BUILDING RESILIENT COMMERCIAL SMALLHOLDER AGRICULTURE (BRECSA)

AGRICULTURE RESILIENCE PLAN (ARP)FOR SARPANG DZONGKHAG (VERSION 1.0)

Type of Document: ARP V 1.0

Document Number: BRECSA-PLN-ARP-2025-001-V1.0

Date: March, 2025

ROYAL GOVERNMENT OF BHUTAN

MINISTRY OF AGRICULTURE AND LIVESTOCK

སོ་ནམ་མཐུན་འགྱུར་དང་ཚོང་འབྲེལ་ཆུང་བ་ཡར་དྲག་ལས་འགྲུལ།

Building Resilient Commercial Smallholder Agriculture

(BRECSA)

AGRICULTURE RESILIENCE PLAN FOR SARPANG DZONGKHAG

(VERSION 1.0)

March 2024

Project Management Unit

Samtenling, Sarpang

TABLE OF CONTENTS

List of Figures

List of Tables

1. INTRODUCTION AND BACKGROUND

The Agriculture Resilience Plan (ARP) is a strategic framework designed to enhance the capacity of agricultural systems to withstand and recover from adverse conditions such as climate change, extreme weather events, pest outbreaks, and economic shocks. Its primary purpose is to suggest recommendations that would ensure food security, maintain agricultural productivity, and support farmers' livelihoods through adaptive practices, technological innovations, and sustainable resource management. The ARP is a document that includes measures like identifying agroecological practices (Crop diversification, IPM), suitable post-harvest management techniques, climate-resilient infrastructure (protected production technologies, rain harvesting, temperature-controlled storage structures, water-efficient technologies, climate-smart animal sheds), and value-addition facilities. It also encompasses other climate change adaptation measures such as water-saving technologies and water harvesting and storage facilities, which must be tailored to each local needs.

2. PURPOSE AND SCOPE OF ARP

The Agriculture Resilience Plan (ARP) for Sarpang Dzongkhag serves as a comprehensive strategic framework to enhance the resilience of agricultural systems amidst the challenges posed by climate variability, limited resources, and socio-economic vulnerabilities. Developed through an inclusive and participatory process, the ARP incorporates findings from the CLEAR+ exercise and ARPR validation workshops, ensuring that it reflects the realities faced by communities across the Dzongkhag.

It envisions building agricultural and livestock systems that can adapt to shifting climate patterns, withstand shocks such as erratic rainfall, droughts, and pest outbreaks, and continue to support farmers' livelihoods. It focuses on promoting sustainable farming practices enhancing the productivity of climate-sensitive crops such as paddy and oranges, and integrating climate-smart technologies, such as rainwater harvesting systems, climate-smart sheds, and polytunnels.

The ARP adopts a **Gewog-specific approach**, emphasizing localized strategies rather than a single Dzongkhag-wide framework. This ensures interventions remain **relevant to local**

contexts and address their specific climate challenges, resource availability, and livelihood priorities. It also targets the critical commodities for each Gewog, addressing challenges like pest outbreaks, irrigation needs, wildlife conflicts, and market constraints. For instance, Gewogs, where paddy or dairy cattle are primary livelihood sources can focus their effort more intensively on water access, pasture development, and market linkages, while others with more emphasis on crops like cardamom may prioritize wildlife conflict management or post-harvest facilities.

3. CONTEXT

The climate plays a pivotal role in Bhutan's agriculture, shaping the productivity and sustainability of this predominantly agrarian economy. Bhutan's diverse topography, ranging from subtropical lowlands to alpine highlands, creates varied microclimates that support various crops. However, Bhutan's agricultural sector faces climate-related challenges, including unpredictable rainfall, increasing temperatures, and more frequent extreme weather events, threatening crop yields and food security.

Climate change threatens livelihood activities in Sarpang Dzongkhag, with wide-reaching impacts across various crops and livestock systems. During community consultations, Gewog residents shared their experiences of shifting climate patterns—particularly erratic rainfall and rising temperatures—increasingly affecting their main livelihood commodities, including Areca nut, paddy, maize, dairy cattle, poultry, piggery, cardamom, oranges, and vegetables.

3.1 Erratic Rainfall: One of the most critical challenges reported was the irregular and insufficient rainfall, leading to water scarcity across various agricultural and livestock activities, particularly during the early months of the year. Crops like paddy rely heavily on water availability during transplanting, while maize, oranges, and cardamom are also impacted, as they need consistent moisture for germination and optimal growth. In the absence of irrigation facilities for these dryland crops, farmers rely entirely on natural rainfall. Paddy growers in Gewogs like Senggey, Samtenling, Dekiling, and Gelegphu frequently face water shortages that hinder the completion of paddy cultivation. Likewise, cardamom growers in Chhudzom and Jigme Chhoeling Gewogs struggle with prolonged dry

spells in March and April, resulting in plant mortality and reduced yields. Investing in water management systems and drought mitigation strategies could help farmers address these challenges effectively.

3.2 Rising Temperatures: Rising temperatures were also a significant concern, with residents observing changes in growth patterns and an increase in pest and disease outbreaks across crops and livestock. Oranges, for instance, have become increasingly vulnerable to pests like citrus greening and fruit flies, resulting in yield losses and plant mortality. Meanwhile, crops like paddy and maize are experiencing more frequent pest issues, such as armyworm infestations. In addition, rising temperatures have made it increasingly difficult for farmers to work in the fields during the day due to the risk of heat stress. To cope with these challenging conditions, many farmers have adjusted their work schedules, choosing to carry out their activities during the cooler parts of the day—early in the morning and late in the evening.

3.3 Livestock Impacts: In dairy cattle farming, water scarcity affects fodder growth, and many farmers reported struggling to find sufficient fodder, impacting cattle health and milk production, especially during the winter months. Additionally, participants in community consultations associated the outbreak of Lumpy Skin Disease in cattle with climate change. Heat stress in birds poses a significant challenge for poultry farms, particularly during periods of high temperatures from March to May. Birds are highly sensitive to heat because they lack sweat glands. This issue is further compounded in farms with limited access to cooling systems, adequate ventilation, or proper housing designs that could help mitigate the effects of high temperatures.

3.4 Wildlife Conflicts: Vegetable, maize, and paddy fields are experiencing heightened wildlife conflict as animals increasingly migrate to new areas in search of food due to changing climatic conditions. All Gewogs reported a rise in crop predation, posing a significant threat to food security and emphasizing the urgent need for effective wildlife conflict management strategies. The most commonly reported wildlife involved in these conflicts includes elephants, wild boars, birds, and rabbits.

To address these challenges, the district's residents emphasize the need for a comprehensive climate adaptation strategy that includes water conservation techniques, pest and disease

management, improved irrigation systems, cooperative marketing to overcome market access issues, and training programs for farmers on climate-smart agriculture. These measures could not only mitigate climate-related risks but also build long-term resilience in Sarpang's agricultural sector, helping the community navigate the evolving impacts of climate change.

4. CLIMATE RESILIENCE

Climate resilience is the ability of rural communities to withstand and quickly recover from climate-related shocks and stressors, such as changes in rainfall patterns, higher temperatures, or extreme weather events like wind storms, without suffering long-term negative effects on food security. In other words, communities with high resilience can recover and improve more rapidly after a climate-related shock than those with low resilience.

The resilience level In Bhutan assessed by CLEAR+ analysis was based on six factors identified during community consultations: access to wealth, food, and land; livelihood diversity; remoteness; access to irrigation and availability of non-climate-sensitive livelihood options (Figure 1).

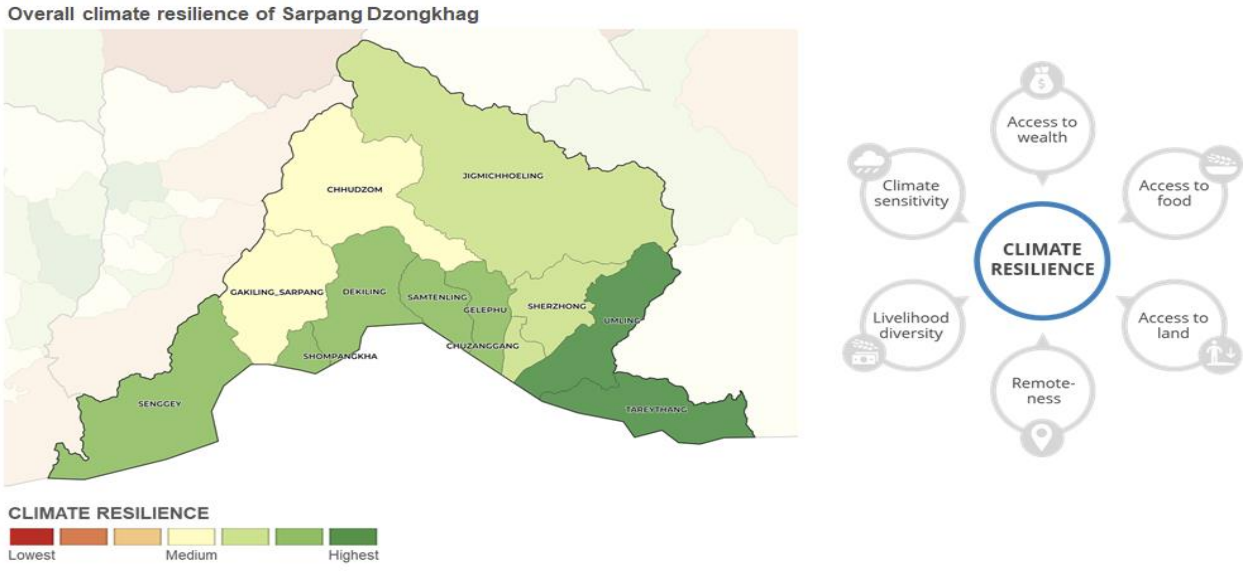

Figure 1: Overall climate resilience of Sarpang Dzongkhag

Table 1 provides an analysis of the resilience levels of each Gewog in Sarpang Dzongkhag, highlighting the district's vulnerability due to economic, climate sensitivity, and

geographical constraints. A score of 1 indicates high resilience, while 4 signifies the lowest resilience in each category. Sarpang, being one of Bhutan's more accessible regions, experiences fewer challenges that impact its resilience to climate-related shocks. Each dimension—wealth, remoteness, access to food, land access, and livelihood diversity—is integral to understanding the district's resilience framework and identifying areas where intervention may strengthen local livelihoods and enhance adaptability.

Table 1. Resilience level Sarpang Dzongkhag

Gewog	Access to wealth	Access to food	Access to land	Remote-ness	Climate sensitivity
Samtenling	1	2	2.5	2	1.75
Chuzanggang	2	1	2	1	2.25
Tareythang	1	1	2	1	1.5
Umling	1	1	1.5	1	2.5
Gakiling	1	4	1.5	4	2.25
Senggey	1	2	1.5	2	1.75
Jigmichhoeling	1	2	1.5	4	2
Sherzhong	1	3	2.5	1	2.25
Dekiling	1	1	2.5	2	2
Chhudzom	1	4	2	4	3
Shompangkha	1	1	2	2	2
Gelephu	1	1	2.5	1	1.75

*Scores 1-4 were assigned to each category, with 1 being the most resilient and 4 being the least resilient.

Gewogs such as Tareythang, Umling, and Gelegphu show high resilience due to better access to wealth, food, and connectivity, scoring 1 in these factors and moderate ratings in other categories. In contrast, Gakiling and Chhudzom are among the least resilient due to their limited access to food and geographical remoteness. The table suggests that Gewogs with low resilience, like Gakiling and Chhudzom, may need focused development interventions to enhance resilience and improve living conditions.

5. DZONGKHAG PROFILE

The Dzongkhag profile provides a comprehensive overview of key information and salient features for twelve Gewogs under Sarpang Dzongkhag. Each Gewog is described in terms of area, number of households, population distribution by gender, irrigation schemes, total irrigation channel length, and agricultural land (wetland and dryland). Overall, it highlights the diversity in the size, population, and agricultural infrastructure across the twelve Gewogs, providing valuable insights for planning and development initiatives. Sarpang's extensive forest cover plays a vital role in shaping its agroecological zones and influencing its residents' agricultural practices and livelihoods. Forests serve as a resource base for many households for products such as fiddleheads and mushrooms, while the proximity of farmlands to forests increases interactions between humans and wildlife.

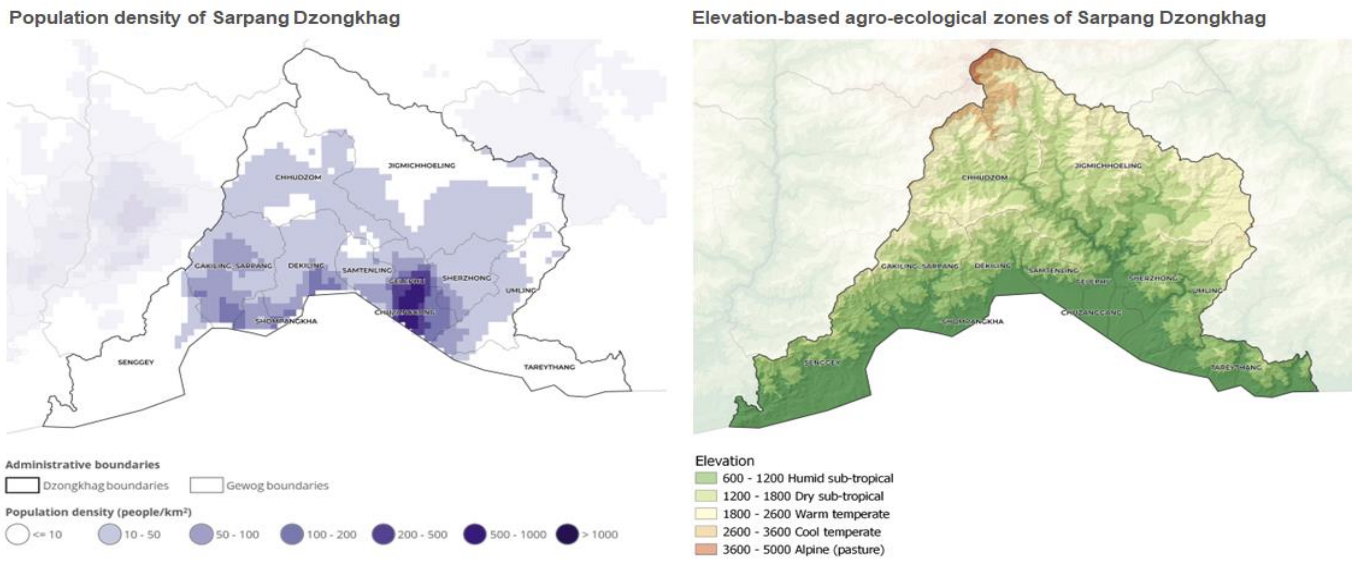

Figure 2: Population density map and Agro-ecological zones of Sarpang Dzongkhag

Wild animals, including elephants and wild boars, frequently raid crops, resulting in significant crop losses and occasionally causing property damage or even posing a threat to human lives. To mitigate these risks, farmers are compelled to invest considerable time and resources in guarding their fields or constructing deterrents to protect their livelihoods. These challenges can intensify, impacting both food security and the overall well-being of the community. Population densities vary significantly, with some Gewogs, such as

Jigmechhoeling and Chhudzom, having relatively higher populations, while other Gewogs, like Tareythang, have smaller populations.

