Project Endline Survey Report

Ministry of Agriculture and Livestock
Wengkhar, Mongar, Bhutan

June 2025

Commercial Agriculture & Resilient Livelihoods Enhancement Program (CARLEP)
Ministry of Agriculture and Forests

IFAD
Investing in rural people

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Acknowledgement

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Abbreviations

ARDC	Agriculture Research Development Centre
ASAP	Adaptation for Smallholder Agriculture Programme
BAIL	Bhutan Agro Industries Limited
CARLEP	Commercial Agriculture and Resilient Livelihoods Enhancement Programme
DAMC	Department of Agricultural Marketing and Cooperatives
DSF	Debt Sustainability Framework grant
FCBL	Food Corporation of Bhutan Limited
FDGs	Focus Group Discussions
HHs	Households
IFAD	International Fund for Agricultural Development
KIIs	Key Informant Interviews
KIL	Koufuku International Limited
M&E	Monitoring and Evaluation
MTR	Mid Term Review
NPSC	National Programme Steering Committee
PCR	Project Completion Report
PMO	Project Management Office
PPD	Policy and Planning Division
PSU	Primary Sampling Units
RAMCO	Regional Agricultural Marketing and Cooperatives Office
RGoB	Royal Government of Bhutan
RLDC	Rural Livestock Development Centre
RNR	Renewable Natural Resource
RPIC	Regional Programme Implementation Committee
SRSWOR	Simple Random Sampling Without Replacement
SSU	Secondary Sampling Units
USD	US Dollar
WDDS	Women Dietary Diversity Score
WHO	World Health Organization

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Executive Summary

The Commercial Agriculture and Resilient Livelihoods Enhancement Programme (CARLEP) funded through International Fund for Agricultural Development (IFAD) aims to facilitate the transformation of a subsistence-based rural agricultural economy into a sustainable value chain and market driven productive sector by promoting climate informed approaches in agriculture and strengthening capacities of communities and local institutions. The project started in December 2015 and premeditated to complete in December 2022 but in 2019 additional finance was approved and the completion date has been extended to December 2025 with the revised budget allocation of US$ 25.6 million. The programme aimed to support 28,975 households in Lhuentse, Mongar, Pemagatshel, Samdrup Jongkhar, Trashigang and Trashiyangtse Dzongkhags. Its goal was to sustainably increase smallholder income and reduce poverty through commercialization of production. The objective was to increase returns to smallholder farmers through climate-resilient production of crops and livestock products in nationally organized value chains and marketing systems. The two prong approaches are commercialization of vegetable value chain and Dairy Value Chain with climate resilient promotion in the programme area.

The survey covered a total of 916 HHs against the sample size of 900 HHs comprising of 59.5% women (545 respondents) and 40.5% men (371 respondents).

Key findings

Demography details:

Among the Dzongkhags, Lhuentse had a total of 92 respondents, with 68.5% women and 31.5% men, Mongar with 250 respondents with 70.4% women and 29.6% men, Pemagatshel 149 respondents with 54.4% men and 45.6% women, Samdrup Jongkhar 149 with 51.7% men and 48.3% women, Trashigang 184 respondents with 55.4% women and 44.6% men while Trashiyangtse had 92 respondents with 69.6% women and 30.4% men.

In terms of head of the households, there is almost equal representation of men and women as represented by 50.76% men (465 households) and 49.24% women (451 households). Out of the total responses 92.14% are married, 3.60% single, 2.18% divorced and 2.07% widowed. In terms of educational background, 62.64% have no formal education, 13.19% have received non-formal education, 1.91% have pursued religious studies, 8.58% have primary education, 13.28% have secondary education, 0.07% have certificate level and 0.34% have tertiary education.

Household settings:

The majority of households (40.17%) consist of 3–4 persons, followed by 33.52% with 2 persons while the larger households with 5–6 members make up 16.92% and only 3.60% of households have more than 6 members. On the other hand, single-person households are minimum comprising of just 5.79%. In terms of actual people available for agricultural works, 57.42% reported of having 2 persons available, 20.41% with 3–4 persons and 19.43% are having single persons. In terms of household assets, most prevalent are Rice/Curry Cooker represented by 99.24% (baseline 95.9%) followed by Water Boiler (90.39%), Electronics (89.08%), and TV (77.84% from 69.2% as per baseline) and then the Refrigerators (75.00% increased from 40.8% baseline). Further, joint ownership by both men and women is highest such as livestock 72.93%, farm machinery and equipment 55.35%, and finance 59.39%. However, men have higher ownership than women such as electronics 32.64%, assets 30.90%, and farm machinery 29.26% but women's ownership is most

prominent in land with 41.59% slightly surpassing men. The proportion of households residing in concrete structures (stone or brick walls) with shingle roofs has increased significantly from 1.4% at baseline to 22.71%, reflecting notable progress in housing quality. Similarly, concrete (stone or brick wall) with CGI roof houses have also increased from 8.8% during baseline to 11.24% now representing improvement in their livelihood.

For the livestock ownership, almost all of the household's own livestock as represented by 98.58%. Among the Dzongkhags, Lhuentse, Mongar, Pemagatshel, and Trashiyangtse reported almost 100% of the respondents' owning livestock with the higest in Samdrup Jongkhar by 98.66% and Trashigang by 94.02%. Even in terms of cattle sheds, most households' do own either improved (42.79%) or conventional/traditional (41.59%) ones which were also increased from the baseline.

Fodder cultivation was also supported by the project with improved fodder over 191.93 acres of land and winter fodder to 70.5 acres of land. Among the Dzongkhags, highest are the Samdrup Jongkhar with over 73.88 acres and Pemagatshel with 62.72 acres for improved fodder while for winter fodder, again Samdrup Jongkhar has over 28.23 acres. In terms of fodder conservation, highest is Trashigang with 67,740 kgs and the lowest is Lhuentse with 500kgs.

Access to irrigation facility:

Overall, 70.74% of the respondents have access to proper irrigation facility while 29.26% lack such access. Among the Dzongkhags, Samdrup Jongkhar, Trashigang and Trashiyangtse have higher coverage of irrigation facility with 75% or more and other Dzongkhags have coverage of over 67%. Overall, 48.15% of the respondents reported that irrigation support has not reduced water shortages while 42.13% feels partially reduced the issue and only 9.72% feels it has significantly alleviated water scarcity on their farms.

The irrigation support has led to varying degrees of production increase across project Dzongkhags where Mongar reported the highest in production across various crops such as fruits (27.35%), cereals (27.29%), and vegetables (27.29%) and Trashigang follows with increase of 20.13% in fruits and 20.09% in both cereals and vegetables. Pemagatshel and Samdrup Jongkhar each recorded increase of 16.3% and 16.1% across all types of crops.

