience of vegetable farmers among climate change and rising farming costs in Hlegu Township, Yangon region

No……

Section 1: Demographic and Farm Profile

1. Village Name
   a. Haing ku
   b. Kyoet Kone
   c. U Yin Wa
2. Age
   o Under 25
   o 26–35
   o 36–45
   o 46 and above
3. Gender
   o Male
   o Female
   o Other (specify)
4. Education level
   o No formal education
   o Primary school
   o Secondary school
   o Diploma/Certificate
   o Bachelor's degree or higher
5. What is the size of your agricultural land (in acres/hectares)?
   - Less than 1 acre
   - 1–5 acres
   - 6–10 acres
   - More than 10 acres
6. How many years have you been engaged in vegetable farming?
   - Less than 1 year
   - 1–5 years
   - 6–10 years
   - More than 10 years

7. What type of land tenure do you have?
    - Owned
    - Rented
    - Sharecropped
    - Other (specify): _____
8. How many members of your household contribute to farming activities?
    - 1
    - 2–3
    - 4–5
    - More than 5
9. What are the main vegetable crops you cultivate? *(Select all that apply)*
    - Tomatoes
    - Chili
    - Cabbage
    - Water Spinach
    - Mustard Greens
    - Eggplant
    - Gourds
    - Long Beans / Green Beans
    - Okra / Lady's Finger
    - Pumpkin
    - Cucumber
    - Other (specify): _____
10. What percentage of your household income comes from vegetable farming?
    - Less than 25%
    - 25–50%
    - 51–75%
    - More than 75%

Section 2: Perceptions and Experiences of Climate Change

1. Have you noticed changes in local climate patterns (temperature, rainfall) over the last 10 years?
    - Yes
    - No
2. Which climate-related challenges have you experienced most frequently? *(Select all that apply)*
    - Drought
    - Irregular rainfall
    - Flooding
    - Heatwaves
    - Increased pest outbreaks
    - Stronger winds/storms
    - Other (specify): _____

3. How often do these climates stresses affect your crop yields?
    - Never
    - Occasionally
    - Frequently
    - Always
4. What impacts has rising temperature had on your crops? *(Select all that apply)*
    - Wilting/stunted growth
    - Reduced yield
    - Poor crop quality
    - Increased water demand
    - Earlier/later maturity
    - Other (specify): _____
5. How has rainfall variability affected your planting schedules?
    - Delayed planting
    - Reduced growing seasons
    - Increased crop failure risk
    - Shifted cropping calendar
    - No significant impact
    - Other (specify): _____
6. Have you experienced increased pest or disease pressure linked to climate changes?
    - Yes
    - No
    - Not sure

Section 3: Economic Challenges

1. How have input costs (fertilizer, seeds, labor) changed in the past 5 years?
    - Increased significantly
    - Increased slightly
    - Remained the same
    - Decreased slightly
    - Decreased significantly
2. What percentage increase in farming costs have you experienced on average?
    - Less than 10%
    - 10–25%
    - 26–50%
    - More than 50%
3. How have rising input costs affected your ability to produce vegetables? *(Select all that apply)*

- Reduced farm size/scale
- Shifted to cheaper/low-quality inputs
- Delayed planting seasons
- Increased debt burden
- Reduced profitability
- Other (specify): _____

4. Have you had difficulty accessing credit or loans for farming?
    - Yes
    - No

    (If Yes) What are the main barriers?
    - High interest rates
    - Lack of collateral
    - Complex application process
    - Limited access to financial institutions
    - Other (specify): _____
5. How stable do you perceive the local vegetable market prices to be?
    - Very stable
    - Moderately stable
    - Unstable
    - Highly unpredictable
6. What strategies do you use to cope with fluctuating market prices? *(Select all that apply)*
    - Diversifying crops
    - Storing produce for better prices
    - Selling directly to consumers (e.g., markets)
    - Contract farming with buyers
    - Reducing production costs
    - Other (specify): _____