Table 2 showcases the distribution of agricultural land in each Gewog, distinguishing between wetland and dryland. This agricultural land data highlights the district's dependence on both irrigated wetland and more prevalent dryland farming. Gewogs like Chhuzanggang and Jigmechhoeling, for instance, have larger areas of wetland, essential for paddy cultivation, while Gewogs such as Dekiling rely more on dryland agriculture because of terrain limitations and water availability. This detailed profile will aid in strategic planning, identifying where improvements in irrigation and infrastructure could bolster agricultural resilience and enhance food security for the Dzongkhag communities.

Table 2: Dzongkhag profile

Gewog	**Area (Sq. Km)**	**Forest cover (%)**	**Number of Households**	**Population**		**Irrigation schemes (Nos.)**	**Total length (km)**	**Wet land (Acre)**	**Dryland (Acre)**
				Male	Female				
Chhuzanggang	21	40.0	625	1271	1406	12	34.60	6255.01	16308.83
Chhudzom	222	96.4	637	2165	2257	17	40.90	262.21	1531.71
Dekiling	113	88.0	1164	2759	2525	19	47.00	533.91	2956.63
Gakiling	787	70.0	539	1045	991	30	47.41	377.50	1504.72
Gelegphu	54	79.8	429	2171	2290	04	9.80	797.32	1013.27
Jigmechhoeling	501	97.5	698	2922	2794	37	81.92	1007.69	1562.12
Samtenling	55	88.6	467	1545	1523	16	50.82	383.82	2229.69
Serzhong	78	80.0	407	2183	2130	11	43.03	420.83	1169.18
Shompangkha	21	76.1	414	1398	1471	9	9.00	311.09	917.69
Senggye	232	96.0	287	909	915	9	24.23	308.93	693.95
Umling	122	85.0	377	1762	1754	19	46.30	710.06	986.72
Tareythang	399	93.5	131	432	405	7	9.00	111.8	376.95

Data source: http://www.sarpang.gov.bt/node/1 and personal communication with District Agriculture Officer.

6. OVERVIEW OF BASELINE CLIMATE, FUTURE SCENARIOS, AND CLIMATE-INDUCED IMPACTS

6.1. Overview of Baseline Climate

Bhutan experiences daily mean temperatures typically ranging from 12°C to 28°C through the year, with daily maximum temperatures sometimes exceeding 30°C during the hottest months (April to June). Temperature varies with topography across Bhutan with colder temperatures at high elevations. The warmest time of year is pre-monsoon (March to May) when the southernmost areas of the country can be affected by severe thunderstorms. The precipitation patterns in South Asia, including over Bhutan, are controlled mainly by the Southwest Monsoon circulation. The Southwest Monsoon is a seasonal pattern of winds from the southwest which brings heavy rain in the months of June to September over most of the country, with southern and eastern parts experiencing the highest rainfall totals due to their proximity to the Bay of Bengal. The variability of monsoon rainfall can lead to dry spells and drought over much of the country.

Seasonally averaged minimum and average maximum temperatures vary with latitude over the country, across all seasons, with the south being the warmest and the north the coldest. The summer months from June to September show the highest temperatures whilst the winter months from December to February show the lowest. The warmest time of year is during the monsoon season, with the highest mean temperatures of 24 °C, and maximum temperatures of 29 °C, occurring in June, July, and August. Seasonally averaged minimum temperatures remain high in Sarpang Dzongkhag across all seasons, with temperatures reaching above 20 °C during summer and only dropping to 5-10 °C during winter. Sarpang Dzongkhag reaches 29 °C during summer, with spring and autumn also reaching 24-28 °C. Winter is cooler but still warm at 10-20 °C. The Southwest Monsoon from June to September contributes about 72% to the total annual rainfall of Bhutan with the highest amount received in the month of July, followed by August. The highest totals are along the southern edge of the country, including the south of Sarpang Dzongkhag. The spring months from March to May and the autumn months of October and November contribute about 22% to the total annual rainfall, and precipitation is low in the winter months of December to February.

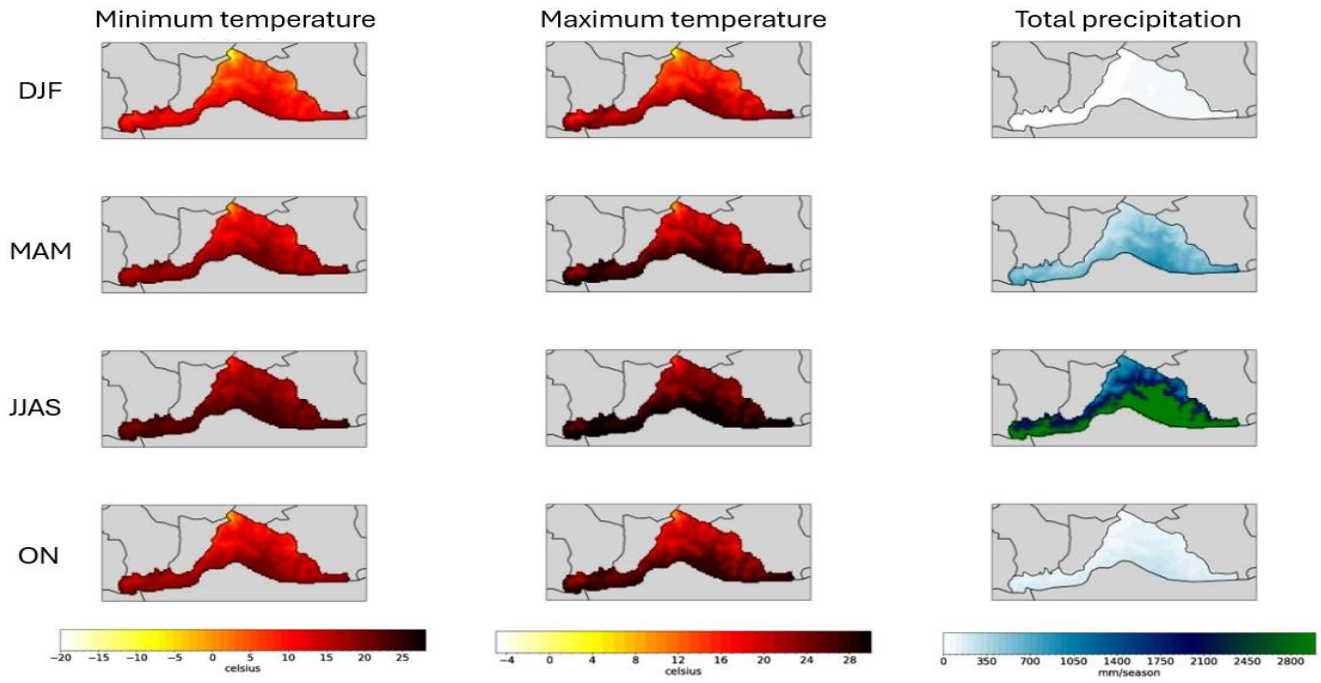

Figure 3: Seasonally averaged minimum temperature (left), maximum temperature (centre), and total precipitation (right) for Sarpang Dzongkhag over the baseline period (1996-2019)

6.2 Overview of Projected Climate

Most climate models project a warmer and wetter climate for Bhutan in 2050. Annual mean temperatures are projected to be 2.5 °C higher on average and the annual average precipitation is projected to be 12.5 percent higher compared to the baseline values, when averaged across the whole of Bhutan. There is a large variation latitudinally in the projected changes in precipitation, with a large increase in the far south of the country where the effect of the monsoon is strongest, including Sarpang Dzongkhag. The main increases occur during the monsoon season from June to September, implying that the monsoon will become stronger in the future. Increases are also projected to occur in the pre-monsoon season from March to May, suggesting a potential earlier start and lengthening of the monsoon season. There is little future change projected for precipitation in the autumn (October-November) and winter (December-February) seasons. Projected changes in temperature vary

latitudinally across the country with increases of around 2.5 °C projected for Sarpang Dzongkhag. There is warming in all seasons, with the largest changes (up to 3.5 °C) occurring in the autumn months October to November.

There are also projected changes in the future occurrence of extreme events, for both rainfall and temperature. The Count of Hot Days (CHD), which here is defined as the number of days in which the maximum daily temperature exceeds 30 °C over one year, is projected to increase by up to 36 days per year for Sarpang Dzongkhag. The occurrence of extreme rainfall events can be quantified by the changes in RX1Day. This is a measure of the maximum total daily rainfall over one day (i.e. the total rainfall on the wettest day of the year). For Sarpang Dzongkhag, the baseline wettest values of RX1Day are approximately 350 mm/day, which is projected to increase to up to 480 mm/day by 2050 – an increase of 37 %. Conversely, changes in Consecutive Dry Days (CDD), which is a count of the longest number of days without any precipitation per season, show that for Sarpang Dzongkhag, the CDD will increase by 8-10 days in the winter and 5 days in the autumn, meaning that there will be less precipitation in these seasons, despite the projection of a generally wetter future.

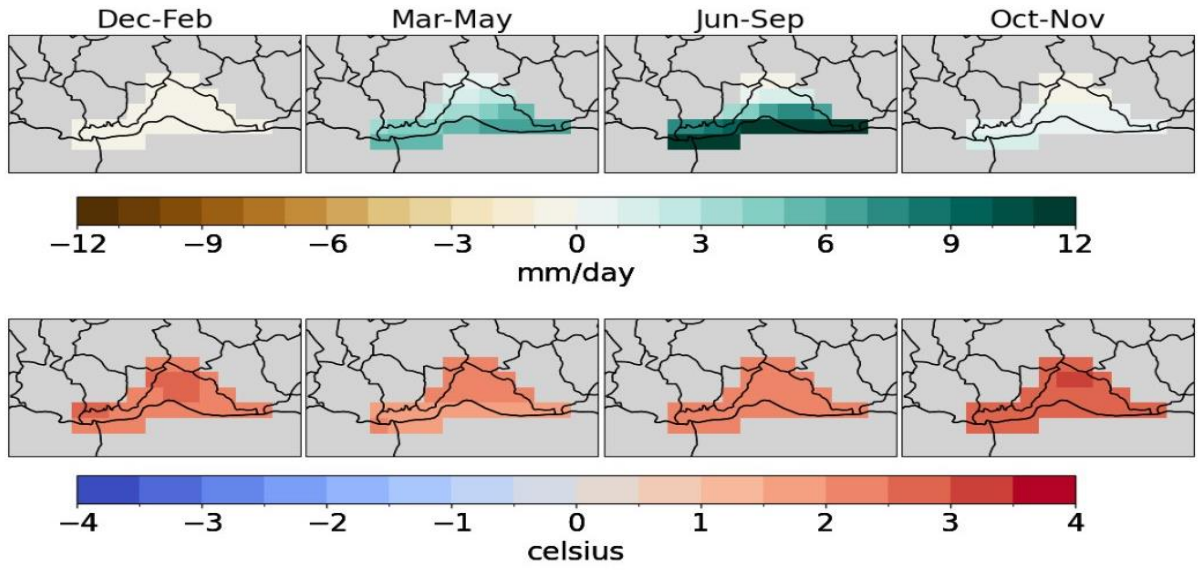

Figure 4: Projected changes in seasonal total precipitation (top panels) and seasonal average daily mean temperature (bottom panels) for 2050 (2036–2065) relative to the baseline (1981–2010).

The projected increase in temperature will result in much higher temperatures on average across the country. This will mean that current peak temperatures will be exceeded earlier in the year and for longer through the year. As such, heatwave conditions will increase in frequency and intensity compared with the baseline climate. This will increase heat stress impacts on crop production where optimum temperatures may be exceeded (e.g., for paddy rice) and health impacts on livestock, particularly in the hottest regions. However, warmer temperatures will also reduce the impacts of frost damage on certain crops, such as vegetables and mandarin oranges, and may also increase the areas in which these can grow.

The increase in the CHD will impact a range of crops (including potatoes and tomatoes), as these suffer yield reduction at temperatures above 30 °C. Many crop pests and diseases favour these warmer temperatures, including Chili Pod Borer and Cut Worm (chilli), Grey Leaf Spot and Armyworm (maize), and Brown Plant Hopper (paddy).

Evaporation rates will increase with rising temperatures, and with larger increases in temperature, the evaporation rates will also be larger. The projected increase in precipitation during the pre-monsoon and monsoon seasons will result in overall increases in water availability during these seasons.

As well as the projected increase in mean precipitation, the intensity of heavy precipitation events is also projected to increase due to the changing nature of precipitation in a warmer climate, further exacerbating the risk of flash flooding events and the associated damage to crops, infrastructure and access to markets and supply chains.

Other impacts on crops and livestock are shifts in cropping seasons linked with precipitation variability, increases in heat stress in years when the monsoon rains are delayed, and the incidence and habitable areas of pests and diseases.

6.3 Climate-Induced Hazards and Impacts

This section analyses historical occurrences of extreme climate events, including heavy precipitation, windstorms, and hailstones, as illustrated in Figure 4. It examines the frequency and distribution of these events across Bhutan over time, with a specific focus on

those linked to heavy precipitation, such as flash floods and landslides, as well as windstorms. The maps use darker shades to indicate Dzongkhags with a higher frequency of reported incidents, while the accompanying charts depict the months when these events are most common.

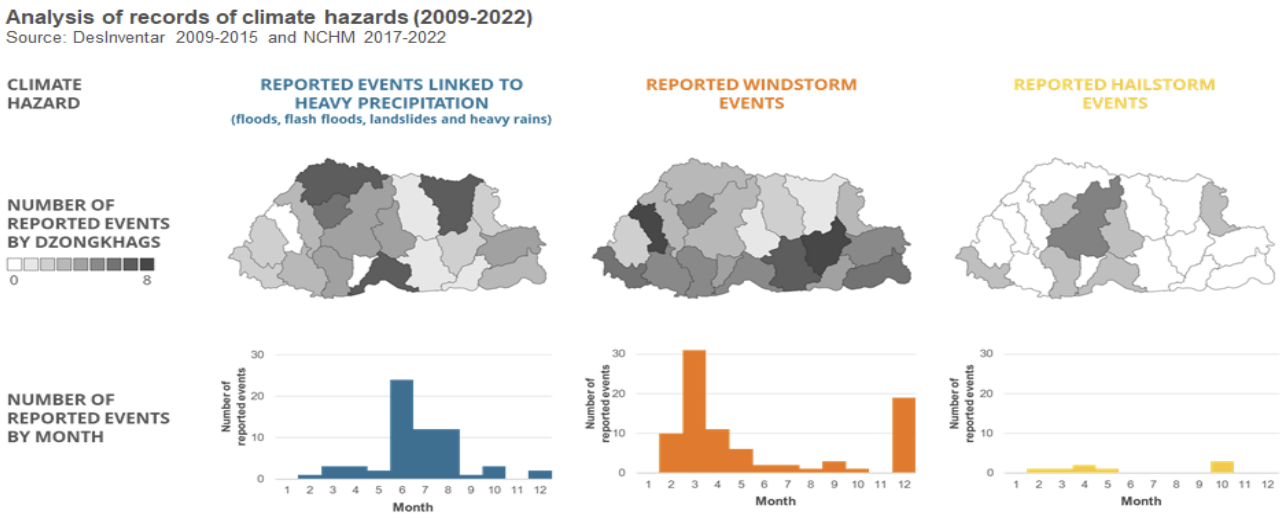

Figure 5: Analysis of records of climate hazards (2009-2022)

Sarpang Dzongkhag has experienced significant climate changes, notably a decrease in rainfall during critical periods like February and March, essential for sowing maize, vegetables, and ginger and maturation of areca nuts, a delay in monsoon rains in June and July, affecting flowering of areca nuts and paddy planting, and increased rainfall from August to September, leading to floods, landslides and soil erosion, particularly affecting paddy harvesting and causing frequent roadblocks. Increased temperatures have resulted in hotter springs and summers, making agricultural work more challenging, drying up water sources, and affecting crop viability, particularly for oranges and cardamom. Hotter and drier periods from March to June have also impacted livestock, reducing production due to heat stress, shortages of fodder, and exacerbated disease instances. In addition, communities have also noted more frequent and severe windstorms damaging homesteads and crops such as maize, areca nuts, and oranges. The most vulnerable groups in Sarpang include households with elderly people and those with disabilities, who have limited capacity to cope with the adverse effects of climate change. Additionally, women and farmers with limited land and those cultivating paddy, which requires substantial water resources, are particularly at risk.