As per the type of irrigation system, pipe networking systems are most common in Pemagatshel (27.67%) and Samdrup Jongkhar (23.12%), followed by Mongar (22.33%) and Lhuentse (11.46%). Drip irrigation is used more in Mongar (30.56%) and Lhuentse (27.78%), while Trashiyangtse shows a notable share (22.22%). Water storage or reservoir tanks are prevalent in Samdrup Jongkhar (28.07%) and Pemagatshel (24.56%), while Sprinkler systems are highly used in Mongar (52.63%), followed by Pemagatshel and Samdrup Jongkhar.

Land under irrigation:

Overall, 53.82% of the households do not have land under irrigation such as Pemagatshel (97.32%) and Samdrup Jongkhar (85.91%). However, proportion of households with very small irrigated plots (<0.25 acres) is highest in Trashigang (31.52%) and Trashiyangtse (27.17%), while Mongar stands out with relatively more households owning 0.25–0.5 acres (25.20%) under irrigation. Lhuentse has about 30.43% of the households with 0.25-0.5 acres of land under irrigation. Larger irrigated land holdings of 1.1–2 acres and above are limited excepting few pockets in

Trashiyangtse and Lhuentse with 9.78% and 8.7% respectively. In addition to that, a total of 96.34 acres of fallow land were brought under cultivation with the support of irrigation from the project.

Production:

In terms of vegetable production, three Dzongkhags of Lhuntse, Mongar and Pemagatshel are the highest producers with 97% to 99% of the households' growing vegetables. Lowest was Trashigang with 89.67% of the households' growing vegetables. In 2024, there is notable growth of vegetable production such as potatoes of 458,737kg from 181.3 acres with the income generation of Nu. 8.88 million, followed by 92,463kg of chilli from 165.99 acres generating income of Nu. 5.05 million and 45,126kg of beans from 86.69 acres earning income of Nu. 1.47 million. The lowest production was asparagus over an area of 1.36 acres, producing 1,238 kg but was able to generate income of Nu. 27,400. Among the fruits, the highest production was mandarin with 67,928 kg from 32.04 acres and earned income of Nu. 2.48 million. This is followed by areca nut and cardamom production of 83,541kg and 5,476kg earning income of Nu. 3.56 million and Nu. 3.71 million respectively. On the other hand, avocado is a high value fruit which has generated Nu. 927,200 from selling just 6,232kg. In terms of cereals, maize is the most grown product cultivated over 836.6 acres, producing 517,064.2 kg and were able to earned Nu. 2.94 million. This is followed by rice earning an income of Nu. 1.27million from production of 501,388kgs from 433.5 acres. Other cereals like quinoa, wheat, buckwheat, and mustard etc. were produced in minimum quantities.

In terms of dairy production, milk is the highest contributor with over 658,000 litres produced earning Nu. 25.35 million from the sale of 377,765 litres fetching on average unit price of Nu. 67.08 per litre in 2024. Butter also recorded a high unit price of Nu. 350.50 per kg, earning Nu. 7.14 million from 20,389 kg sold despite smaller production, cheese production of 279,058 balls fetched a unit price of Nu. 46.03 per ball, generating nearly Nu. 11.64 million. In the poultry sector, eggs saw a substantial production of nearly 195,000 dozen, with sales of over 181,000 dozen earning Nu. 3.97 million, fetching on average of Nu. 1.83 per egg. Production of both vegetables as well as dairy products have increased from the baseline stage.

Market:

With regard to access to market information through smartphones, only about 36% of respondents reported being able to access such information while 64% are not. However, the actual use of information in making investment decisions is limited since only 25.33% of respondents reported using the information while 74.67% are not. The sources of information vary by location and reflect a mix of traditional and modern platforms such as Radio and BBS TV are most common in areas like Mongar (40.78% radio, 27.14% BBS TV) and Trashigang (30.10% radio, 22.73% BBS TV), while social media platforms such as Facebook (38.71% in Pemagatshel, 29.44% in Samdrup Jongkhar), WeChat (31.20% in Mongar, 30.90% in Pemagatshel), WhatsApp (33.02% in Pemagatshel, 25.00% in Trashigang), and Telegram (30.41% in Pemagatshel, 21.63% in Mongar) are increasingly used. Peer-to-peer communication is significant in Trashigang (34.55%) and Lhuentse (25.45%), reflecting strong informal networks. Additionally, agriculture extension centers play a crucial role in Samdrup Jongkhar (66.67%) and Mongar (33.33%) but are not used in Lhuentse, Trashigang, or Trashiyangtse.

The primary market for vegetables is the local markets within a short vicinity of the villages makes about 51.05% in Mongar, 13.50% in Lhuentse, and smaller proportions in other Dzongkhags. Thromde markets are significant in the case of Mongar (53.54%) and Trashiyangtse (23.62%). Aggregators or contract buyers dominate in Mongar (58.77%), followed by Trashigang (13.60%) and Lhuentse (7.89%). Other markets such as schools, monastic institutions or project offices also make a major share as in Trashigang (29.45%) and Mongar (37.45%). For the dairy products, Mongar shows a stronger reliance to the KIL (Chenery) facility by 63.64% of the households followed by use of middlemen by 55.50% while Samdrup Jongkhar stands out to be the highest exporter of milk to India as reported by 88.89%.

Sources of income:
The sources of income across Dzongkhags varies with the highest total income from the sale of vegetables amounting to over Nu. 11.16 million in Mongar, followed by Trashigang and Trashiyangtse with Nu. 3.06 million and Nu. 2.52 million respectively. Livestock dairy products generate substantial income totaling to more than Nu. 31.67 million (Pemagatshel Nu. 10.05 million, Mongar Nu. 9.82 million). While income from cereals is comparatively lower, with Mongar leading at Nu. 1.75 million, and Trashigang and Trashiyangtse showing moderate earnings. Salary earnings are highest in Samdrup Jongkhar, amounting to Nu. 4.38 million, indicating more formal employment engagement of those rural farmers. Sale of egg contributes to over Nu. 3.54 million with significant contributions from Samdrup Jongkhar and Pemagatshel. Cash crop income totals to nearly Nu. 18.6 million, mainly from Samdrup Jongkhar and Mongar Dzongkhags. Other sources of income contribute over Nu. 12.3 million with major contributions from Pemagatshel and Samdrup Jongkhar. Enterprise income totals to over Nu. 4.28 million, mainly concentrated in Pemagatshel and Samdrup Jongkhar. The sources of income has increased from vegetables and dairy products as compared to baseline survey.

Technology adoption:
As per the agriculture practices, crop rotation (731) and double cropping (584) are the most common, followed by use of local seeds (602), improved seeds (504), manure application (669), fertilizer application (365), plain dry land cultivation (439), wet land cultivation (287), pasture cultivation (245) and ridge (bed) cultivation (263). However, in the case of livestock production technologies, there is improved cattle shed (228) followed by bio-gas use (161), clean milk production (136), improved fodder grass plantation (183).