Section 4: Adaptation and Resilience Strategies

1. Have you adopted any new farming techniques to cope with climate change?
    - Yes
    - No *(Skip to Q5)*

2. If yes, what types of adaptation strategies are you using? *(Select all that apply)*
    - Crop diversification
    - Improved irrigation methods
    - Soil conservation (mulching, cover crops, etc.)
    - Pest/disease-resistant crop varieties
    - Adjusting planting/harvesting schedules
    - Agroforestry/intercropping
    - Water harvesting/storage
    - Other (specify): _____
3. How effective do you believe these strategies are in mitigating climate risks?
    - Very effective
    - Moderately effective
    - Slightly effective
    - Not effective
4. Have you diversified your household income sources beyond farming?
    - Yes
    - No *(Skip to Q6)*
5. If yes, what alternative livelihoods are you engaged in? *(Select all that apply)*
    - Livestock/poultry farming
    - Wage labor (non-farm)
    - Small business/trading
    - Remittances from family
    - Handicrafts/artisan work
    - Other (specify): _____
6. What barriers do you face in adopting new farming technologies or strategies? *(Select all that apply)*
    - Lack of financial resources
    - Limited access to training/information
    - High cost of inputs/technology
    - Unavailability of improved seeds/tools
    - Resistance to change (traditional practices)
    - Climate uncertainty makes planning difficult
    - Other (specify): _____
7. How confident are you in your ability to cope with climate variability in the future?
    - Not confident
    - Somewhat confident
    - Very confident
8. How do you obtain information or training related to climate adaptation and farming practices? *(Select all that apply)*
    - Government agricultural extension services
    - NGOs/farmer cooperatives
    - Radio/TV programs

- Fellow farmers/community knowledge
- Mobile apps/internet
- Workshops/training programs
- Other (specify): _____

Section 5: Institutional and Policy Support

1. Are you aware of any government or NGO programs that support climate-resilient farming?
   - Yes
   - No

   (If Yes) Please specify which programs: _____
2. Have you participated in any training, subsidy, or credit programs aimed at smallholder vegetable farmers?
   - Yes
   - No

   (If Yes) What type of support did you receive? *(Select all that apply)*
   - Climate-smart agriculture training
   - Subsidized seeds/fertilizers
   - Low-interest loans/credit
   - Irrigation equipment support
   - Other (specify): _____
3. How satisfied are you with the support services available to farmers in your area?
   - Very dissatisfied
   - Dissatisfied
   - Neutral
   - Satisfied
   - Very satisfied
4. What additional support would help you improve your farm's resilience to climate and economic challenges? *(Select all that apply)*
   - Better access to weather forecasts
   - Affordable irrigation technology

- More training on climate-smart practices
- Improved access to markets
- Government price stabilization policies
- Easier loan/credit processes
- Other (specify): _____

5. How accessible are extension services or agricultural advisors to you?
    - Very accessible (regular visits/contact)
    - Somewhat accessible (available when needed)
    - Rarely accessible (difficult to reach)
    - Not accessible at all
6. Do you feel that current policies adequately address the challenges faced by vegetable farmers?
    - Not at all
    - Somewhat
    - Mostly
    - Completely

      (If "Not at all" or "Somewhat") What policy changes would you suggest?

Section 6: Community Resilience and Collaboration

1. How would you describe your community's involvement in supporting farmers during climate or economic difficulties?
    - Very active (regular collective action, resource sharing)
    - Moderately active (occasional support during crises)
    - Minimal (limited organized assistance)
    - No community support

      (If "Very active" or "Moderately active") What forms of support are most common? *(Select all that apply)*
    - Shared labor/work exchanges
    - Group savings/loans
    - Collective input purchases
    - Knowledge-sharing networks

- Other (specify): _____

2. Have you participated in any farmer groups, cooperatives, or collective marketing initiatives?
    - Yes
    - No

    (If Yes) How has participation benefited you? *(Select all that apply)*
    - Better market prices
    - Reduced input costs
    - Access to training/resources
    - Increased bargaining power
    - Other (specify): _____
3. How important is social support (family, neighbors, cooperatives) in helping you cope with farming challenges?
    - Extremely important
    - Moderately important
    - Slightly important
    - Not important
4. What role do local customs or indigenous knowledge play in your farming decisions related to climate adaptation? *(Select all that apply)*
    - Guides planting/harvesting timing
    - Informs crop selection (drought-resistant varieties)
    - Shapes soil/water management practices
    - Predicts weather patterns
    - No significant role
    - Other (specify): _____

Section 7: Outlook and Resilience of Vegetable Farmers

1. Over the last 5 years, how has your overall livelihood been affected by climate change and rising costs?

o Significantly worsened

o Moderately worsened

o Unchanged

o Moderately improved

o Significantly improved

2. What are your main concerns for the future of vegetable farming in your area? (Select up to 3)

o Increasing temperatures/heat stress

o Unpredictable rainfall patterns

o Rising input costs (seeds, fertilizers, labor)

o Declining soil fertility

o Water scarcity

o Pest/disease outbreaks

o Market price instability

o Lack of government support

o Other (specify): _____

sustaining vegetable farming under changing climate and economic conditions? *(Rank in order of importance: 1 = Most important, 5 = Least important) *

o Access to climate-resilient seeds/varieties

o Affordable irrigation/water management

o financial support/credit access

o Training on sustainable farming techniques

o Strong farmer cooperatives/marketing networks