To cope with these impacts, the community has adopted various strategies. These include protecting water sources and the surrounding environment, expanding irrigation systems, sowing alternative crops when paddy cultivation is delayed, and focusing on dairy farming and piggery for income generation. Additionally, some farmers have started building water storage systems to collect water during the peak rainy season; however, with mixed success due to issues with evaporation and stagnation. Diversifying crops and engaging in off-farm work, such as construction or roadside labor, are other strategies being employed to mitigate the effects of climate change.

7. ADAPTATIONS AND MITIGATION MEASURES

Farmers in Sarpang Dzongkhag face a variety of challenges linked to climate change, wildlife conflicts, pest outbreaks, and market inefficiencies. Based on these challenges, the recommended adaptation and mitigation measures focus on enhancing resilience and promoting sustainable practices across the agricultural and livestock sectors.

Water Management: Erratic rainfall and water scarcity have severely affected crop yields, especially paddy cultivation. Strategic interventions in irrigation infrastructure, such as the construction and maintenance of irrigation channels, are critical. Water-saving devices, technologies, and practices should be actively promoted and supported for vegetable production. Drip irrigation systems, for instance, deliver water directly to the root zone, reducing evaporation and runoff, while rainwater harvesting systems can be used to capture rainwater, which can be utilized during dry spells. Adopting these water-saving solutions can help farmers address water scarcity, enhance productivity, and build resilience to climate change.

Human-Wildlife Conflict Mitigation: Crop predation by wild animals is a major challenge across multiple Gewogs in the Dzongkhag, affecting paddy, maize, buckwheat, and cardamom. Elephants, Boar, rabbits, and Deer are the primary wild animals damaging crops in Sarpang. Elephants are known to raid cardamom and areca nut plantations, causing widespread destruction and significant losses to farmers. Although preventing crop damage from birds and other smaller animals such as rabbits can be challenging, establishing a

community-based robust fencing system remains the only viable means to protect crops from animals such as wild boar. However, such barriers are often ineffective against elephants, leaving crops vulnerable to their raids.

Pest and Disease Management: Outbreaks of pests and diseases threaten both crops and livestock. In Sarpang Dzongkhag, the challenge is particularly acute due to its highly porous border with India, which facilitates the cross-border movement of animals, pests, and pathogens. This situation increases the risk of introducing and spreading livestock diseases such as foot-and-mouth disease, swine fever, and avian diseases, as well as crop pests that can decimate agricultural production. To address these challenges, it is essential to strengthen pest and disease management systems, with a focus on early detection, rapid response, and effective control measures. Establishing a robust disease surveillance network, enhancing veterinary and agricultural extension services, and providing timely alerts about outbreaks are critical steps to empower farmers.

Farm Mechanization and Labor Shortages: Labor shortages, particularly in paddy cultivation, can be alleviated through farm mechanization. Providing access to affordable machinery and training farmers on its use will reduce dependency on manual labor while improving efficiency and productivity.

Market Linkages and Infrastructure Development: Many farmers, particularly those engaged in vegetable cultivation or producing dairy, piggery, and poultry products, struggle with distant or underdeveloped markets (Lack of proper transportation market information, lack of investment, etc.). They also contend with intense competition from cheaper imports from India. Strengthening market linkages through cooperative models, cold storage facilities, and improved market information can help overcome these issues.

8. CLIMATE RESILIENT LIVELIHOODS

Empowering communities to sustain and enhance their livelihoods amidst changing climatic conditions is crucial. This involves supporting and promoting agricultural practices that are

resilient to climate variability. Such practices ensure that households can maintain food security and achieve stable incomes despite unpredictable weather patterns.

To effectively support these efforts, this section outlines key livelihood activities that serve as a foundation for resilience in various Gewogs in the Dzongkhag. It identifies potential value chain commodities that can be developed to enhance local economies and promote sustainable practices. Additionally, it explores niche products that leverage existing knowledge and resources within the Dzongkhag. By focusing on current production capabilities, existing expertise, and future opportunities, this section seeks to provide a comprehensive framework for promoting agricultural resilience and enhancing the livelihoods of community members.

8.1 Prioritization of commodities for livelihood

The livelihood prioritization serves as a detailed summary of the main livelihood activities that sustain households within a Gewog, focusing on the contributions to food and income. It serves as a critical tool in understanding the economic landscape of a particular Gewog, guiding decision-making processes, and designing targeted interventions that can enhance resilience and improve livelihoods. The profile helps pinpoint the main sources of food and income for households, which is crucial for understanding the community's economic priorities.

During the community consultations for CLEAR+ exercise, community representatives defined the four main livelihood activities in each Gewog based on the contributions to households' food and income. For Sarpang, the following livelihood activities were highlighted (listed in the order of importance - i.e. the number of Gewogs that highlighted the activity): Paddy, Areca nut, Cattle (for dairy), Vegetables, Orange, Maize, Cardamom, Ginger, Poultry.

A similar exercise was conducted during the ARPR validation workshop, utilizing a broader set of selection criteria. The participants prioritized the potential commodities based on their significance for livelihood and income generation, which helped identify the most

valuable commodities for each Gewog, as outlined in Table 3. This was further integrated to produce a Dzongkhag commodity list (Table 4).

Table 3. Ranked list of commodities for all Gewogs of Sarpang Dzongkhag

Sengye	Gakiling	Dekidling	Samtenling	Chhudzom	Gelegphu	Sershong	J/choling	Chuzergang	Umling	Tareythang	Shompangkha
Paddy	Ginger	Ginger	Dairy	Cardamom	Dairy	Paddy	Dairy	Paddy	Vegetables	Dairy	Dairy
Dairy	Dairy	Mushroom	Paddy	Vegetables	Arecanut	Dairy	Honey	Vegetables	Dairy	Vegetables	Vegetable
Areca Nut	Turmeric	Dragon fruits	Vegetables	Paddy	Honey	Seedless lime	Mandarin	Arecanut	Maize	lemon	Arecacnut
Vegetables	Vegetables	Coffee	Mushroom	Dairy	Piggery	Arecanut	Piggery	Dairy	lemon	Coffee	Ginger
Poultry	Paddy	Turmeric	Piggery	Kiwi	Poultry (Layer)	Black pepper	Poultry	Black pepper	Paddy	Banana	Layer
Oranges	Mushroom	Vegetables	Poultry	Poultry	Chevon	Vegetables	Mushroom	Ginger	Millet	Mango	Broiler
Piggery	Millet	Potato	Fishery	Vegetables	Poultry	Litchi	Paddy	Turmeric	black pepper	Ginger	Mandarin
Maize	Poultry	Dairy	Spices	Avocado	Vegetables	Poultry	Cardamom	Poultry	Ginger	maize	Paddy
Turmeric	Arecanut	Quinoa	Arecanut	Goat	Ginger	Piggery	Vegtables	Piggery	Turmeric	millet	Piggery

Table 4. Prioritized list of commodities for Sarpang Dzongkhag

Commodity	Rank
Dairy	1
Vegetables	2
Paddy	3

Ginger	4
Areca nut	5
Poultry	6
Turmeric	7
Piggery	8
Seedless lime	9

Based on insights from community consultations and the validation workshops with local government officials, several adaptation strategies are proposed by the workshop participants to address the specific challenges encountered in various livelihood and value chain activities. These adaptations are tailored to mitigate the environmental, economic, and logistical difficulties that impact sustainability and resilience and serve as the foundation for the **Agriculture Resilience Plan** (**ARP**). The priority adaptation measures can be broadly categorized into thematic areas**: technology and practices** and **capacity development**. These cover agricultural land and water management, addressing human-wildlife conflict, enhancing pest and disease management, strengthening market linkages, and promoting farm mechanization in crop farming. In livestock production, adaptation measures encompass fodder management, pest and disease control, product processing, and market enhancement.

8.3. Value chain interventions and Agri-entrepreneurship development

In Sarpang Dzongkhag, 21 crops are cultivated, with the largest proportion of households (47%) engaged in areca nut production, making it a major income source for farmers. However, despite its significance, areca nut has not been prioritized for value chain analysis and development as it is not considered a priority crop under the BRECSA project.

In addition to crops, farmers in Sarpang also produce livestock products such as meat, eggs, and milk. Sarpang's favourable social and cultural environment supports backyard pork production. The value chain analysis performed during the CLEAR+ analysis recommended **dairy and eggs** (**Table 5**) for the Dzongkhag. In this analysis, these commodities were

selected based on their potential to offer households a steady income year-round without being dependent on seasonal factors. Since many farmers in Sarpang are involved in livestock production, particularly dairy products and eggs, strengthening these two value chains would help farmers generate consistent income year-round, unaffected by seasonal changes.

Table 5. Potential commodities for value chain development

Value chain commodities	Value chain inefficiencies	Adaptation options /Recommendations	Expected results (outputs)	Target groups*	Remarks (e.g., seasons, specific Gewog, need for additional study/research)
Dairy	Lack of assured market for milk	Revamping of the already existing infrastructure of the milk processing unit at Gelegphu	Assured market for milk	Every household producing milk including marginal households	Enablers required to establish the value chain
Eggs	-Loss of price competitive edge if sold outside the Dzongkhag	Formation of egg marketing cooperative targeting the institutional consumers	Consistent year-round market for the eggs produced	Every farm, semi or commercial farms including marginal households producing eggs	Enablers required to facilitate the establishment of the value chain

***** Subsistence, Semi-commercial, and/or Commercial, Policy makers, Women, Youth

8.4 Identification of strategic location for establishment of Gender and Youth Inclusive hubs in Sarpang

The strategic locations for the establishment of gender and youth-inclusive hubs for Sarpang were identified during the validation workshop using the multi-criteria specified in **Table 6**. The selection of hub commodities was primarily based on the recommendations from the value chain analysis in the **CLEAR+** report and the priority commodity list from the **BRECSA** project. Additionally, inputs from the ARPR validation workshop participants were taken into account. The prioritized commodities, based on local production strengths and future potential, were then grouped and ranked. All twelve Gewogs proposed at least two potential commodities based on these criteria. Among the commodities listed, **Dairy** and **vegetables** were selected as the focus commodities for the Agri-food Hub in Sarpang. Consequently, the workshop recommended a reorientation of value chain priorities towards dairy and vegetables, aligning investment and development efforts more closely with local preferences and market opportunities.

Table 6. Location and commodities for Agri-food Hub for Sarpang Dzongkhag

Gewog	Location	Commodity	Factor of site selection
Gelegphu	**Pelrithang**	**Dairy**	1. Production scale
			2. Potential for upscaling
Chhudzom	**Galaythang**	**Vegetables**	3. Central location
			4. Market Assurance
			5. Possibility of value addition
			6. Land & other infrastructure availability

8.5 Identification of Niche Commodities

During the workshop, two commodities were identified as niche products for Sarpang Dzongkhag: **Honey and black pepper**. These products were selected based on specific

criteria and considerations that align with the region's environment, Dzongkhag's Agriculture Development Plan, current production, existing knowledge, and future potential.

8.6 Identification of commercial crops:

Although value chain commodities and commercial commodities are quite similar, the group decided to define them clearly to ensure a shared understanding and avoid future confusion. The distinction between the two lies in the funding strategy: for commercial commodities, funding is focused solely on enhancing or scaling up production. In contrast, Hub commodities will receive end-to-end funding, covering all stages of the value chain, from production to processing and marketing. It is expected that the differentiation will help in the planning and allocation of resources effectively. **Seedless lime and Mushroom** have been identified as two commodities with strong potential for commercial production within the Dzongkhag. Each of these commodities has unique advantages that make them well-suited for expansion in both local and regional markets, supporting economic development and income generation for local farmers.

9. PRIORITIZATION OF INFRASTRUCTURE NEEDS TO ADDRESS THE PRODUCTION AND MARKETING CONSTRAINTS

The infrastructure assessment for production and marketing in Sarpang Dzongkhag was conducted using a **multi-criteria assessment approach**. This method allowed for a comprehensive evaluation of the current infrastructure, identifying gaps and prioritizing key areas for intervention and investment. The criteria were carefully selected to reflect the unique challenges and opportunities of the Dzongkhag. Below is an elaboration on the approach and the factors considered:

Road Infrastructure: Sarpang Dzongkhag, characterized by predominantly flat terrain except in a few Gewogs, generally does not face significant accessibility challenges. However, during the rainy season, flash floods often block roads, particularly farm roads. This factor assesses the quality and availability of roads connecting villages to markets and main

highways. The focus is on identifying bottlenecks that hinder the transportation of goods, particularly during the summer when the farm roads get blocked due to landslides.

Production infrastructures: Based on the prioritization of key agricultural and livestock commodities, an evaluation of relevant production infrastructures was conducted. This included an assessment of the need for facilities such as dairy sheds and chain-link fencing, which are critical or supporting the production needs of both sectors. Additionally, criteria related to climate conditions and soil suitability were incorporated to determine the feasibility and potential of each prioritized commodity based on local knowledge and insights.

Storage and Processing Facilities: The lack of proper storage facilities often leads to post-harvest losses, particularly for perishable commodities. This criterion evaluates the existing warehousing capacity, cold storage options, and the need for new facilities to reduce wastage and extend the shelf life of produce. Assessing the presence of value addition facilities, such as milling, drying, and packaging units, is crucial. The focus is on the availability and adequacy of processing units for key commodities, which can enhance market value and provide better returns for farmers.

Market Infrastructure: The proximity and condition of marketplaces, including weekly markets and trading centers, are vital for producers to sell their goods. This assessment looks at the availability of local markets to understand how well-connected the farmers are.

Irrigation infrastructure: Given the issue of erratic rainfall and water scarcity reported by the community, assessing irrigation infrastructure is critical. This includes evaluating existing irrigation channels, and storage structures, and their effectiveness in supplying water to agricultural fields.

9.1. Categorization of infrastructures

The infrastructure assessment for production and marketing in Sarpang Dzongkhag is given in **Table 7.**

A. Production infrastructures: This category focuses on the facilities and structures needed to enhance the primary production of agricultural and livestock commodities. The assessment of these infrastructures was initiated during the validation workshop, where stakeholders identified key requirements to support efficient production.