In terms of adoption of agricultural production technologies, most widely adopted are the sprinklers (199) followed by soil and water management (176) and greenhouse or poly-tunnel usage (170), plant protection (142) reflecting awareness of pest and disease control including new vegetable production techniques (135) and composting (98). In contrast, adoption of post-harvest technologies (34), farm mechanization and land development (33), and orchard management (42) are implemented less.

Support for environmentally sustainable and climate-resilient technologies and practices, Lhuentse received the most by 63.04% followed by Mongar with 61.60%. In contrast, Samdrup Jongkhar (7.38%), Trashigang (11.41%), Pemagatshel (13.42%), and Trashiyangtse (17.39%) have lesser exposure or support. Overall, only 30.57% of respondents across all dzongkhags received support on environmentally sustainable and climate resilient technologies and practices.

Producer groups or enterprises:
Among the Dzongkhags, the highest percentage of members of the farmer's group are from Mongar, Pemagatshel and Samdrup Jongkhar ranging from 42.95% to 48.80%. The lowest group members are from Trashigang with 22.28% followed by Lhuentse with 28.26%. In total, about 393 individuals are engaged in various group activities consisting of 176 in dairy groups, 143 in vegetable groups, and 74 participating in both. Mongar accounts for the highest number of individuals engaged in various groups. However, only 31.66% are currently functional while 62.34% are not. Among the dzongkhags, Mongar and Pemagatshel reported the highest number of functional groups by 42.4% and 41.61% respectively while Trashigang and Trashiyangtse shows the lowest functionality of the groups with over 71% reported as non-functional. The non-functionality of these groups can be attributed to a range of structural, environmental, and organizational challenges such as poor group management, lack of coordination, often compounded by insufficient cooperation and misunderstandings among group members. Several groups also reported limited or no access to markets, with concerns ranging from lack of traders and marketing channels to increased competition from new vegetable markets and reduced customer demand.

On the other hand, joining groups provided a range of benefits such as improvement in financial position, production enhancement, and market access. Overall, 287 individuals reported financial benefits, 276 reported improvements in production, and 271 noted marketing-related gains.

Trainings:
In terms of training activities, 44% reported having participated while 56% are not where Mongar and Lhuentse recorded the highest participation rates, with 69.6% and 64.1% respectively. Trashigang and Trashiyangtse showed moderate levels of engagement, with participation rates of 38.0% and 41.3% respectively. The most commonly attended training was in Vegetable Production (176 participants), Sprinkle Irrigation (128 participants) and Dairy Development (119 participants), Bio-gas (109 participants), Improved Cattle Shed construction (106 participants), and Greenhouse and Poly-tunnels (103 participants) among others.

Source of energy:
As per the respondents, only 21.83% have a biogas plant while 78.17% do not. Among the dzongkhags, Samdrup Jongkhar reports the highest rate of biogas adoption at 32.89%, followed by Mongar at 29.60%. Among the functional users, about 20.5% use in between 30 minutes to 1 hour on daily basis. Most of the biogas plants are non-functional as reported by 51.5%. Highest non-functionality of bio-gas was reported from Trashiyangtse with 75% followed by Pemagatshel with 62.96% and the lowest was from Trashigang. Most problems are with the minimum gas production from biogas due to insufficient dung, gas stove problem itself and poor equipment design along with lack of skilled operator.

After adopting biogas, households reported a noticeable reduction in the use of several traditional fuels. Firewood saw the largest average reduction, with 34.92% less usage, Liquified Petroleum Gas (LPG) usage declined by 28.04%, electricity consumption reduced by 20.37%, and kerosene use dropped by 16.67%.

Drudgery reductions:

Drudgery reduction interventions have reached varying levels of adoption. Biogas adoption played a key role in reducing the workload related to cooking and fuel collection. Chaff cutters ease the process of fodder preparation such as Pemagatshel with the highest adoption by 32.89%. Overall, 64.68% of respondents reported saving 0–1 hour, followed by 24.88% who saved 1–2 hours, and 5.47% reported saving of 2–3 hours. A small proportion, 4.98%, experienced reductions of more than 4 hours.

Utilization of various other interventions:

The use of greenhouses has brought diverse benefits such as 70.54% in Trashigang shows the ease of farming followed by Samdrup Jongkhar with 46.04% as well as on convenience by 33.17% and Pemagatshel with 48.38% on ease of farming. In terms of dry land irrigation, Mongar shows the highest for self-sufficiency by 27.58%, cultivation of various crops and vegetables by 55.20%, utilization of barren land by 24.01% and enhancement of production by 23.70%. Pemagatshel also reported high levels for utilization of barren land by 22.64% and enhancement of production by 23.70%.

Similarly, benefits of dry land irrigation have shown leading to self-sufficiency by 27.51% in Mongar along with cultivation of various crops and vegetables by 34.36%, utilization of barren land by 41.29% and enhancement of production by 15.87%. Among other Dzongkhags, Pemagatshel reported enhancement of production by 33.79%, Samdrup Jongkhar for utilization of barren land by 30.97%, Trashigang for enhancement of production by 24.26% and self-sufficiency by 20.33%. In the case of benefits of wet land irrigation, Trashigang and Trashiyangtse shows the highest for self-sufficiency by 39.70% and 21.49%, enhancement of land utilization by 35.54% and 31.93%, enhancement of production by 36.72% and 31.07%, and cultivation of various crops or vegetables by 27.15% and 24.89%. It is followed by Mongar for self-sufficiency by 22.39%, cultivation of various crops and vegetables by 25.34% and enhancement of production by 15.87%.

Among the utilization of other facilities, Trashigang uses majority of the facilities such as collection store by 35.29%, irrigation channel by 35.96%, milk collection shed by 35.35% and milk processing center by 34.83%. This is followed by Pemagatshel for utilization of milk collection shed by 32.79%, milk processing center by 34.83%, milk collection center by 28.40% and irrigation channel by 22.91%. In the case of Mongar, the highest was for dry land irrigation by 30.92% and milk collection center by 30.86%.

Nutrition:

Overall, 52.72% of households produced cereals for their own consumption where Mongar and Lhuentse produce the highest with 86.80% and 78.26% respectively while Pemagatshel (14.09%) and Samdrup Jongkhar (6.71%) are the lowest. In terms of vegetable production, overall production is 89.48% for family consumption where Lhuentse and Mongar are the major producers with 97.83% and 98.40% respectively while Samdrup Jongkhar is lowest with 75.17%. For the dairy production, 71.83% produced dairy products for self-consumption. The highest dairy producers for self-consumption are Mongar and Lhuentse with 95.60% and 93.48% respectively while Pemagatshel and Samdrup Jongkhar are lowest with 55%.

Over the past 12 months, the vast majority of households across the six dzongkhags reported no difficulty in having three meals a day. On average, 98.8% of households did not face any food insecurity while only 1.2% experienced some difficulty.