1. **Irrigation Systems**: Both the construction of new irrigation systems and the rehabilitation of existing ones were identified as priorities. This includes large-scale irrigation for paddy and maize as well as dryland irrigation specifically tailored for crops like ginger, turmeric, and vegetables.
2. **Fencing**: Chain link fencing is essential for protecting crops like paddy, maize, and vegetables from wildlife damage.
3. **Greenhouses**: The provision of greenhouses is critical for rain protection during summer, especially for vegetables.
4. **Livestock Facilities**: The construction of climate-smart cattle, poultry, and piggery sheds was proposed to enhance the productivity of dairy and meat products by providing adequate shelter and promoting better management practices.

B. Post-harvest processing and market infrastructures: This category includes facilities and equipment that support the handling, processing, and marketing of agricultural and dairy products after harvest. Unlike production infrastructures, the needs in this category are set to be further evaluated during the **Multi-Stakeholder Platform** (**MSP**) meeting.

1. **Milk Collection Centers**: Establishing milk collection centers to streamline the dairy supply chain and reduce losses during transportation.

2. **Processing Plants:** For commodities such as milk, ginger, and turmeric, processing plants are essential to increase the shelf life and add value to raw produce.
3. **Cold Storage Facilities**: Given the perishability of certain products like vegetables and livestock products, the construction of cold storage units is crucial for preserving quality and extending market access.

Table 7. Infrastructure requirement of Sarpang Dzongkhag

Infrastructure	Unit	Total target	Tareythang	Umling	Chuzergang	Sershong	J/choling	Gelegphu	Samtenling	Dekidling	Chhudzom	Shompangkha	Gakiling	Senggey	Total budget (Nu.M)	Commodity
Production infrastructure																
Construction of new irrigation	KM	**40.5**		0.5	15	0							5	20	**55.5**	Paddy
Dryland irrigation/pipe irrigation	Sets	**1240**			100	1055				40	45				**115.5**	Ginger, vegetables
Rehabilitation/renovation of existing irrigation	KM	**85.9**			15							3.4	67.5		**101**	Paddy, areca nut
Chain link fencing	KM	**152.5**	2	6		44	3	1.5	1.5	21	35	15.5	8	15	**152**	Paddy, Bio-security and vegetable

Land development	Acre	**1415**						1	304	200	300	100	450	60	**90.5**	Orange, paddy, vegetable, maize
Greenhouses/Hydroponic/high-tech mushroom shed	Nos.	**1414**			7		301	154	154	206	254	20	213	105	**198.5**	Vegetables
Cattle shed construction	Nos.	**635**		35			20	5	5	120	50	200	100	100	**23.7**	Dairy
Poultry shed construction	Nos.	**331**		5	3	10		25	25	150		55	50	8	**31.5**	Piggery
Piggery shed	Nos.	**505**	10	5	25	10	8	20	20	150	30	100	120	7	**58.45**	Poultry
Goat shed	Nos.	**30**									30				**6**	
Post-harvest, processing and value additional infrastructure																
Milk collection center/MPU	Nos.	**2**										2			**6.5**	Dairy
Collection shed/pack house/storage center	Nos.	**26**		2	2						1	11	5	5	**117.5**	Ginger/vegetable
Ginger processing plant	Nos.	**8**	1		1	1				3			2		**62**	Ginger
Meat processing unit	Nos.	**1**								1					**10**	Pork/chicken
Construction of cold stores	Nos.	**1**		1											**5**	vegetables
Bio-gas Installation	Nos.	**240**	10	30				30		30		10	100	30	**15**	Dairy
Market infrastructure/equipment																
Procurement of milk freezer van	Nos.									1	1	1			**30**	
Construction of sales outlet	Nos.	**1**										1			**2.5**	Dairy

10. AGRICULTURE RESILIENCE PLAN

10.1 Agriculture Resilience Plan for Chhuzanggang Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Paddy	Labour shortage	Farm mechanization	Supply of farm machineries (Thresher, rice transplanter)	Nos.	3	1.50
	Lack of proper irrigation channels	Irrigation infrastructure development	Construction of irrigation channels	Kms	15	25.00
			Maintenance of existing irrigation channels	Kms	15	15.00
	Lack of market linkages	Market linkage intervention	Linkages with FMCL, FCBL and high-end hotels	Nos.	5	0.50
	Low yielding varieties and poor-quality seeds	Seed supply	Supply of high yielding and quality seeds	HHs	100	1.50
	Pests and disease outbreak	Pest and disease management	Supply of pesticides	HHs	100	1.50
	Lack of proper storage facilities	Post harvest infrastructure development	Establishment of a common storage facility	Nos	1	3.00
			Supply of grain bags (high end)	HHs	100	1.00
Vegetables	Poor quality seeds and inputs	Quality inputs supply interventions	Supply of high yielding and hybrid seeds	Kg	150	1.00
	Nutrient least soil	Soil nutrient management	Farmers training on FYM and bio-compost making in all chiwogs	HH	100	1.00

			Supply of bio fertilizers	Nos.	1000	1.00
	Pest and disease outbreak	Pest and disease management	Supply of bio inputs (fungicides, pesticides)	Nos.	1000	1.00
	Climate change impact on production	Climate smart infrastructural development	Development of hydroponics	Nos.	2	3.00
			Supply of climate smart greenhouse	Nos.	5	2.00
	Lack of access to market	Market linkage interventions	B2B meeting with FCBL, linkage with school feeding programs	no of linkage	4	0.50
	Lack post-harvest facility	Post harvest infrastructure development	Establishment of cold storage facilities	Nos.	1	5.00
	Water shortage in dry seasons	Water management	Installation of drip irrigation system and smart irrigation system	HHs	50	3.00
Areca nut	Lack of value addition and product processing	Value addition infrastructure development	Establishment of muza processing unit	Nos.	1	8.00
			Establishment storage facility	Nos.	1	2.50
			Installation of micro irrigation system	Nos.	100	1.5
	Pests and disease outbreak	Pests and disease management	Supply of pesticides	Nos.	1000	1.00
	Lack of high yielding seed	Quality seed supply	Supply of high variety seeds	Mt.	100	1.00
Dairy	Frequent outbreak of diseases	Animal health management intervention	Animal health awareness and advocacy to farmers of all chiwogs	HHs	200	0.50

	Poor quality cattle breed	Cattle breed improvement	Supply of jersey heifers/ milking cow to all chiwogs	Nos.	25	2.50
	Lack of processing and value-addition facilities	Post-harvest infrastructure development	Supply of milk storage can	Nos.	250	1.30
			Supply of milk churner all chiwog	HHs	100	1.00
Black pepper	Poor and low-yielding varieties	Supply quality inputs	Supply of high-yielding varieties	Nos	2000	5.00
	Pest and disease outbreak	Pest and disease management	Supply of pesticides, bio fungicides	Set	250	3.00
	lack of value addition and market access	Product processing and market channelization	Supply of equipment (electric dryer)	Nos.	4	1.50
			Market linkage with FCBL, FMCL	Nos.	3	0.50
	Lack of post-harvest facilities	Post-harvest infrastructure development	Supply of post-harvest packaging materials	Nos.	500000	2.50
	Water shortage in dry seasons	Smart irrigation infrastructure development	Installment of Drip irrigation system	Nos.	100	5.00
	Poor soil fertility	Soil nutrient management	Supply of pesticides, bio fungicides, biopesticides	Set	250	3.00
			Supply of biofertilizers	HHs	100	1.50
			Development of Vermicompost, capacity building	Nos.	1	0.50
Ginger and Turmeric	Low yielding		Farmers capacity building	HHs	350	1.00

		Quality inputs supply interventions	Supply high-yielding variety"Rio de Janerio"	Kg	10,000	3.50
	Pest and disease outbreak	Pest and disease management	Supply of pesticides, bio fungicides, biopesticides	Set	200	2.50
	Lack of post-harvest facilities	Product processing and market channelization	Market linkage with FCBL, FMCL	Nos.	3	0.50
			Product development training to farmers	HHs	250	1.40
	Water shortage in dry seasons	Smart irrigation infrastructure development	Installment of Drip irrigation system	Nos.	100	5.00
	Poor soil fertility	Soil nutrient management	Supply of pesticides, bio fungicides, biopesticides	Set	250	3.00
			Supply of bio fertilizers	HHs	100	1.50
Poultry	Inadequate pullet supply	Quality inputs supply interventions	Procure and supply of layer DOC	Nos.	5000	0.35
	High cost of feed cost/transportation cost	Quality inputs supply interventions	Procure and supply of feed	MT	216	8.60
	Climate change impact on production	Upgrading Poultry shed construction	Procure and supply of climate-smart poultry shed construction materials	farm	3	6.00
	Diseases outbreak	Diseases management	Animal health awareness and advocacy to farmers of all chiwogs	farm	50	0.50

Piggery	High cost of Piglet	Quality inputs supply interventions	Procure and supply of piglets	Nos.	200	2.00
	Climate change impact on production	Upgrading piggery shed construction	Procure and supply of climate smart piggery shed construction materials	nos	25	1.25

10.2 Agriculture Resilience Plan for Chhudzom Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Vegetable	Frequent outbreak of pests and diseases	Crop protection interventions	Supply insecticides and pesticides and materials	HH	600	2.00
			Training of farmers on crop protection	HH	600	0.50
	Climate change impact on crop production	Installation of mega - green house and smart Irrigation	Supply of Mega- Green house	Nos.	2	6.00
			Supplying smart irrigation for two MGH	Set	2	2.00
		Investment on hybrid seeds	Supply of seeds	Pkts	3500	1.50
		Climate smart production infrastructure interventions	Installation of Polyhouse in individual houses with drip irrigation installed	Nos.	250	2.5
		Knowledge enhancement intervention	Capacity building of farmers in all Chiwogs on vegetable cultivation	Nos.	200	0.50
		Post harvest facility development	Construction of pack house with storage facilities (weighing, packing, cleaning, grading etc) at Gallegthang	Nos.	1	50.00
	Uneven land terrain for cultivation	Land development and consolidation	Terracing, leveling etc at all Chiwogs	Acre	100	4.00

	(Proper land development)	Procurement of Backhoe Machine and Stone collector machine	Stone collection, land terracing, leveling etc at all Chiwogs	Nos.	1	4.00
	Labour Shortage	Farm mechanization	Supply of Mini tiller	Nos.	100	10.00
	Wildlife Conflict	Crop protection interventions	Electric fencing/ Chain link in all chiwogs	km	30	7.50
		Farm mechanization	Supply Of Grass cutter	Nos.	50	1.50
Cardamom	Climate change impact on crop production	Climate smart production infrastructure interventions	Supply of pipes, sprinkle, irrigation system	Acre	600	20.00
		Quality inputs supply	Supply of quality seedlings	Nos.	607050	15.00
		Post harvest facility development	Supply of electric drying machine	Nos.	500	40.00
Paddy	Uneven land terrain for cultivation (Proper land development)	Farm mechanization	Supply of Mini tiller	Nos.	30	3.00
			Supply of paddy thresher	Nos.	40	2.00
		Land development and consolidation	Terracing, leveling etc at 4 Chiwogs	Acre	200	3.00
Kiwi	Climate change impact on crop production	Production infrastructure interventions	Supply PI wire, Iron poles and Cement, sand, gravels to three Chiwogs	Acre	40	30.00

		Climate-smart production infrastructure interventions	Construction of rainwater harvesting pond at three Chiwogs	Nos	30	1.00
			Supply of pipes, irrigation system	Acre	40	35.00
Mushroom	Climate change impact on crop production	Production infrastructure interventions	Supply of raw materials to the farmers for the construction of high-tech mushroom shed at Draagchu and Gallegthang	Nos.	2	30.00
		Quality spawn production interventions	Supply of raw materials to the farmers for spawn production at Draagchu and Gallegthang	set	2	20.00
	Labour Shortage	Farm mechanization	Supply of raw materials for smart irrigation system to the farmers at Draagchu and Gallegthang	set	2	30.00
Goat	Lack of knowledge on Goat Husbandry	Climate smart production infrastructure interventions	Construction of climate smart goat shed	HH	30	6.00
			Herd health management and farm biosecurity awareness to all chiwogs	HH	30	0.2.00
			Supply of breeding buck	Nos.	30	0.45
Piggery	Lack awareness on bio-security and piggery management	Climate smart production infrastructure interventions	Construction of piggery shed (10 sow level)	HH	30	15.00
			Herd health management and farm	HH	100	0.50

			biosecurity awareness to all chiwogs			
Dairy	Frequent outbreak of diseases	Animal health management intervention	Awareness on herd health management and clean milk production to farmers of all chiwogs	HH	600	1.00
	Feed and fodder shortage	Feed and fodder development interventions	Fodder development in 5 chiwogs	Acre	400	3.00
			Silage production for winter feeding in all chiwogs	HH	350	0.80
			Supply of oat seeds for winter fodder development	Kg	2000	0.20
			Supply of electric chaff cutter machine	HH	150	3.00
			Promotion of Total Mixed Ration (TMR) technology	HH	400	1.00
	Poor quality cattle breed	Cattle breed improvement	Supply of good dairy cattle to 100 HHs in 5 chiwogs	HH	100	10.00
			Construction of dairy shed (5-10 head capacity)	HH	50	3.00
			Establishment of AI centre at Chhudzom	Nos.	1	0.50
	Production of Quality dairy products	Quality product processing and packaging	Supply of dairy processing equipment (electric butter churner/vacuum packaging machine etc.)	HH	100	1.00

Avocado	Pest and diseases outbreak and poor soil nutrient management	Climate smart production infrastructure interventions	Supply and Installation drip irrigation	Acre	200	40.00
		Soil nutrient management	Preparation of basin and Canopy Management	Acre	200	20.00
		Quality inputs supply	Supply of grafted seedlings to all Chiowgs	HH	600	5.00
		Crop protection interventions	Supply of pheromone trap and insecticides to all Chiwogs	Acre	25	2.00
Maize	Wildlife conflict	Climate smart production infrastructure interventions	Supply and install electric fencing /C\chain-link fencing in all chiwogs	Acre	500	12.50
	Labour Shortage	Farm mechanization	Supply of maize miller to all Chiwogs	HH	400	32.00
Ginger, Turmeric	Management and studies	Training on cultivation Practices	Training on cultivation and seed selection for all chiwogs	HH	100	1.00
	Labour Shortage	Farm mechanization	Supplying of weeder, grass cutter etc to ginger growing farmers	HH	100	5.00
			Supply of plastic mulching to all chiwogs	Nos.	200	1.00
	Wild Life Conflict	Crop protection interventions	Construction of electric fencing /chain-link Fencing	Acre	5	1.00
	Climate change impact on crop production	Land development	Bushes clearing, stone collection, land leveling	Acre	5	3.00
		Smart Irrigation	Supply smart irrigation system to Two chiwogs	Acre	5	5.00