The nutritional assessment of children aged 0–5 years based on WHO growth standards indicates generally good health and growth status. Only 3.4% of the children are stunted (height-for-age below -2 SD), with none being severely stunted (below -3 SD), and the mean height-for-age z-score is 0.0, suggesting normal linear growth. In terms of weight-for-age, 6.7% of children are underweight, though none fall below the severe threshold of -3 SD, with a slightly negative mean z-score, indicating minor deviation from the standard.

Overall average WDDS for women across the surveyed areas was 5.94, suggesting that on average, women consumed food from nearly six different groups, reflecting a moderately diverse diet. However, district wise variations were observed such as Pemagatshel with the highest WDDS at 7.91, followed by Samdrup Jongkhar (7.18), Lhuentse (5.76), Mongar (5.61), Trashigang (5.25), and Trashiyangtse (4.63) and Trashiyangtse (4.63).

Recommendations:

Access to irrigation

Presently only about 70.74% have access to proper irrigation system and there are still about 29% to be covered with the irrigation system to boost agriculture production. Even in terms of various types of irrigation system that has been implemented by the project, the coverage differs from place to place such as surface or open irrigation system, drip irrigation, storage system, pipe irrigation system, sprinklers etc. However, all these types of irrigation system are being used by only about 22% to 27%. As the irrigation system in the country is undergoing significant changes to enhance climate resilience and improve water management- particularly for smallholder farmers through retrofitting of existing systems with climate-resilient technologies such as pressurized piped systems and solar-powered lift irrigation. It is important to coordinate with various ongoing projects to further expand irrigation coverage, ensure a more reliable water supply, increase agricultural productivity, and support sustainable livelihoods in the face of climate change.

Land for cultivation:

Majority of land holdings are small where most agricultural activities are concentrated in land below 2 acres. For instance, 57.22% of total dry land cultivated and 86.68% of total wet land cultivated fall within the range of 0–2 acre. Upland rice and cardamom cultivation are particularly concentrated in very small land holdings of 0.25 acres to about 78.93% and 81.22% households respectively. As per the 13th Five-Year Plan, the emphasis is on transforming the agrifood sector for economic growth and sustainable development by enhancing productivity, diversifying markets and products, and fostering inclusive economic growth. Thus, there is a need for optimum utilization of agricultural land as well as to allocate some of the un-utilized government land for agriculture development. In this case, there is a need to coordinate with various responsible agencies to further bring about a change in the land utilization for agriculture with proper plans for agriculture productivity enhancement in future projects.

Livestock production:

It was found that only about 20% to 30% of the respondents own various types of livestock such as local cattle owed by only 40%, improved cattle by about 34%. The priority of the government on livestock sector is to enhance food security, improve rural livelihoods and sustainable natural resource management. This objective will be possible only through improving livestock production, enhancing feed quality, expanding breeding programs, and promoting efficient farming practices. While CARLEP has made notable progress in improving dairy production through the enhancement of the dairy value chain, survey findings indicate that further efforts are needed to address remaining gaps and strengthen the sector. Accordingly, there is a need to further enhance milk production, improve milk quality and diversify dairy products to strengthen market opportunities and meet evolving consumer demands.

Agriculture production:
As compared to baseline information of the project, production of vegetables, fruits and cereals have shown significant improvement such as rice from 15,026kgs in 2015 to 501,388 kgs in 2024, maize production from 45,566kgs in 2015 to 517,064kgs in 2024. Similarly, potato production has increased from 16,067kgs in 2015 to 458,737kgs in 2024. However, in line with the priority of the government to transform the country's agri-food systems from deficit to surplus through improved agricultural practices, promotion of organic farming and increased exports. It is important to further strengthen agricultural practices, develop infrastructure for agriculture production, and introduce high end agriculture products for export.

Access to market:
The distribution of agriculture and dairy products varies across the eastern dzongkhags, where most producers prefer to sell within the community, to Dzongkhag markets, schools and institutions, or directly to the traders. However, only small section is sold outside the country that too only by few Dzongkhags. Majority of the households sell milk to KIL (Chenery) with the guaranteed continuous demand from the KIL. Thus, in order to improve and expand market for agriculture and dairy products, there is a need to introduce various post-harvest processing units for value addition and diversification of products. It is also important to plan for supply of vegetables and dairy products to nearby cities like the Gelephu Mindfulness City and Smart City coming up in Guwahati in India.

Since KIL is the major player in the diary value chain in eastern Bhutan, it is important for KIL to plough back some incentives to the farmers for long term sustainability of the value chain. The option will be to increase milk flow to the plant by KIL’s investment to cow leasing program. At least 30-40% of the net profit from the business operation should be reinvested into procurement of Dairy Cows and Leasing Dairy Cows to farmers through special cost sharing mechanism and recover cost through monthly installment basis from the milk. This new approach of investment will ease farmer’s limited access to credit from the financial institutions.

Adopt, adapt and scale up of technologies:
The project has brought about lot of changes in the adoption of various climate resilience technologies including innovative technologies for both agriculture and dairy value chain. However, there is a need to scale up those technologies to larger beneficiaries and actors in the agriculture and dairy value chain. Climate change is impacting all works of life mainly to agriculture and farming where the government is trying to promote climate-resilient agricultural

practices to mitigate the impacts of climate change due to rising temperatures, erratic rainfall, and increased frequency of extreme weather events. These efforts include enhancing water management, promoting drought-tolerant crops, improving land management, and diversifying the crops. Accordingly, various climate resilient interventions need to be scale up by collaborating with various programmes or upcoming projects to further enhance agriculture and livestock sectors.

Sustainability of project interventions:

Project has undertaken to establish various value chain infrastructure or facilities in the communities such as market sheds, market outlets, milk collection centers, milk processing units etc. However, there is no clarity on operation and management of these facilities. Accordingly, there is a need to draw clear responsibility and ownership of these facilities with proper handing or taking over notes between the parties as well as to work out proper operation and management of these facilities for long term sustainability of the infrastructure.

Even the equipment or mechanization supplies provided to the farmers or groups, farmers or beneficiaries are not aware of critical spare parts including repair and maintenance. Accordingly, there is a need to impart training on repair and maintenance of those equipment and mechanization tools.

On the other hand, even those who have undergone various trainings in agriculture, vegetable production, land management or dairy production require periodic refresher courses to remain relevant and keep pace with the evolving technologies and management practices.

1. Introduction

The Commercial Agriculture and Resilient Livelihoods Enhancement Programme (CARLEP) funded through International Fund for Agricultural Development (IFAD) aims to facilitate the transformation of a subsistence-based rural agricultural economy into a sustainable value chain and market driven productive sector by promoting climate informed approaches in agriculture and strengthening capacities of communities and local institutions.

The Project started in December 2015 and premeditated to complete in December 2022 but in 2019 additional finance was approved and the completion date has been extended to December 2025. The revised budget allocation for the project was US$ 25.6 million. The programme aimed to support 28,975 households in Lhuentse, Mongar, Pemagatshel, Samdrup Jongkhar, Trashigang and Trashiyangtse Dzongkhags. Its goal is to sustainably increase smallholder income and reduce poverty through commercialization of production. The objective was to increase returns to smallholder farmers through climate-resilient production of crops and livestock products in nationally organized value chains and marketing systems. The two prong approaches are commercialization of vegetable value chain and Dairy Value Chain with climate resilient promotion in the programme area. The programme focused on increased agricultural production and makes a basic shift in approach towards marketing and climate resilient farming practices. Its goal was to sustainably increase smallholder farmers' income and reduce rural poverty.

The programme expected to benefit 28,975 smallholder households (HHs), of which 7,115 HHs would directly benefit from vegetable and dairy value chains. Although CARLEP project got extended till December 2025 through the additional funding of IFAD-II, the overall goal and objectives remain unchanged except for some incorporations of entrepreneurship development through diverse agricultural activities. The main implementing partners were six Dzongkhags & concerned Gewogs, Regional Agricultural Marketing and Cooperatives Office (RAMCO), Agriculture Research and Development Centre (ARDC) Wengkhar, Regional Livestock Development Centre (RLDC) Kanglung and Koufuku International Limited (KIL) Chenery, Trashigang.

In line with the programme objective, the implementation of a two-pronged approach has been adopted – i) Commercial or value chain approach to be focused in those Gewogs and village with high production & market potential and ii) Targeted interventions in those far-flung Gewogs and villages having higher incidences of poverty. The overall programme implementation was being coordinated by the Office of Programme Management (OPM) based at Wengkhar. The OPM is supported and guided by the National Programme Steering Committee (NPSC) at the national level and Regional Programme Implementation Committee (RPIC) at the regional level. The programme was also supported by one focal officer at the Policy and Planning Division (PPD) and one focal accounts officer at the Administrative and Finance Division (AFD) of the Directorate Services in liaising with the RGoB and other external agencies at the national level.

The total programme cost of US$ 31.526 million, over seven years, was financed by - IFAD (US$9.3 million), ASAP (US$ 5 million), RGoB (US$5.767 million), Beneficiaries (US$ 0.659 million) and a financing gap (USD 6 million). In addition, an IFAD has approved additional

financing of US $10.28 million as loan and US$ 1.0 million as Debt Sustainability Framework Grant (DSF).

2. Project context

The goal was to sustainably increase smallholder producers' incomes and reduce poverty through commercialization of production by programme households. The key impact indicators at the goal level were:

a) 5,336 household beneficiaries reporting at least 25% improvement in household asset as compared to baseline (disaggregated by HHs-head gender)
b) 15% reduction in the prevalence of child malnutrition as compared to baseline
c) More than 23,180 smallholder households supported in coping with the effects of climate change

The objective of the Project is to increase returns to smallholder farmers through climate resilient production of crops and livestock products in nationally organized value chains and marketing systems. The key impact indicators at the development objective level are:

a) Addition of 1,500 tons of vegetables, 452 tons of rice/maize and 3 million litres of milk in programme areas
b) Develop vegetable value chain and scaled-up nation-wide
c) Develop dairy value chain and scaled-up in the six eastern dzongkhags
d) Rehabilitation or restoration of ecosystem services to more than 32,000 hectares of land

The project has four programme components as summarized below:

Component 1: Market led Sustainable Agricultural Production (USD 17.34 million): The Market led Sustainable Agricultural Production would lead to sustainable increase in resilient agricultural production by rural households. The three outputs are: i) increased production resilience and diversification in agriculture, ii) intensification and expansion of vegetable production by rural households, and iii) expansion of dairy production by rural households.

Component 2: Value Chain Development and Marketing (USD 11.6 million): Component 2 focuses on instituting organized value chains and marketing systems by establishing networks of farmer groups to facilitate marketing of vegetable and dairy products to enhance smallholder incomes. FCBL to develop market-led value chains, provide physical agricultural marketing services and with the support of Dzongkhag RNR sectors, identify and put in place required value chain infrastructure. DAMC to develop marketing groups and cooperatives while Dzongkhag RNR sectors to support in production activities in value chains in the dzongkhags and provide necessary assistance to DAMC and FCBL to identify potential locales of production to set up necessary market infrastructure in villages.

Component 3: Institutional Support and Policy Development (USD 0.526 million)

Component 4: Programme Management: Important functions of programme management to include gender mainstreaming, monitoring & evaluation and knowledge management. The key M&E functions which includes conducting baseline survey, vulnerability assessment, endline

survey, annual outcome surveys, RIMS, MTR, PCR and special studies besides coordinating for IFAD's supervision and implementation support missions.

The project has four expected outcomes as shown below:

Outcome 1: Resilient agricultural production by rural households has sustainably increased. Challenges remain to make farming a source of robust and resilient rural livelihoods and to achieve national food security. The key production related outputs and activities to achieve Outcome 1 are:

a) Output 1.1 Production resilience in agriculture increased and agriculture production diversified-support promotion of integrated agricultural production and management.
b) Output 1.2 Vegetable production increased through expansion and intensification of vegetable production by smallholder households.
c) Output 1.3 Dairy production increased through expansion and intensification of dairy production in the six eastern dzongkhags to ensure adequate volumes and quality standards of milk are produced by smallholder dairy farmers to ensure the development of a sustainable dairy value chain.

Outcome 2: Increased smallholder income from crop and livestock value chains

a) Output 2.1 Resilient vegetable and dairy value chains development will be supported where FCBL will take the lead to develop value chains and marketing system in coordination with the CARLEP PMO.
b) Output 2.2: Commercial farming expanded and new farm enterprises developed by supporting groups and enterprises that work along the vegetable and dairy value chains, such as in terms of input supply, production, processing, and marketing.
c) Output 2.3: Community driven market infrastructure developed by creating value chain infrastructure at the local community level, such as village storage houses, cold stores, small trucks, market sheds, etc. to be owned and managed by communities, farmers' groups/ cooperatives or small entrepreneurs.