10.3 Agriculture Resilience Plan for Dekiling Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Dairy	Low milk production	To enhance clean milk production & hygienic shed	Supply of climate smart dairy shed materials	Nos.	120	5.00
			Supply of automatic potable milking machines for dairy farmers (> 5 milking cows)	HH	100	5.00
			Support & supply of cow mats	HH	100	2.00
			Training and awareness program in clean milk production	HH	120	1.00
	Lack of product diversification and access to market	Value addition to dairy products	Milk products diversification and value addition (processing, leveling, packaging, and marketing)	Nos.	7	1.00
			Revive & expansion of existing dairy farmers group	Nos.	5	1.00
			Supply of MPU equipment (Percolator, cream separator, Milk cans and Chilling machine)	Nos.	1	5.00
			Supply of milk cans to all the dairy farmers in the Chiwogs	HH	800	2.00

	Lack of green energy	Control of methane Gas for smart climate	Supply and maintenance of defunct plants & establishment of Sistema biogas plants	HH	150	5.00
	Frequent outbreaks of notifiable diseases	Animal health management intervention	Animal health awareness and advocacy for farmers in all Chiwogs	HH	800	1.50
			Conduct training to CoAHW (Community Animal Health Worker)	Nos.	10	0.50
			Procurement and Supply of medicines	Nos.	14	0.50
			Vaccination of cattle for preventative measures	Nos.	1450	1.50
	Shortage of feed and fodder	Feed and fodder development for better production	Supply of pasture inputs (seeds and seedlings, grass slips)	Acre	150	2.00
			Capacity development of TMR (Total Mixed Ration) formulation and purchase of ingredients for TMR.	HH	100	1.00
			Supply of labour-saving Machines (Chaff cutters)	HH	100	2.00
			Supply of barbed wire & chain-link fencing	HH	80	8.00
			Installation & establishment of hydroponic feed & fodder for cattle	HH	5	4.00
			Fodder Conservation of Hay and Silage production	HH	400	2.00

			for winter feeding in all chiwogs			
	Poor quality cattle breed	Cattle breed improvement program	Supply of improved heifer breeds	Nos.	100	3.00
			Supply of Sex sorted semen in all Chiwogs	HH	800	3.00
			Purchase of digital AI guns for 100% accuracy	Nos.	1	0.20
			Capacity development of CAIT (community AI Technician) and purchasing of AI equipment)	Nos.	5	1.50
Ginger and Turmeric	Low yield	Supply of Quality seeds	Supplying improved and disease-free ginger rhizome to all chiwogs	Kg	80000	8.00
		Soil nutrient management	Farmers training on FYM and bio-compost making in all chiwogs	HH	300	0.70
	Lack of product processing and value addition	Product processing and market linkage interventions	Establishment of Ginger processing plant at Dolungang	Nos.	1	5.00
			B2B meeting with FCBL and private grocery dealers	Nos.	10	5.00
	Difficult land terrant	Land Development	Land development for farm mechanization to reduce labour shortage	Acre	200	45.00
	Labour shortage	Farm Mechanization	Support Farm Machines (Power tiller for multi usage), Grass cutter), weeders	Nos.	200	50.00

Potato	Poor quality seeds	Improvement of seeds	Procurement and distribution to all chiwogs	MT	1400	2.00
	Pest and diseases outbreak	Crop protection interventions	Procurement and distribution to all chiwogs	Ltrs	3500	2.00
	Labour shortage	Farm Mechanization	Supply of mini-power tillers to all chiwogs	Nos.	250	25.00
	Limited access to market	Improvement of market linkages	B2B meeting and market linkages with FCBL, traders to all chiwogs	Nos.	20	20.00
Vegetables	Non availability of hybrid seeds.	Quality input supply	Supply of hybrid seeds to all chiwogs	Pkts	50000	5.00
	Poor irrigation facilities	Improvement of dry land irrigation	Pipeline irrigation facilities in Dekiling, Gawaithang, Nubgang and maintenance of existing channel at Jigmeling, Chokhorling	Km	30	33.00
	Pest and diseases outbreak	Protected Cultivation Technology	Purchasing and supply of materials (Green house, drip irrigation, mulching plastic), establishment of Mega Poly house	Nos.	200	20.00
Mushroom (Oyster)	Non availability of spawn as and when required	Spawn production intervention	Strengthening of existing spawn production unit at Chokhorling to make the quality spawn available all the time	Nos.	1	2.00
	Climate change impact on production	Climate smart cultivation	Support materials for construction and establishment of controlled temperature	Nos.	5	25.00

			cropping house at Dolungang for youth group			
	Lack of production, post-harvest and processing skills	Capacity building	Create awareness on production, management, post-harvest, processing, Marketing and group formation and management	HH	250	4.00
Coffee	Lack of product processing and value addition	Product processing interventions	Establishment of processing house with equipped machineries and support drier in strategic location	HH	250	15.50
	Lack of production and processing skill	Enhancement of production processing capacity	Create awareness starting from production, post-harvest, processing and till marketing	HH	250	1.50
	Poor quality seedlings	Supply improved variety	Support and distribute improved and suitable planting materials to 250 farmers in 80 acres of land (Fallow land revival)	Acre	80	5.00
Dragon fruit	Lack of production technique	Enhancement of fruit production capacity	Provide detailed training in plantation, management, processing and marketing	HH	350	1.50
	Lack of proper climbing post		Provide materials for construction of dragon fruit climbing post	Acre	15	5.00

			(Cement, Iron angle post, GI wire)			
	Unavailability of suitable seedlings	High variety supply	Distribute a suitable variety of dragon fruit for commercial production in Dekiling, Gawaithang and Jigmeling Chiwog	Acre	15	2.00
Poultry	Outbreak of frequent diseases	Animal health management intervention	Animal health awareness and advocacy to farmers of all chiwogs	HH	100	0.50
			Installation of farm Biosecurity (chain link fence) to all chiwogs	Nos.	100	9.00
			Procurement and Supply of medicine and vaccines to all chiwogs.	Set	50	0.50
	Climate impact on mortality rate	Climate-smart intervention	Supply of heat exhaust fans	Set	200	4.00
	Low egg & Chicken production	Enhancement of egg production	Supply of poultry shed to all chiwogs	Nos	150	4.00
			Supply of DoC and pullets to all chiwogs (layer & broiler)	Nos	50000	5.00
			Supply of packaging materials to all chiwogs	HH	150	4.00
			Supply of debeaking & de-feathering machines to all chiwogs	Nos.	100	1.50
			Supply of automatic feeders & drinkers	HH	150	2.00

Piggery	Frequent outbreaks of notifiable diseases	Animal health management intervention	Animal health awareness and advocacy to farmers of all chiwogs	HH	200	0.50
			Installation of farm Biosecurity (chain link fence) to all chiwogs	Nos.	150	8.00
			Procurement and Supply of medicine and vaccines to all chiwogs	HH	150	0.50
			Supply of automatic disinfection sprays in the farms	HH	200	1.50
	Low pork production	To enhance pork production	Supply of piggery shed to all chiwogs	Nos.	150	8.00
			Supply of weaned piglets to all chiwogs	Nos.	3000	5.00
			Supply of freezer van for transportation	HH	1	1.50
			Supply of drinking water nipples and other piggery equipment to all chiwogs	Nos	100	3.00
			Installation of farm Biosecurity (chain link fence) to all chiwogs	HH	150	8.00
	Low weaning rate	To produce healthy piglets	Supply of creep boxes and sows' crates	HH	50	5.00
	Low-quality pork	To produce clean & quality pork for food safety	Pork Processing unit with equipment	HH	1	10.00
Apiculture	Low honey production		Supply of improved bee hives	HH	300	2.00

			Training and awareness program in honey production & bee management	HH	300	2.00
			Supply of basic beekeeper tools & equipment in all the Chiwogs	HH	300	2.00
		Enhancement clean honey production	Supply of honey extractors, Wax melters machines, Casting machines, Bee feeders and Packaging materials	HH	300	5.00
			Supply of improved bee colonies from Bumthang	HH	100	0.80
			Construction of Honey collection & processing Unit/centre	No	1	4.00

10.4 Agriculture Resilience Plan for Gakiling Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Coffee	Lack of product processing and value addition	Investment in product processing and value addition	Establishment of processing house with equipped machinery and support drier in strategic location	HH	250	15.50
	Lack of production and processing skill		Create awareness starting from production, post-harvest, processing and till marketing	HH	250	1.50
	Poor quality seedling	Variety improvement intervention	Support and distribute improved and suitable planting materials to 250 farmers in 80 acres of land (Fallow land revival)	Acre	80	5.00
Ginger and Turmeric	Low yield	Quality seed supply	Supplying improved and disease-free ginger rhizome to all chiwogs	Kg	80000	8.00
		Soil nutrient management	Farmers training on FYM and bio-compost making in all chiwogs	HH	300	0.70
	Lack of product processing and value addition	Product processing and market linkage interventions	Establishment of ginger processing plant at Gakiling	Nos.	1	5.00
			B2B meeting with FCBL and private grocery dealers	Nos.	10	0.50

	Labour shortage	Land Development	Land Development for farm mechanization to reduce labour shortage	Acre	300	20.00
		Farm Mechanization	Support Farm Machines (Power tiller for multi usage), Grass cutter), weeders	Nos.	200	15.00
Dairy	Low milk production	To enhance clean milk production	Supply of dairy shed materials	Nos.	100	2.00
			Procurement and supply of Milking Equipment (yogurt churner/Butter churner, digital AI gun and ultrasound device)	HH	160	10.00
			Training and awareness program in clean milk production & Dairy cow Management	HH	100	5.00
			Conduct training to CoAHW (Community Animal Health Worker)	Nos.	10	5.00
			Mass Vaccination of cattle for disease prevention measures (LSD/FMD/HS-BQ)	Nos.		7.00
	Lack of reduction of CFC gas production	Bio-gas management and improvement for green energy development/Bio -slurry management	Maintenance of defunct biogas plants for gas production in all Chiwogs to help conserve our environment	HH	100	5.00

	Feed and fodder shortage	Feed and fodder development	Mass pasture development (land development, seed & seedling supply) & construction of silo pit & lease land for fodder development/fencing	Acre	150	7.00
			Supply of barbed wire/chain link fencing	Acre	150	5.00
			Hay and Silage production for winter feeding in all chiwogs	HH	100	5.00
	Poor quality cattle breed	Cattle breed improvement program	Supply of improved breeds (Holstein) and Breeding Bull	Nos.	100	3.00
			Intensification of AI program (sex-sorted semen; AI gloves, AI sheet, straw)	Nos.	2	5.00
			Capacity development of CAIT (community AI technician) and purchasing of LN2 equipment)	Nos.	20	3.00
Areca nut	Pest and disease outbreak	Crop protection intervention	Disease-free seedling distribution.	HH	250	15.00
	Lack of access to the market	Enhance access to the market	Seed money from the project for the purchase of pesticides			
	Water Scarcity	Irrigation improvement	improvement and rehabilitation of irrigation canals.			

Paddy	Inadequate Irrigation facilities	Water source protection	Five main irrigation water source protection in all chiwogs	Nos	5	10.00
		Improvement of irrigation facilities	Maintenance of existing channel and Supply of HDPE Pipes to Gakiling, Getemkha, Rilangthang, Sangkha and Meanchulam chiwogs	Km	60	20.00
	Crop damage by wild animals	Crop Protection	Improved and effective electric fencing establishment at Gakiling, Chainlink fencing at Getemkha and Meanchulam	km	50	30.00
	Frequent outbreaks of pest and diseases	Crop Protection	Supply of chemicals to all chiwogs to Paddy growing chiwogs	Ltrs	4000	4.00
Vegetables	Non-availability of hybrid seeds.	Quality seed supply	Supply of hybrid seeds to all chiwogs	Pkts	5000	8.00
	No proper packaging	Construction of Packhouse	Construction of packing, grading and collection house	Nos.	5	50.00
	Pest and disease outbreak	Protected Cultivation Technology	Establishment of improved automated digital greenhouse farming under-managed and controlled environment.	Nos.	2 Farm	20.00

			Purchasing and supply of materials (Greenhouse, drip irrigation, mulching plastic, Automated irrigation), establishment of Mega Poly house	Nos.	200	15.00
Mushroom (Oyster and Shetakee)	Non-availability of spawn as and when required	Spawn production intervention	Set up spawn production unit for shetakee mushroom at Gechu or timely supply spawn for cultivation to the interested and potential farmers	Nos.	1	5.00
	Climate impact on production	High-tech production intervention	Support materials for construction and establishment of controlled temperature cropping house	Nos.	10	13.00
	Lack of Production, post-harvest and processing skills	Capacity building	Create awareness of production, management, post-harvest, processing, Marketing and group formation and management	HH	250	4.00
Poultry	Outbreak of frequent diseases	Animal health management intervention	Animal health awareness and advocacy to farmers of all chiwogs	HH	50	5.00

			Installation of farm Biosecurity (chain link fence) to all chiwogs	Nos.	2	20.00
			Procurement and Supply of medicine and vaccines to all chiwogs	Set	20	5.00
	Low egg production	To enhance egg production	Supply of poultry shed and equipments to all chiwogs	Nos.	50	5.00
			Supply of DoC and pullets to all chiwogs	Nos.	5000	5.00
			Supply of packaging materials to all chiwogs	HH	50	5.00
			Supply of debeaking and defeathering machine to all chiwogs	Nos.	50	3.00
Piggery	Outbreak of frequent diseases (ASF)	Animal health management intervention	Animal health awareness and advocacy to farmers of all chiwogs	HH	120	3.00
			Installation of farm Biosecurity (chain link fence) to all chiwogs	HH	120	5.00
			Procurement and Supply of medicine and vaccines (Iron Injections Vaccine) to all chiwogs	Nos.	1800	5.00
	Climate impact on production	To enhance pork production	Supply of piggery shed construction to all chiwogs	HH	120	10.00
			Supply of healthy piglets to all chiwogs	HH	120	10.00

			Supply of packaging materials to all chiwogs (Piggery group)	HH	120	6.00
			Stunning Gun, Teeth clipping machine, creep box, AI Crate	HH	120	3.00
			Training of Breeding Boar and (Pig AI)	HH	120	3.00
Honey	No improved bee hives.Low production	To enhance Honey production	supply of improved bee hives, bee management training and equipment	HH	200	5.00

10.5 Agriculture Resilience Plan for Gelegphu Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Dairy	Frequent outbreak of diseases	Animal health management intervention /Capacity Building	Animal health awareness and advocacy to farmers of all chiwogs	HH	400	0.50
	Feed and fodder shortage	Feed and fodder development	Fodder development in Chokhorling and Khempagang chiwogs	Acre	50	0.30
			Training on silage production for winter feeding in one chiwog	HH	10	0.50
			Support for Purchase of Silage bags /chopping machines /Excavation of pits/urea	HH	10	3.00
	Poor quality cattle breed	Cattle breed improvement	Supply of jersey heifers to 50 HHs of all chiwogs	HH	50	1.00
	Low quality farm sheds	Infrastructures improvement	Supply of farm construction materials such as a wire mesh, CGI sheath, etc	Nos.	5	2.00
	Water shortage	Improve water supply for dairy farm	Supply of modern irrigation materials such as Pipe, sintex	HH	5	0.50
Vegetables	Pest and diseases outbreak	Diseases and pest control and management	Capacity development to farmers	HH	400	0.50
			Procure and supply of pp chemicals.	HH	400	0.80