Outcome 3: Strengthened Agricultural Institutions and Policies for Improved and Resilient Agricultural and Marketing Practices. Climate resilient farming practices require collaboration and proactive communication between various stakeholders, including farmers, researchers and policy makers. Success of value chains, similarly, depends on collaboration and proactive information exchange between the players in the chain. Such practices require an institutional culture that fosters collaboration, legitimizes participatory approaches to engaging with farmers and values partnerships with the private sector.

a) Output 3.1 Value chain and marketing knowledge and communication strengthened by capturing and documenting knowledge and good practice from programme implementation, especially related to climate resilience, value chain and market development.

b) Output 3.2: Climate resilience and value chain development lessons mainstreamed in agricultural policies and sector strategies

Indicators	End target	Achievement
Outreach		
Household members	141,562	153,905
Women-headed households	14,486	16,015
Non-women-headed households	14,486	16.988
Persons receiving services promoted or supported by the project	110,053	102,566
a) Male	55,000	51,115
b) Female	55,053	51,115
c) Young people	2,000	1,255
Outcome		
6,000 HH adopt sustainable agricultural practices	6,000	10,602
Output 1		
≥ 23 000 (of which 50% are women) smallholder HH supported in coping with the effects of climate change with sustainable land management practices	23,000 (11,500 females)	10,444 (6,266 females)
Output 2		
300 new vegetable farmer groups (4,500 HH) established and functional; minimum 60% female members	300	152
Output 3		
150 Smallholder Dairy Farmer Groups (450 HH) established and functional, with minimum 50% female members	150	100
Outcome		
70% of the agricultural enterprises established have a positive outlook on their profitability and sustainability	70%	
Supported rural enterprises reporting an increase in profit (no. of enterprises)	140	151
Output		
65 gewogs have developed climate resilient vegetable and dairy production, marketing, and infrastructure management plans	65	60
200 agriculture enterprises (including cooperatives) established and strengthened as part of value chain development	200	170
Other productive infrastructure constructed/rehabilitated	1000	581
People in groups managing productive infrastructure **(**male/female)	2,500/2,000	3227/2491
Groups managing productive infrastructure formed/ strengthened	30	64
Crop/Livestock production groups formed/strengthened	30	48
People trained on land management practices (Male/Female)	1000/1000	687/556
Supported rural producers that are members of a rural producers' organization	3,337	9187
Market, processing or storage facilities constructed or rehabilitated	111	115
Farmland under water-related infrastructure constructed/ rehabilitated	1,922 Ha	1898 Ha

Land brought under climate-resilient practices	3000 Ha	3242.71 Ha
Output		
Vegetable and dairy value chain processing and marketing infrastructure designed and constructed in 10 dzongkhags		115
Outcome		
≥ 70% of VC stakeholders report the use of market information in investment decision-making 60% of VC stakeholders report satisfaction with the policy and regulatory framework as providing a fair distribution of incentives, costs, benefits, and risks		
Households reporting adoption of environmentally sustainable and climate-resilient technologies and practices	20,283	19,707
Households reporting a significant reduction in the time spent for collecting water or fuel	8,693	2,478
Households reporting reduced water shortage vis-à-vis production needs		2603
Poor smallholder household members supported in coping with the effects of climate change (males/females)	57,500/57,500	72,763/71,475
Households supported with increased water availability or efficiency	10,000	8,916
Individuals engaged in NRM and climate risk management activities	30,000	33,003
Community groups engaged in NRM and climate risk management activities	65	329
Output		
Persons trained in income-generating activities or business management	9671	9460
Persons provided with climate information services	5000	1657
Rural producers accessing production inputs and/or technological packages		48186
Persons accessing technologies that sequester carbon or reduce greenhouse gas emissions	5000	3708
Government officials and staff trained (male/female)	180/80	291/61

3. Purpose

The objective was to carry out End Line Survey for Commercial Agriculture and Resilient Livelihoods Enhancement Programme (CARLEP) which covers six Dzongkhags-Lhuentse, Mongar, Pemagatshel, Samdrup Jongkhar, Trashigang and Trashiyangtse. The Programme targeted selected gewogs in six eastern Dzongkhags with high production and marketing potential in the selected value chains expected to benefit 28,975 smallholder households, of which 7,115 households would directly benefit from vegetable and dairy value chains. However, the project has gone beyond and covered almost all gewogs in eastern Bhutan.

4. Methodology

The study involved mixed of qualitative and quantitative methods. The quantitative part is carried out through the conduct of cross-sectional survey to sampled households covering the study domain (project areas) and the stakeholders. The qualitative part includes the Key Informant Interviews (KIIs) with relevant stakeholders. The details of the methodology are given below.

4.1 Data collection mode

The main respondents were the members of the households and individuals who were the beneficiaries of the project in the target Dzongkhags. The interviews were conducted through a structured, standardized questionnaire using Kobo tool box and hardcopy questionnaire interchangeably. Wherever, there were internet connectivity issues, the hardcopy questionnaires were administered for the data collection, which otherwise was done online. The hardcopy data gathered were eventually keyed into the system later. For the other stakeholders, key informant interviews were conducted to support the actual survey results.

4.2 Literature Review

The purpose of the literature review was to examine project concepts, project plans, guidelines and project documents to understand the project better, specifically those geared towards disaggregated data of respondents such as male, female, youths and persons with disabilities, economic activities such as farming and marketing, women empowerment in decision making etc. Desk review entailed a comprehensive review of existing documents (references provided at the end of the report) to assess current socio-economic status, youth engagement, issues related to women and their empowerment. Desk review was a vital part of the assessment through which we can understand the similar studies conducted in the past for reference.

4.3 Survey Questions

A semi-structured survey questionnaire was formulated during the inception phase and was deliberated in length in addition to the comments received from the members. The survey questions have undergone numerous changes before the finalization. The questions were finally validated and edited during the inception report presentation at CARLEP office, Wengkhar, Mongar. The survey questionnaires were uploaded in Kobo tool box to enable enumerators to collect data using smart phones and to ease data compilation. Even after the enumerator training, the survey questions were once again modified in some cases as per the convenience during the actual field survey.

4.4 Enumerator recruitment, training and piloting

The enumerators were recruited from the respective Dzongkhags of the project sites in order to build capacity of the local community and to provide direct benefits in the form of cash incentives. A day-long training was conducted for the survey enumerators in terms of understanding the concept of project terminologies, project scope and objectives. The enumerators were thoroughly trained in terms of details of the survey questions along with the aptitudes and method of conducting the survey professionally. Based on the training, piloting was done within one district to test the questionnaires. The piloting was also done among the enumerators to see convenience

of responding to each of the questions. Accordingly, few changes were made in some of the questions based on the findings of the pilot survey.

4.5 Field Surveys

Field surveys were conducted in the six Dzongkhags of project target areas viz. Lhuentse, Mongar, Trashigang, Trashiyangtse, Pemagatshel and Samdrup Jongkhar. The selected households in the targeted gewogs were approached after obtaining their consent for the interviews. Pre-test of the questionnaire had been carried out within the nearby villages in Mongar as well as among the enumerators to simply check the flow of the questions and skip patterns.

Trained enumerators conducted face-to-face interviews using a pre-developed interview questionnaires that encompassed various dimensions of project requirements from 7th April to 22nd May 2025. During the interviews, interviewers created comfortable and conducive environment to encourage open and honest responses. Probing techniques were employed to dive deeper into respondents' perspectives and experiences. Care was taken to respect the privacy and consent of the participants, and their responses were accurately recorded through note-taking and online Kobo tool box forms.

4.6 Data Analysis

The collected data underwent a systematic process of analysis where the data was exported to Excel spreadsheets to ensure accuracy and consistency. Subsequently, the data was exported to the Statistical Package for Social Sciences (SPSS version 17), a widely used software for statistical analysis. To provide a comprehensive understanding of the data, frequencies and percentages were calculated based on the responses received from the respondents, considering their gender as a differentiating factor. This enabled a gender-specific analysis of the data to identify any patterns or variations. Cross-tabulation, a statistical technique, was employed to explore potential associations between relevant variables and to uncover any significant relationships. To enhance the clarity and visual impact of the results, tables and graphs were used to present the findings in a clear and concise manner, making it easier for readers to comprehend and interpret the data effectively.

4.7 Limitations

There are several limitations in this study. Firstly, the number of target beneficiaries listed from the project records as per the household numbers were actually not present in the field (some deceased while others moved to various other places). This created confusion on the comparative analysis from the earlier baseline data. Secondly, there were attrition rates among the officials from Central Agencies, Associations and other agencies in the Dzongkhags and Gewogs. The officials who had knowledge about the project have already left the job or transferred to different locations without the replacement. Thus, during the process of conducting this study, some variations in the information provided by the respondents may have affected in the overall reliability and completeness of the information.

Despite these limitations, the study progressed with the cooperation of the field team to collect as much information as possible so as to provide essential information required for the analysis. However, future studies can address these limitations by implementing strategies to ensure a more balanced representation of participants considering the high attrition rate of the government officials in the regions along with the inclusion of broader range of stakeholders.

4.8 Sample design

A stratified cluster sampling procedure was adopted for the study. The 6 Dzongkhags were considered as strata. The Primary Sampling Unit (PSU) were the Gewogs and the Secondary Sampling Unit (SSU) were the household. The Gewogs were considered as Cluster and households as Sampling Units. The Gewogs per strata were selected randomly using the random number generators in Microsoft Office Excel. In each stratum or Dzongkhag, certain number of Gewogs or clusters were selected based on proportional allocation using simple random sampling without replacement (SRSWOR).

In total 33 clusters (Gewogs) were sampled using SRSWOR. The sample sizes for the household were obtained using the following sample size calculation formula.

$n_o = z2\ p\ (1-p)\ d/e2$

Where,
n_o = sample size
z = statistic that defines the level of confidence desired (1.96 for 95% confidence level)
p = an estimate of a key indicator to be measured by the survey (assumed to be 0.5)
d= the sample design effect, diff, assumed to be 1.5
e = precision level, +- 5%

For the purpose of this study, ‘project areas’ are the Gewogs covered by the project interventions. It was estimated that there are 28,795 beneficiaries of which 5,614 households are the direct beneficiaries. The households are spread over 6 Dzongkhags (Lhuentse, Trashiyangtse, Trashigang, Mongar, Pemagatshel and SamdrupJongkhar) as shown in the table below.

Table 1: Number of Gewogs reached by project

Dzongkhag	Gewogs	Gewogs reached
Trashigang	15	Merak, Sakteng, Khaling, Lumang, Thrimshing, Yangner, Bidung, Phongme, Radi, Samkhar, Shongphu, Bartsham, Kanglung, Ozorong, Kangpara
S/Jongkhar	11	Orong, Gomdar, Wangphu, Dewathang, Phuntshothang, Pemathang, Martshala, Samrang, Serthig, Lauri, Langchenphu
Pemagatshel	11	Shumar, Nanong, Chongshing, Zobel, Khar, Yurung, Chhimung, Dungmin, Dechheling, Norbugang, Chokhorling
Mongar	17	Shermung, Balam, Drametse, Chaskhar, Ngatshang, Tshakaling, Thangrong, Chhali, Mongar, Drepong, Tsamang, Saleng, Silambi, Gongdu, Kengkhar, Jurmey, Narang

T/Yangtse	8	Bumdeling, T/yangtse, Toetsho, Khamdang, Tomzhangtshen, Jamkhar, Ramjar
Lhuentse	8	Kurtoe, Khoma, Minjay, Tshenkhar, Jarey, Metsho, Menbi, Gangzur
Total	**70**	

Considering 5% non-response rate and based on the above formula, the sample size required was approximately 900 households in the project Gewogs. Out of 70 project Gewogs, 33 Gewogs or clusters were selected for the study with at least one project Gewog from each Dzongkhag with both dairy and vegetable value chain interventions. The selected number of sampled households were actually chosen among the beneficiaries listed as per the project record.

Table 2: Household sample size by Gewog

Dzongkhag (Project areas)	**Gewogs intervened by project (Nos)**	**Sample Gewogs (Nos)**	**Total households**	**Sample households**	**Sampled Gewogs**
Trashigang	15	6	9,078	180	Samkhar, Khaling, Kanglung, Merak, Radhi, Bartsham
S/Jongkhar	11	5	5,323	150	Phuntshothang, Dewathang, Langchenphu, Orong, Pemathang
Pemagatshel	11	5	5,902	150	Dungmin, Decheling, Yurung, Nanong, Norbugang
Mongar	17	8	8,327	240	Drametse, Drepong, Tshakaling, Mongar, Chhaskhar, Chhali, Narang, Saleng
T/Yangtse	8	3	5,056	90	T/Yangtse, Ramjar, Khandang
Lhuentse	8	3	5,034	90	Jarey, Khoma, Gangzur
Total	**70**	**33**	**38,720**	**900**	

5. General

5.1 Demographic characteristics

The survey comprised a total of 916 respondents across six eastern Dzongkhags of Bhutan: Lhuentse, Mongar, Pemagatshel, Samdrup Jongkhar, Trashigang, and Trashiyangtse. Of these, 59.5% were women (545 respondents) and 40.51% were men (371 respondents), indicating a higher female representation among the survey respondents.

Lhuentse had a total of 92 respondents, with 68.5% women and 31.5% men. Mongar, having the largest number of respondents (250), has a notable female majority, with 70.4% women and 29.6% men. Pemagatshel was one of the few Dzongkhags where men outnumbered women, with 54.4% men and 45.6% women out of 149 total respondents. Similarly, Samdrup Jongkhar showed a slightly higher male participation, with 51.7% men and 48.3% women among 149 respondents. Trashigang had 184 respondents, with a relatively balanced gender distribution but still skewed

slightly towards women at 55.4%, compared to 44.6% men. Trashiyangtse followed the general trend of female majority, with 69.6% women and 30.4% men among its 92 respondents.