	Poor quality seeds	Quality input supply	Procure and supply of hybrid seeds	HH	400	1.50
	Farm labour shortage	Farm mechanization	Procure and supply power tillers and mini tractor on cost sharing mechanism.	HH	50	5.00
	Lack of product processing and value addition	Product processing and market linkage interventions	Trainings on value addition and post-harvest	HH	400	0.50
			B2B meeting with FCBL and private vegetable vendors	Nos.	10	0.50
	Water shortage	Irrigation support	Supply of smart irrigation materials like drip irrigation kits, sintex, and HDPE pipes.	HH	200	5.00
	Climate impact on crop production	Protected cultivation technology	Procure and supply materials (mega playhouse materials, drip irrigation system and mulching plastics on a cost-sharing basis)	HH	150	12.00
	Land not suitable for farm mechanization	Land development	Hiring of machinery to widen the terrace for mechanization	Acre	300	3.00
Mushroom	Lack of quality spawn	Spawn production unit	Support farmers with construction materials for spawn production unit	Nos.	1	1.00
	No off-season production	Initiate off-season production	Support farmers with construction materials for off-season	Nos.	3	4.00

			production in controlled environment			
Fruits	Lack of orchard management	Orchard management initiative	Provide training on orchard management and fruit trees management	HH	400	0.50
Quinoa	Lack of product processing and value addition	Product processing and market linkage interventions	Supply of threshing and processing unit at Samtenling Chiwog	Nos.	1	30.00
			B2B meeting with FCBL and traders	Nos.	5	0.20
Spices	Non-availability of quality seedlings	Quality seedling supply	Improved seedling (black pepper) supply to all chiwogs.	Nos.	10000	1.00
	Lack of product processing and value addition	Product processing and market linkage interventions	B2B meeting with FCBL and traders	Nos.	5	0.20
Poultry	Frequent outbreaks of diseases	Animal health management intervention	Animal health awareness and advocacy to farmers of all chiwogs	HH	25	0.10
			Supply of Chain link fence	HH	30	1.00
	Large scale production	Inputs supply	Supply of DoC through a cost-sharing mechanism	Nos.	20000	0.20
	Poor farm infrastructure	Improve infrastructure	Maintenance of existing infrastructure such as CHS sheaths, Wire mesh, etc	Nos.	25	0.50

Piggery	Frequent outbreaks of diseases	Animal health management intervention	Animal health awareness and advocacy for farmers	HH	100	0.20
			Supply of Chain link fence	HH	25	1.00
	Poor Farm Knowledge	Knowledge of piggery farming	Providing Training and workshops on Pig farming	HH	100	0.20
	Poor farm infrastructure	Improved infrastructure	Improvement of existing infrastructure	Nos.	20	3.00
	Lack of value addition	Marketing, Packaging and Processing	Analyzing fixed and variable market source	Nos.	50	0.10
			Training on Modern dressing techniques	Nos.	20	0.50
	Age-old slaughter method	Supply of modern slaughtering techniques	Supply of Stun Gun, and dressing equipment through a cost-sharing basis	Nos.	10	1.00
	Very limited commercial-level farms	Inputs supply	Supply of Piglets through a cost-sharing mechanism	Nos.	500	1.00
			Supply of Adult Pigs through a cost-sharing mechanism	Nos.	100	1.00
	Water storage issues	Storage of water during off-seasons	Supply of Sintax on a cost-sharing basis	HH	50	0.50
Fishery	Land Scarcity	Land Development and management	Development of land at Khenpagang	Nos.	5	0.50

	Catching of market fish	Marketing	Supply of Fish catching-net through cost-sharing basis	Nos.	10	0.10

10.6 Agriculture Resilience Plan for Jigme Chhoeling Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Dairy	Frequent outbreaks of diseases	Animal health management intervention	Animal health awareness and advocacy to farmers of all chiwogs	HH	450	1.00
			Disease control Program (vaccination Campaigns) in all Chiwogs	HH	200	1.50
	Feed and fodder shortage	Feed and fodder development	Supply of Napier and Gautemalas slips to Gongdugang and Gongtshekha Chiwogs	Acre	200	1.00
			Supply of Oat and ruzi fodder grass seeds to All chiwogs	Acre	300	0.80
	Labour shortage	Supply of farm machinery and equipment	Procurement of Milk analyzer and pasteurizer machine for Jigme Chhoeling Dairy Group	Nos.	1	0.15
			Supply of Chaff cutter in all chiwogs	HH	50	1.50
			Supply of Aluminum Cans for milk collection for Jigme Chhoeling Dairy Group	Nos.	5	0.10
	Poor quality cattle breed	Cattle breed improvement	Supply of jersey heifers to 200 HHs in all chiwogs	Nos.	200	10.00
			Supply of jersey breeding bulls to all six chiwogs for breed improvement	Nos.	6	0.80

	Poor cattle housing	Infrastructure development	Supply of raw materials such as bricks, cement, CGI sheets, TMT rod for improved dairy shed construction in all chiwogs	Nos.	20	5.00
	Poor CFC gas reduction from dairy farming	Green Energy Development	Biogas construction using FRP (fiber-reinforced plastic)	HH	20	3.00
Honey	Shortage of modern bee hives	Apiculture development	Supply of improved beehives to farmers of Samkhara Chiwog and Chortenkhar Chiwog	HH	50	0.80
	Lack of packaging materials	Apiculture development	Supply of packaging and Labeling materials	HH	200	1.00
	Lack of improved technologies	Enhance the capacity of farmers	Beekeeping (queen management) training	HH	100	0.80
Piggery	Poor housing	Infrastructure development	Supply of raw materials such as bricks, cement, CGI sheets, and TMT rod for improved and standardized housing to interested farmers	HH	8	5.00
	Unaffordable price of piglets for farmers	Input supply	Supply of subsidized improved breed of piglets to fattening farm	HH	100	10.00
	Poor Biosecurity	Improve bio-security measures	Supply of chain-linked fencing to farms	Nos.	10	2.00

Poultry	High cost of DOCs	Input supply	Supply of Layer DOC to Layer farms	Nos.	1	1.00
			Supply of Broiler DOC to Broiler farms	Nos.	10	0.50
	Poor Biosecurity	Improve bio-security measures	Supply of chain-linked fencing of farms	Nos.	10	2.00
Cardamom	Pest and disease outbreak	Pesticide application and cultural practices	Supply of pesticides, lures	HH	450	0.50
			Training on diseases and pest management	HH	500	0.50
	Lack of water in dry season	Improve water supply	Supply of HDPE pipes, flexible pipes, sprinklers, drip irrigation sets	Nos.	1000	5.00
Vegetables	Climate impact on production	Protected agriculture	Supply of Fabricated Polyhouse	Nos.	300	4.00
	Lack of water in dry season	Dryland smart irrigation	Supply of HDPE pipes, flexible pipes, sprinklers, drip irrigation sets	Nos.	1000	5.00
	Labour shortage	Farm machineries	Supply of sprayers, dryers	Nos.	200	5.00
	lack of storage facilities	Supply of cold chain equipment	Supply of display refrigerator, cool boxes, crates	Nos.	5	0.50
	Lack of quality seeds	Supply of improved seeds	Supply of improved seeds	Pkts	50000	2.00
Mandarin	Pest and disease outbreak	Supply of Chemicals	Supply of Chemicals lures	Nos.	5000	0.50

	Lack of water in the dry season	Dryland irrigation and smart irrigation	Supply of HDPE pipes, flexible pipes, sprinklers, drip irrigation sets	Nos.	1000	5.00
	Poor citrus orchard management	Canopy management	Canopy management, procurement of tools and equipment	Nos./HHs.	200	2.00
	Lack of quality seedlings	Supply of improved seedlings	Supply of improved seedlings	Nos.	2000000	15.00
Mushroom	Lack of equipment	Procurement of equipment	Procurement of equipment, tools	Nos.	50	1.00
	Lack of mushroom cultivation shed	Construction of mushroom shed	Construction of mushroom shed	Nos.	1	2.00
Paddy	Manpower shortages	Supply of labour-saving machinery	Supply of power tillers, rice huller	Nos.	200	10.00

10.7 Agriculture Resilience Plan for Samtenling Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Dairy	Frequent outbreak of diseases	Animal health management intervention	Animal health awareness and advocacy to farmers of all chiwogs	HH	400	0.50
	Feed and fodder shortage	Feed and fodder development	Fodder development in Chokhorling and Khempagang chiwogs such as land clearing	Acre	50	0.30
			Traning on silage production for winter feeding in one chiwog	HH	10	0.50
			Support for Purchase of Silage bags /chopping machines /Excavation of pits/urea	HH	10	3.00
	Poor quality cattle breed	Cattle breed inprovement	Supply of jersey heifers to 50 HHs of all chiwogs	HH	50	1.00
	Low climate smart cattle sheds	Climate smart production infrastructure	Supply of farm construction materials such as a wiremesh, CGI sheath, etc	Nos.	5	2.00
	Water shortage for animal	Improve water supply	Supply of modern irrgation materials such as Pipe, sintax,etc	HH	5	0.50

Vegetables	Pest and diseases outbreak	Control protection management	Capacity development to farmers	HH	400	0.50
		Supply of pesticides	Procure and supply of pp chemicals.	HH	400	0.80
	Poor quality seeds	Improve inputs	Procure and supply of hybrid seeds	HH	400	1.50
	Labour shortage	Farm mechanization	Procure and supply power tillers and mini tractor on cost sharing mechanism.	HH	50	5.00
	Lack of product processing and value addition	Product processing and market linkage interventions	Trainings on value addition and post-harvest	HH	400	0.50
			B2B meeting with FCBL and private vegetable vendors	No (linkage)	10	0.50
	Water shortage	Irrigation support	Supply of smart irrgation materials like drip irrigation kits, syntex, HDPE pipes.	HH	200	5.00
	Climate impact on production	Protected cultivation technology	Procure and supply materials (mega polyhouse materials, drip irrigation system and mulching plastics on a cost-sharing basis)	HH	150	12.00
	Land not suitable for farm mechanization	Land development	Hiring of machineries to widen the terrace for mechanization	Acre	300	3.00

Mushroom	Lack of quality spawn	Spawn production unit	Support farmers with construction materials for spawn production unit	Nos.	1	1.00
	Climate impact on production	Protected cultivation technology	Support farmers with construction materials for off season production with controlled environment	Nos.	3	4.00
Fruits	Lack of orchard management	Capacity development on orchard management	Provide trainings on orchard management and fruit trees management	HH	400	0.50
Quinoa	Lack of product processing and value addition	Product processing and market linkage interventions	Supply of threshing and processing unit at Samtenling Chiwog	Nos.	1	30.00
			B2B meeting with FCBL and traders	Nos.	5	0.20
Spices	Non availability of quality seedlings	Quality seedling supply	Improved seedling (black pepper) supply to all chiwogs.	Nos.	10000	1.00
	Lack of product processing and value addition	Product processing and market linkage interventions	B2B meeting with FCBL and traders	Nos.	5	0.20
Poultry	Frequent outbreak of diseases	Animal health management intervention	Animal health awareness and advocacy to farmers of all chiwogs	HH	25	0.10

			Supply of Chain link fence	HH	30	1.00
	No commercial-level farming	Inputs supply	supply of DoC through a cost-sharing mechanism	Nos.	20000	0.20
	Poor farm infrastructure	Improve infrastructure	Maintenance of existing infrastructure such as CHS sheaths, Wiremesh, etc	Nos.	25	0.50
Piggery	Frequent outbreaks of diseases	Animal health management intervention	Animal health awareness and advocacy for farmers	HH	100	0.20
			Supply of Chain link fence	HH	25	1.00
	Poor Farm Knowledge	Knowledge of piggery farming	Providing Training and workshops on Pig farming	HH	100	0.20
	Transportation issues	Procurement of Vehicle	Purchase of Meat Van Vehicle through a cost-sharing basis	Nos.	2	2.50
	Poor farm infrastructure	Improved infrastructure	Improvement of existing infrastructure	Nos.	20	3.00
	lack of value addition	Marketing, Packaging and Processing	Analysing fixed and variable market source	Nos.	50	0.10
			Training on Modern dressing techniques	Nos.	20	0.50
	No commercial-level farming	Inputs support for commercial-level farming	supply of Piglets through cost sharing mechanism	Nos.	500	1.00
			supply of Adult Pigs through a cost-sharing mechanism	Nos.	100	1.00

	Water storage issues	Improvement of water availability	Supply of Sintax on cost-sharing basis	HH	50	0.50
Fishery	Land shortage	Land Development and management	Development of land at Khenpagang	Nos.	5	0.50
	Lack of harvesting facilities	Supply harvesting facilities and equipment	Supply of Fish catching-net through cost-sharing basis	Nos.	10	0.10

10.8 Agriculture Resilience Plan for Senggey Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Paddy	Pest and diseases outbreak	Pest and Disease management	Supply of PP chemicals to all the paddy growers	HH/ Nos	250	0.50
	Irrigation water shortage	Irrigation channel Development	Construction of irrigation channel in Yarpheling and Sangaythang chiwogs	Kms	20	20.00
	Wild life conflict	Crop protection intervention	Construction of chainlinked along with solar fencing in Sangaythang chiwog	kms	8	11.00
	Farm Labour Shortage	Farm Mechanisation	Supply of farm machineries	Nos.	50	20.00
	Conflict in farm mechanisation	Land Development	Terrace consolidation	Acres	50	2.00
Dairy	Frequent outbreak of diseases	Animal health management intervention	Mass animal vaccination and disease control programme	Nos.	700	1.00
			Supply of medicine	Set	200	0.50
	Feed and fodder shortage	Feed and fodder development	Fodder development and fodder land development	Acre	10	0.50
			Supply of fodder seeds and seedlings	HH	130	0.50

	Poor quality cattle breed	Cattle breed improvement	Supply of improved jersey and Holstein Friesian breed	Nos.	100	1.00
	Low milk production	To enhance clean milk production	Supply of dairy shed materials	Nos.	100	2.00
			Procurement of milking machine	Nos.	5	0.50
			Training and awareness program in clean milk production	HH	100	1.00
	Lack of CFC gas reduction from dairy farming	Green energy production	Supply of latest biogas equipment	HH	30	0.50
Areca Nut	Irrigation Shortage	Irrigation development	Installation of drip irrigation in 5 chiwogs	Acres	50	2.00
	Wild life conflict	Crop protection intervention	Construction of high voltage fencing in three chiwogs	Kms	24	1.50
	Poor soil fertility	Soil fertility management	Hands on training on preparation of biochar, bokashi and compost	HH	250	0.15
Vegetables	Non availability of hybrid seeds.	Quality seed supply	Supply of hybrid seeds to all chiwogs	Pkts	6000	2.00
	Pest and diseases outbreak	Protected Cultivation Technology	Purchase and supply of poly house	Set	70	7.00

	Lack of climate mitigation measures	Greenhouse automation	Introduction of automated dip set irrigation in the green house	Nos	35	2.00
	Lack of processing facilities	Packaging and Value addition	Procurement of packaging machine and introduction of value addition unit	unit	1	2.00
Poultry	Frequent outbreak of diseases	Improvement of bio security measures	Provide Chain linked fencing to poultry farms (layer and Broiler)	HH	10	7.00
		Animal health management intervention	Strategic disease monitoring and awareness	HH	20	0.20
	Low Egg Production	Egg Production enhancement	Poultry shed enhancement to poultry farmer	HH	8	2.00
			Supply of DOCs	Nos	40000	1.40
			Supply of Packaging materials to poultry farmers	HH	5	0.70
			Supply of Debeaking and defeathering machine to poultry farmers	HH	15	1.00
	Heat stress in poultry	Heat Stress management	Supply of heat reduction equipment	HH	20	0.50
Oranges	Low yield	Orchard Management	Citrus canopy management	Acres	30	3.00
			Hands on training on disease management	HH	250	0.10

	Pest and diseases outbreak	Pest and Disease management	Supply of PP chemicals	HH	250	0.10
Piggery	Low Production	Pork Production enhancement	Supply of piggery shed materials	No	7	0.70
			Support farmers with feed	No	30	1.00
			Supply of piglets	No	100	0.70
	Disease outbreak	Disease management	Awareness on swine disease and management practices	HH	25	0.10
	Lack of clean meat production facilities	Strategic market planning	P2P and B2B talk with the local and intra dzongkhag marketers	Nos.	20	0.10
		Introduce clean meat production facilities	Awareness on clean meat production to the piggery farmers	Nos.	30	0.15
			Supply of Swine stunning machine, Scalding machine and evisceration machines	Nos.	4	1.00
			Vacuum Packing for better marketing and procurement of deep freezing and blast freezer	Nos.	1	2.00
Maize	Low yield	Quality seed supply	Improved maize variety seed supply to all chiwogs	Kg	5000	2.50
		Soil nutrient management	Farmers training on FYM and bio-compost making in all chiwogs	HH	80	0.70

	Lack of product processing and value addition	Product processing and market linkage interventions	Supply of corn flake machine at Yarpheling centre	Nos.	10	12.00
			Supply of shelling machine	Nos.	80	0.50
			B2B meeting with FCBL and traders	Nos.	10	0.30
Turmeric	Low yield	lack of quality seeds	Supply of quality seeds	Kgs	7000	0.50
	outbreak of pest and diseases	Pest and Disease management	Supply of PP chemicals	Nos.	1400	0.10
	Lack of processing facilities	Packaging and Value addition	Procurement of grinder machine, packaging machine and introduction of value addition unit	Nos.	1	1.00
Ginger	Low yield	lack of quality seeds	Supply of quality seeds	Kgs	7000	0.50
	Outbreak of pest and diseases	Pest and Disease management	Supply of PP chemicals	Nos.	1400	0.10
	Lack of storage facilities	No storage infrastructure	Construction of storage house in every chiwog	Nos.	5	2.00

10.9 Agriculture Resilience Plan for Serzhong Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Paddy	Pest and diseases outbreak	Pest and diseases management	Awareness and advocacy on Pest and diseases management to all chiwogs	HH	200	0.50
	Low yield	Quality input supply interventions	Supply of improved seed	KG	200	0.10
	Poor soil fertility	Soil Nutrition management	Composting and capacity building	Nos.	200	0.50
	Irrigation water shortages	Water management	Pipe irrigation provisions	Nos.	50	1.00
	Lack of post-harvest facilities	Post harvest management	Supply of Post harvest packaging materials	Nos.	200	0.90
	Labour shortage	Farm mechanization	Supply of milli power tiller and grass cutter.	Nos.	100	11.00
	Wild animal conflict	Crop protection intervention	Chain link fencing support/ Electric fencing	Nos.	2	15.00
	Limited access to market	Improvement of market access	Market linkage development and conduct B2B	Nos.	4	1.00
Dairy	Outbreak of diseases	Animal health management	Animal health awareness and advocacy to farmers of all chiwogs	HH	200	0.50

	Low production cattle breed	Breed improvement	Sex sorted semen	Acres	25	0.20
	Climate impact on dairy farming	Climate smart dairy management	Supply of high yielding breed	Nos.	150	2.50
			Supply of medicines	Set	100	0.25
			Build climate smart sheds	Nos.	10	5.00
Seedless lime	Low yield	Quality input supply	Supply of high yielding varitey seed	Nos.	2835	0.90
	Poor soil fertility	Soil nutrition management	Farmers training on soil nutrient management	HH	405	1.00
	Pest and diseases outbreak	Pest and diseases management	Awareness and advocacy on pest and diseases management to all chiwogs	HH	405	0.50
	Lack of irrigation water	Water management	Farmers capacity building	HH	200	0.50
			Supply of water management materials	HH	200	0.50
	Lack of post-harvest facilities	Value addition and product diversification intervention	Supply of post-harvest and packaging materials (crates)	Nos.	405,000	2.00
	Limited access to market	Improvement of market access	Market linkage development and conduct B2B meetings	Nos.	4	1.00

	Wild animal conflict	Crop protection intervention	Chain link fencing support/ electric fencing	Nos.	2	15.00
Areca nut	Pest and diseases outbreak	Pest and diseases management	Awareness and advocacy on pest and diseases management to all chiwogs	HH	405	1.00
	Low yield	Quality input supply	Supply of improved seed	Nos.	405	15.00
	Poor soil fertility	Soil nutrition management	Composting and capacity building	HH	405	1.00
	Lack of irrigation water	Water management	Improvement of pipe irrigation, mulching.	Nos.	405	20.00
	Lack of post-harvest facilities	Value addition and product diversification intervention	Supply of post-harvest packaging materials	Nos.	405	1.00
	Labour shortage	Farm mechanization	Supply of grass cutter.	Nos.	200	22.00
	Wild animal conflict	Crop protection intervention	Chain link fencing support/ Electric fencing	Nos.	5	22.00
	Limited access to market	Improvement of market access	Market linkage development and conduct B2B	Nos.	4	1.00
Ginger	Pest and diseases outbreak	Pest and diseases management	Awareness and advocacy to farmers of all chiwogs	HH	405	1.00
	Low yield	Quality input supply	Supply of high-yielding variety seed	Nos.	2835	0.90

	Less soil fertility	Soil Nutrition management	Farmers training on soil nutrient management	HH	405	1.00
	Lack of irrigation water	Water management	Farmers capacity building	HH	200	0.50
			Supply of water management materials	HH	200	0.50
	Lack of post-harvest facilities	Value addition and product diversification intervention	Supply of post-harvest packaging materials (crates)	Nos.	405,000	2.00
	Labour shortage	Farm mechanization	Supply women-friendly machines	Nos.	30	42.00
	Limited access to market	Improvement of market access	Market linkage development and conduct B2B	Nos.	4	1.00
Betel leaf	Pest and diseases outbreak	Pest and diseases management	Awareness and advocacy to farmers of all chiwogs	HH	405	1.00
	Low yield	Quality seed supply	Supply of high yielding variety seed	Nos.	2835	0.90
	Poor soil fertility	Soil nutrition management	Farmers training on soil nutrient management	HH	405	1.00
	Lack of irrigation water	Water management	Farmers capacity building	HH	200	0.50
			Supply of water management materials	HH	200	0.50
	Lack of post-harvest facilities	Packaging materials	Supply of post-harvest packaging materials (crates)	Nos.	405,000	2.00

	Limited access to market	Improvement of market access	Market linkage development and conduct B2B	Nos.	4	1.00
Vegetables	Pest and diseases outbreak	Pest and diseases management	Awareness and advocacy on pest and diseases management to all chiwogs	HH	405	1.00
	Low yield	Quality seed supply	Supply of improved seed	Nos.	405	15.00
	Poor soil fertility	Soil nutrition management	Composting and capacity building	HH	405	1.00
	Lack of irrigation water	Water management	Improvement of pipe irrigation, mulching, green house.	Nos.	405	20.00
	Lack of post-harvest facilities	Value addition and product diversification intervention	Supply of Post harvest packaging materials	Nos.	405	1.00
	Labour shortage	Farm mechanization	Supply of milli power tiller, grass cutter.	Nos.	100	11.00
	Wild animal conflict	Crop protection intervention	Chain link fencing support/ Electric fencing	Nos.	3	20.00
	Limited access to market	Improvement of market access	Market linkage development and conduct B2B	Nos.	4	1.00
Poultry	Outbreak of diseases	Bio-security management & disease control	Chain link fencing support	HH	10	1.50
	High-cost DoC	Input supply on subsidy	Supply of DoC Layer & Broiler	Nos.	10000	2.24

	Low quality of Products	Maintain quality products	Supply of drip freezer, quality Packaging material.	HH	10	0.50
Piggery	Diseases outbreak	Animal Health management	Awareness, Advocacy and mass vaccination	HH	10	0.50
	High-cost inputs	Subsidy on inputs	Improve piglets supply on subsidy	Nos.	200	5.60
	Poor farm bio-security	Bio-security management	Chain link fencing support, Shed construction support	HH	10	1.50
Coffee	Pest and diseases outbreak	Crop protection intervention	Awareness and advocacy to farmers of all chiwogs	HH	405	1.00
	Low yield	Quality seed supply	Supply of high yielding variety seed	Nos.	2835	0.90
	Poor soil fertility	Soil nutrition management	Farmers training on soil nutrient management	HH	405	1.00
	Lack of irrigation water	Water management	Farmers capacity building	HH	200	0.50
			Supply of water management materials	HH	200	0.50
	Lack of post-harvest facilities	Value addition and product diversification intervention	Supply of post-harvest packaging materials (crates)	Nos.	405,000	2.00
			Construction process unit	Nos.	1	2.00
Mung bean	Pest and diseases outbreak	Crop protection intervention	Awareness and advocacy to farmers of Pemaling and Norbuling chiwogs	HH	232	0.50

	Low yield	Quality seed supply	Supply of high yielding variety seed	KG	1000	4.00
	Poor soil fertility	Soil nutrition management	Farmers training on soil nutrient management	HH	232	0.50
	Lack of irrigation water	Water management	Farmers capacity building	HH	232	0.50
			Supply of water management materials	HH	232	1.00
	Lack of post-harvest facilities	Value addition and product diversification intervention	Supply of post-harvest packaging materials and harvesting machine	Nos.	2	20.00
			Market linkage development and conduct B2B	Nos.	4	1.00
	Labour shortage	Farm mechanization	Supply of grass cutter.	Nos.	232	10.00
	Wild animal conflict	Crop protection intervention	Chain link fencing support/ Electric fencing	Nos.	2	20.00
Black pepper	Pest and diseases outbreak	Crop protection intervention	Awareness and advocacy to farmers of all chiwogs	HH	405	1.00
	Low yield	Quality seed supply	Supply of high yielding variety seed	Nos.	2835	0.90
	Poor soil fertility	Soil nutrition management	Farmers training on soil nutrient management	HH	405	1.00
		Water management	Farmers capacity building	HH	200	0.50

	Lack of irrigation water		Supply of water management materials	HH	200	0.50
	Lack of post-harvest facilities	Value addition and product diversification intervention	Supply of post-harvest packaging materials (crates)	Nos.	405,000	2.00
			Market linkage development and conduct B2B	Nos.	4	1.00

10.10 Agriculture Resilience Plan for Shompangkha Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Dairy	Fodder shortage	Fodder Development	Fodder development through seed supply in available land	Kgs	1500	2.00
			Silage preparation	Nos.	5	1.50
			Proper treatment and storage of paddy straw	HH	150	1.50
			Total Mixed Ration (TMR) formulation training using locally available resources	HH	150	2.00
			Chaff cutter machine supply	Nos.	100	2.50
	Limited land holding for fodder development	Climate smart fodder development	Hydroponic fodder development	Nos.	5	2.50
			Training on this new technology	HH	150	1.50
	Inferior cattle breed	Improve cattle breed through cross breeding	Supply of improve semen including sex-sorted semen	Nos.	1000	1.00
			Train CAIT and Extension Supervisor	HH	60	1.00
			Annual bull sterilization camp to nature scrub bull to curb inbreeding	Nos.	100	2.00
			Estrus synchronization program	Nos.	500	2.00
			LN2 storage tank	Nos.	4	1.00

			Purchase of potable AI can	Nos.	3	3.00
	Lack of proper climate smart sheds	Improve cattle sheds	Construction of climate smart sheds with proper drainage and high celling	Nos.	200	2.00
			Supply of milking machine	Nos.	300	4.00
			Construction of latest bio-gas technology	Nos.	20	2.00
	Animal diseases outbreak	Disease prevention and prophylaxis measure	Annual FMD, BQ & HS vaccination, LSD vaccination program,	Nos.	1200	3.00
			Supply of medicine on time (eco-parasite, deworming)	Nos.	500	3.00
			Supply of cow mat to reduce foot rot and improve welfare	Nos.	1500	2.00
			Supply of basic medicine	Set	100	2.00
			Disease awareness program	HH	300	1.00
	Lack post harvest facilities in the existing MPUs	Enhance collection and processing of milk	New construction or maintenance of existence MPU	Nos.	1	4.00
			Supply of milk collecting Can	Nos.	50	2.50
			Milk analyzer supply	Nos.	4	2.00
			Freezer for storage supply	Nos.	4	3.00
			Sale outlet/counter construction	Nos.	1	2.50

			Milk collection center at Kencholing & Rigsumgang	Nos.	1	2.50
			Procurement of collection milk van	Nos.	2	3.00
			Raw milk storage tank supply	Nos.	5	3.00
			Supply of milk churner/cream separator	Nos.	5	2.00
			Supply yogurt cup	Nos.	1500	2.00
			Supply of sealing machine	Nos.	4	2.00
			Supply of vacuum packaging machine	Nos.	3	1.00
			Supply of water storage tank	Nos.	2	2.00
			Supply vacuum packaging plastics	Nos.	5000	1.50
Piggery	Shortage of piglets	Enhance piglet production	Increase contract piglet breeding farm	Nos.	5	3.00
			Tran pig farmers on handling of farrowing and piglets	HH	80	2.00
	Disease outbreak	Enhance biosecurity	Chain-link or barbed wire fencing	Nos.	30	5.00
		Sign board display	Install sign board display to caution passerby	Nos.	30	1.50
	Enhance AI services	Improve breed and piglets' production	Procure high quality semen	Nos.	1000	2.00

	Storage facilities	Enhance pork quality	Supply deep freezer	Nos.	10	3.00
			Transporting van procurement	Nos.	2	3.00
	Lack of proper climate smart sheds	Improve shed and amenities	Proper construction of shed with drainage and faces collection	Nos.	50	3.50
			construct separate shed for different category (piglets, fattening, farrowing, breeding shed)	Nos.	50	3.50
			Water storage tank (high pressure water using water pump)	Nos.	25	2.00
			New technology Bio-gas construction	Nos.	10	1.50
			Construction of proper feed store	Nos.	10	1.50
			Supply of chaff cutter machine	Nos.	50	2.00
	Lack of capacity of LES and CAIT	Capacity building interventions	Train CAIT farmer on AI	Nos.	20	2.00
			Train LES staff on AI	Nos.	20	2.50
Poultry (layer)	Shortage of DoC/pullet	DoC/Pullet production enhancement	Initiate DoC production center	Nos.	1	4.00
	Lack of climate smart shed	Climate smart shed development	Construct climate smart sheds with well ventilation	Nos.	30	3.00
			Egg collection center/aggregation center	Nos.	1	1.50

			Water storage tank for auto drinker	Nos.	20	2.50
	Disease outbreak	Enhance bio-security measures	Chain-link fence or barbed wire fencing	Nos.	10	2.50
			Biological pit construction	Nos.	30	1.50
			Foot-dip and vehicle dip construction	Nos.	30	1.50
			Procurement of freezer at RNR-center for vaccine storage	Nos.	2	2.00
Broiler	Shortage of broiler DoC	DoC production	Initiate Broiler DoC production unit	Nos.	1	4.00
	Lack of climate smart shed	Climate smart shed development	Improve Existing shed into climate smart farm	Nos.	25	3.00
			Install sprinkle machine to reduce heat stress	Nos.	50	2.00
			Installation of water storage tank for duto drinker and sprinkler	Nos.	30	2.00
	Lack of proper cold storage	Cold storage	Install deep freezer	Nos.	5	2.50
	Disease outbreak	Bio-security establishment	Chain-link/barbed wire fencing	Nos.	20	3.00
			Construct basic biosecurity measures	Nos.	20	1.50
			Construct biological pit	Nos.	15	1.50
			Install sign board display to caution passerby	Nos.	30	1.00

Vegetables	Lack quality seed	Quality input supply	Supply of hybrid seeds (tomato, onion, chili, cauliflower, beans)	Pkts	15400	3.50
	Water shortage	Waters Management	Install drip irrigation,	HHs	105	1.00
			water source protection	Nos.	8	1.00
	Lack of post harvest management & market access	Post harvest and market linkages	Supply of electric dryer	HHs	30	2.00
			Linkage with GMC, Gyelsung, schools, and vegetable dealer.	HHs	50	0.50
	Labour shortage	Mechanized farming	Mechanized farming (bed making with mulching machine,	Nos.	5	5.00
			Supply of weeder, mulching plastic and bush cutter	Nos.	5	1.00
	Un productive land	Land development	Terrace consolidation	Acres	50	2.00
	Crop depredation by wildlife	Crop protection intervention	Electric fencing	km	12	18.00
			Green net fencing	km	12	2.00
	Low yield	Soil fertility management	hand-on training on Bio char, compost, bokashi preparation.	HH	404	0.20
		Climate smart production	Green house automation	Nos.	20	6.00
	Pest and disease outbreak	Pest and disease management intervention	Supply of PP Chemicals	Nos.	2100	1.00
Ginger	Low yield	Quality input supply	Procurement of quality seeds	Kgs	7000	0.50

	Pest and disease outbreak	Crop protection intervention	Supply of PP Chemicals	Nos.	2100	1.00
Mandarin	Pest and disease outbreak	Pest and disease management intervention	Supply of PP chemicals	Nos.	2100	1.00
	Low yield	Orchard management	Citrus orchard management (canopy, IPM, nutrient and water management)	Acres	23	3.00
	Lack of quality planting materials	Quality input supply	Supply of disease-free seedlings in Gomchula and Rigsumgang.	acres	23	5.00
	Labour shortage	Farm mechanization	Procurement of farm machineries with all equipment	set	2	5.00
Paddy	Out break of pest and disease	Pest and disease management intervention	Supply of PP chemicals	Nos.	2100	1.00
	Difficulty in farm mechanization	Land Development	Terrace consolidation	Acres	50	3.00
	Wild life conflict	Crop protection intervention	Construction of chain-link fencing	km	5	8.00
	Irrigation water shortage	Improve water management	Renovation of lower phurpaling irrigation channel	km	2	2.10
			Renovation of jaisi Kholsi Irrigation channel	km	0.4	1.00

			Maintenance of upper phurpaling irrigation channel	km	3	50.00
			Water source protection	Nos.	8	1.00
Areca nut	Irrigation water shortage	Improve water management	Installation of drip irrigation	Sets	500	3.70
			Reservoir tank	Nos.	3	2.00
			Water source protection	Nos.	8	0.80

10.11 Agriculture Resilience Plan for Tareythang Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Dairy	Lack of superior cattle breed	Breed improvement intervention	Supply of improved cattle breeds (jersey cow and sex sorted semen)	HH	30	3.00
	Feed and fodder shortage	Feed and fodder development	More varieties of fodder supply, like Ruzi, Stylo and Gutimalla winter Oat	Acre	200	1.00
			Fodder conservation. Silage, straw treatment and Silo pit, Fencing of pasture field in all chiwog	HH	100	2.00
	Frequent outbreak of diseases	Animal health management	Awareness and advocacy to farmers on diseases, Mass vaccination campaign in whole Gewog	HH	100	1.40
	Lack post-harvest equipment	Post harvest and processing intervention	Supply of 10,20 and 30l size of churning machine in all chiwog	Nos.	20	0.80
	Lack of labour	Farm mechanization	supply of good quality chopper machine to all chiwog	Nos.	20	1.00
Millet	Lack of irrigation water	Climate smart water management	Proper support on distribution of irrigation material (sprinklers) of all chiwog	Sets	200	

	No quality seeds	Supply of Hybrid seeds	Supply Quality seed to farmers of all chiwogs	Kg	10000	1.50
Ginger	Lack of quality planting materials	Quality input supply	To provide quality seedling to farmers of all chiwogs	kg	20000	1.00
	Pest and disease infestation	Crop protection intervention	Provide hands on training to farmers on manufacturing bio pesticides in all chiwogs	HHS	90	0.07
	Water shortage during dry season	Water management intervention	Supply drip irrigation sets	Sets	50	4.00
Mango	High pest and diseases	Crop protection intervention	Farmers to be supply repellent sets and fruits protective nets in all chiwogs	Sets	300	0.70
	Poor seedling Quality	Quality input supply	All the farmers to be supply grafted seedling in all chiwogs	Nos.	500	0.50
Vegetables	Water shortage	Water management intervention	Support on distribution of drip, sprinkler and water harvesting facilities to all chiwog	Sets	300	2.00
	Labour shortage	Farm mechanization	Based on CSM, quality of women Mini tillers to be procured and supply to all Chiwog	Sets	30	3.00

	Lack of quality seeds	Quality input supply intervention	Commercial farmers to provide high yield seeds in all chiwogs	Pkts	50	1.50
Coffee	Lack post-harvest equipment	Product processing and value addition	Well set up structure at Pemacholing chiwog for aggregation and processing	Nos.	1	7.00
	Low quality saplings	Supply high quality saplings	Supply quality saplings to all chiwog and nearby Gewogs	Nos.	10000	0.50
Lemon	Less knowledge on orchard Management	Provide advocacy and capacity development on Orchard management	To provide hand on Trainings on orchard management (canopy management, ipm water and nutrient management)	HH	100	0.25
	No proper irrigation equipment	Procure quality irrigation materials	Farmers to supply drip irrigation sets and sprinkler to all growers	sets	50	0.80
Maize	Pest and diseases infestation	Supply of pest repellent set	All farmers to be support with pest repellent and control sets	sets	300	0.40
	Lack of quality seed	Procure high yielding varieties	Farmers to be supply seeds qualities without any impurities and quality in all chiwog	kg	7000	0.40

Piggery	Frequent outbreak of disease	Awareness and Advocacy	Awareness and advocacy to farmers on diseases, Mass vaccination campaign in whole Gewog	HSHs	10	0.05
	High cost of piglets	Supply of improve Piglet	Piglets to be supply in subsidy support in CSM	Nos.	100	0.60
	Poor Farm Bio security	Construction of improve shade	Shade support to farmers in CSM / support with chain link fencing	Nos.	10	3.00
Paddy	High infestation by vertebrate's pest	Supply of poly wire electric fencing	Supply of Electric fencing in paddy cultivating area i.e. Yoezergang and Tashichholing	Sets	2	3.00
	lack of irrigation supply	Construct new irrigation channel	Construct the new pipe irrigation scheme in Yoezergang and Tashicholing Chiwog	Nos.	4	6.00
Poultry (Layers)	Frequent outbreak of diseases	Awareness and Advocacy	Awareness and advocacy to farmers on diseases, Mass vaccination campaign in whole Gewog	HHs	10	0.70
	No medical services	Timely supply of medicine	Need to provide good extension services and medicine in Yoezergang and Tashichholing Chiwog	sets	500	1.00

	Low market lingkage	Proper market lingkage requried	Farmers of Yoezergang and Tashicholingsupport with market Lingkage in school, institution and farm gates with workshops	Nos.	10	0.30

10.12 Agriculture Resilience Plan for Umling Gewog

Livelihood Activity	Challenges	Key Investment area	Strategic Action	Unit	Proposed Target	Budget (M)
Vegetables	Outbreak of pest and diseases	Pest and diseases management	Advocacy/Awareness/ training on pest and disease management to all chiwogs	HH	514	0.50
			Procurement of pesticides and equipment's	Set	25	0.50
		Quality input supply	Supply of Quality Seed	Set	200	0.50
	Water shortage	Irrigation water management	Proper Design and layout, and Procurement of drip, pipes, storage tanks, water sprinklers, water pump.	HH	25	0.50
	Labor shortage	Farm mechanization	Procurement of mini tillers, vaccum packaging, dryer	Nos.	15	1.50
	Lack of market	Processing and value addition	Construction of pack house, purchase of cleaning machines, weighing machines, packaging materials	Nos.	1	4.50
Dairy	Outbreak of diseases	Animal health management intervention	Animal health awareness, training and advocacy to all chiwogs	HH	200	0.20
			Supply of medicine and vaccine	Nos.	1000	0.50
	Feed and fodder shortage	Feed and fodder development	Fodder development in Dangling, Tashithang, Rejung, Dungmin, Gaden	Acre	70	0.50
			Winter fodder development	Acre	100	0.50
			Hydroponic fodder development	HH	200	0.50
			Fodder Chuff cutter machine	Nos.	70	2.10
			Hay conservation	Tones	100	0.20
			Feed grinder and mixer supply	Sets	2	1.50
			Silage production for winter feeding in all chiwogs	HH	70	0.50

	Lack of post-harvest and processing equipment	Product processing and value addition	Purchase of cleaning machines, weighing machines, packaging materials	Nos.	1	1.00
	Lack climate smart cattle housing	Construction of climate smart dairy shed	Supply CGI sheets, bricks, cements, irons	Nos.	35	0.70
	Poor quality cattle breed	Cattle breed improvement	Cattle outsourcing	Nos.	70	0.70
			Procurement of AI equipment and semen	Nos.	400	0.50
			Water supply	Nos.	70	1.00
			Ear tagging of Progenies	Nos.	200	0.10
Maize	Pest and diseases	Pest and Diseases Management	Strengthening pest and diseases management practices	HH	514	0.50
	Soil fertility and nutrient management	Soil health and nutrient management	Promoting soil health and nutrient management practices (soil testing, access to high quality organic fertilizers, educating/training farmers on sustainable soil practice), and Farmers Training on FYM and compost making practices in all chiwogs	HH	200	0.20
	Labor Shortage	Mechanization and equipment	Promoting cooperatives farming and shared services	Sets	15	1.50
Lemon	Climate sensitivity and water requirement	Distribution of Improved verities to farmers, training on the best practices for growing these varieties	Training farmers on the characteristics and best management practices for managing climate-resilient seedlings and rootstocks at chiwog levels	HH	250	0.50

	Pest and diseases outbreak	Investment on the climate-resilient and drought tolerant verities.	Advocacy/Awareness/ training on pest and disease management and IPM Solutions to all chiwogs	HH	250	0.50
	Labor Shortage	Farm mechanization	Labor-saving mechanization and automation	Sets	25	0.20
	Water scarcity and irrigation need	Irrigation water management	Drip and sprinkle irrigation, and rain water harvesting	Sets	25	0.20
Paddy	Shortage of water	Irrigation water management	Construction the new irrigation scheme at Rijook and Dungmin	Nos.	2	0.50
	Shortage of labor	Mechanization and affordable equipment	Labor-saving mechanization, promoting cooperatives farming and shared services at chiwog levels	Sets	25	0.30
	Outbreak of pest and diseases	Pest and diseases management	Advocacy/Awareness/ training on pest and disease management to all chiwogs	HH	150	0.10
	Crop depredation by wildlife	Improve crop protection	Adopting chain-link fencing at all Chiwogs	Nos.	5	2.50
Millet	Pest and diseases outbreak	Pest and diseases management	Supply of improved varieties and quality seed supply	HH	150	0.10
	Low yield	Soil nutrient management	Providing Framers training on adopting FYM and compost making at chiwogs level	HH	150	0.20
	Lack of market	Processing and value addition	Construction of pack house, purchase of cleaning machines, weighing machines, packaging materials	Nos.	1	4.50

Black Pepper	Pest and diseases outbreak	Pest and Diseases Management	Supply of improved varieties, awareness/ training program	HH	150	0.10
	Low yield	Soil and nutrient management	Providing Framers training on making FYM and bio-compost at chiwog levels	HH	150	0.20
	Increase in cost of sapling	Supplementary on sapling varieties	Supply of high quality of sapling varieties to all the chiwogs.	HH	150	0.10
Ginger	Low yield	Quality seed supply	Supply of Improved Varieties	Kg	5000	0.10
		Soil nutrient management	Framers training on making FYM and bio-compost at chiwog levels	HH	150	0.10
	Pest and diseases outbreak	Pest and diseases management	Supply Improved Varieties and Quality seed	Pkts	1000	0.10
Turmeric	Low yield	Quality seed supply	Adopting improved Varieties	Pkts	1000	0.10
		Soil nutrient management	Framers training on making FYM and bio-compost at chiwog levels	HH	150	0.20
	Pest and diseases outbreak	Pest and diseases management	Supply Improved Varieties and Quality seed	HH	150	0.10
Poultry	Frequent outbreak of diseases	Animal health management intervention, Bio-security	Animal health awareness, training and advocacy to farmers of all chiwogs	Nos.	10	0.10
			Supply of Debeaking Machine, medicine and vaccine	Nos.	5	0.15
	Heat stress	Construction of Smart poultry sheds	Supply of fans, CGI sheets, bricks, cements.	Nos.	5	2.50

	Lack of quality inputs	Supplying quality inputs	Supply of standard feeders and drinkers, doc and pullets	Nos.	100	0.20
	Lack of proper packaging, processing and storage facilities	Standard packaging and storage	Supply of plastic/paper trays with cartoon and needed deep frizzier, abaitors and defeathering for chicken production.	Nos.	1000	0.50
	Shortage of water	Water supply interventions	Supply 30mm pipes, labour charge, water sockets and etc..	Set	5	0.50
Piggery	Frequent outbreak of diseases	Animal health management intervention, Bio-security	Animal health awareness, training and advocacy to farmers of all chiwogs	Nos.	5	0.05
			Supply of medicine and vaccine	Nos.	100	0.10
			Supply of chain-link fencing and construction of foot dip to all the farm.	Nos.	5	2.50
	Lack clean meat production facility	Improve technology (Slaughtering, packaging & storage)	Supply of stun gun	Nos.	2	0.10
	High cost of feed	Low-cost feed production intervention	Supply equipment for processing low-cost feed	Nos.	5	0.30
	Lack of climate smart shed	Climate smart pig Sheds development	Supply CGI sheets, bricks, cements, irons and etc. for climate smart piggery shed construction	Nos.	5	2.50
	Shortage of water	Improving water supply	Supply 60mm pipes, labour charge, water sockets and etc..	Set	5	0.50
Bettle leaf	Pest and diseases outbreak	Pest and Diseases Management	Supply of improved varieties, equipments, awareness/training at Tashithang	HH	1	0.10

	Lack of post-harvest and processing equipment	Processing and value addition	Construction of pack house, purchase of cleaning machines, weighing machines, packaging materials	Nos.	1	2.50