Table 3: Respondents by gender

Dzongkhags	**Count and Percent**	**Gender of respondent**		**Total**
		Male	**Female**	
Lhuentse	% of total	3.17%	6.88%	10.04%
	Count	29	63	92
Mongar	% of total	8.08%	19.21%	27.29%
	Count	74	176	250
Pemagatshel	% of total	8.84%	7.42%	16.27%
	Count	81	68	149
Samdrup Jongkhar	% of total	8.41%	7.86%	16.27%
	Count	77	72	149
Trashigang	% of total	8.95%	11.14%	20.09%
	Count	82	102	184
Trashiyangtse	% of total	3.06%	6.99%	10.04%
	Count	28	64	92
Total	**Percentage**	**40.51%**	**59.50%**	**100.00%**
	Count	**371**	**545**	**916**

In terms of head of the households, men constituted 50.76% (465 households) and women 49.234% (451 households). Among the Dzongkhags, Lhuentse has 7.64% female-headed households (70) and 2.40% male-headed households (22) out of total of 92 households, representing higher women representation as head of households than men. Mongar has the highest number of female-headed households represented by 20.41% (187) compared to 6.88% men (63). Pemagatshel showed a reverse trend, with 11.35% male-headed households (104) against 4.91% female-headed (45) and is one of the Dzongkhag with a majority male headed households. Samdrup Jongkhar followed a similar pattern with 12.55% men headed households (115) compared to only 3.71% women headed households (34). Trashigang had the highest number of male-headed households with 13.21% (121) compared to 6.88% female-headed households (63). Trashiyangtse displayed a more balanced distribution, with 4.37% male-headed households (40) and 5.68% female-headed households (52).

Table 4: Head of the households by gender

Dzongkhags		**Count and Percent**	**Head of the Household**		**Total**
			Male	**Female**	
Lhuentse	Endline	% of total	23.91	76.09	100
		Count	22	70	92
	Baseline	% of total	31.8	68.2	100
		Count	27	58	85
Mongar	Endline	% of total	25.20	74.80	100
		Count	63	187	250
	Baseline	% of total	41.7	58.3	100

		Count	45	63	108
P/gatshel	Endline	% of total	69.80	30.20	100
		Count	104	45	149
	Baseline	% of total	68.5	31.5	100
		Count	61	28	89
S/Jongkhar	Endline	% of total	77.18	22.82	100
		Count	115	34	149
	Baseline	% of total	70.5	29.5	100
		Count	62	26	88
T/gang	Endline	% of total	65.76	34.24	100
		Count	121	63	184
	Baseline	% of total	52.6	47.4	100
		Count	70	63	133
T/Yangtse	Endline	% of total	43.48	56.52	100
		Count	40	52	92
	Baseline	% of total	52.8	47.2	100
		Count	28	25	53
Total	**Endline**	**Percentage**	**50.76**	**49.24**	**100**
		Count	**465**	**451**	**916**
	Baseline	**Percentage**	**52.7**	**47.3**	**100**
		Count	**293**	**263**	**556**

In terms of marital status of the respondents across six eastern Dzongkhags, majority are married along with relatively low proportions of single, divorced, and widowed. Out of the total responses 92.154% are married, 3.60% single, 2.208% divorced and 2.097% widowed. Mongar has the highest proportion of married respondents at 25.66% followed by Trashigang with 18.67%. While Samdrup Jongkhar and Pemagatshel has around 14.5% and 14.7% married respondents respectively. Trashiyangtse and Lhuentse are the lowest in terms of married as well as other categories of marital status.

Table 5: Marital status of respondents

Dzongkhags	Divorced	Married	Single	Widow	Grand Total
Lhuentse	0.11%	9.06%	0.76%	0.11%	10.04%
Mongar	0.33%	25.66%	0.98%	0.33%	27.29%
Pemagatshel	0.44%	14.74%	0.66%	0.44%	16.27%
Samdrup Jongkhar	0.55%	14.52%	0.76%	0.44%	16.27%
Trashigang	0.66%	18.67%	0.22%	0.55%	20.09%
Trashiyangtse	0.11%	9.50%	0.22%	0.22%	10.04%
Grand Total	**2.820%**	**92.154%**	**3.60%**	**2.097%**	**100.00%**

In terms of educational background of the household members, 62.64% were illiterate while a smaller group of 13.19% have received non-formal education and only 1.91% have pursued religious studies. In terms of formal schooling, 8.58% have primary education, 3.82% have higher

secondary and 9.46% middle secondary education indicating that about a quarter of the respondents have received at least basic formal education. Additionally, only 0.07% of the population have obtained certificate level, while 0.34% have tertiary education. This distribution highlights varying levels of educational attainment but majority are without any formal education followed by primary and secondary educational levels. This indicates that it is mainly the uneducated lot who are into farming activities and also the school dropouts who are unemployed and remains in the villages. Compared to baseline information on educational background of the household members, there is not much of difference but slight change in number of those without any formal education from 44.4% at the time of baseline to 62.64% at the endline. This can be due to youths leaving the villages either to urban areas or to abroad.

Table 6: Educational level of respondents

Dzongkhags		**Lhuentse**	**Mongar**	**P/gatshel**	**S/Jongkhar**	**T/gang**	**T/yangtse**	**Average**
No education	Endline	61.96	65.20	53.69	55.70	74.46	64.84	**62.64**
	Baseline	36.5	54.6	43.8	58.0	37.6	32.1	**44.4**
Non-formal	Endline	13.04	12.80	16.78	16.78	5.43	14.29	**13.19**
	Baseline	24.7	19.4	21.3	6.8	36.8	32.1	**23.9**
Certificate level	Endline	0.00	0.40	0.00	0.00	0.00	0.00	**0.07**
	Baseline	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Primary school	Endline	4.35	7.60	11.41	10.07	8.15	9.89	**8.58**
	Baseline	9.4	8.3	7.9	9.1	8.3	18.9	**9.5**
Higher secondary level	Endline	4.35	4.00	2.68	2.01	3.26	6.59	**3.82**
	Baseline	8.2	2.8	9.0	3.4	7.5	3.8	**5.9**
Middle secondary level	Endline	13.04	6.80	13.42	14.77	4.35	4.40	**9.46**
	Baseline	14.1	11.1	7.9	18.2	9.0	11.3	11.7
Monastic education	Endline	3.26	2.40	2.01	0.00	3.80	0.00	**1.91**
	Baseline	7.1	3.7	9.0	3.4	0.8	1.9	**4.1**
Graduate	Endline	0.00	0.80	0.00	0.67	0.54	0.00	**0.34**
	Baseline	0.0	0.0	1.1	0.0	0.0	0.0	**0.2**
Total		**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

In terms of age of the respondents, majority are women as compared to men among the productive age groups between 26 to 50 years. However, for those above 60 years, there are more men than women as shown in the figure below.

	Male	Female
Above 80	2	4
76-80	4	3
71-75	15	11
66-70	30	25
61-65	50	34
56-60	40	53
51-55	41	64
46-50	55	72
41-45	45	101
36-40	35	78
31-35	25	53
26-30	16	34
20-25	11	9
Below 20	0	4

Fig.1. Age of respondents

Samdrup Jongkhar accounts for the largest proportion of children aged 0–5 years amongst all Dzongkhags at 39.18%, followed by Pemagatshel with 22.68%. These two Dzongkhags account for more than 60% of those reporting children aged 0–5 years. Trashiyangtse and Trashigang have similar proportions of children aged 0-5years with 13.40% and 12.37% respectively. Although Mongar, having the highest total number of respondents, it accounts only for 10.31% of children aged 0–5 years while Lhuentse has the lowest proportion at 2.06%.

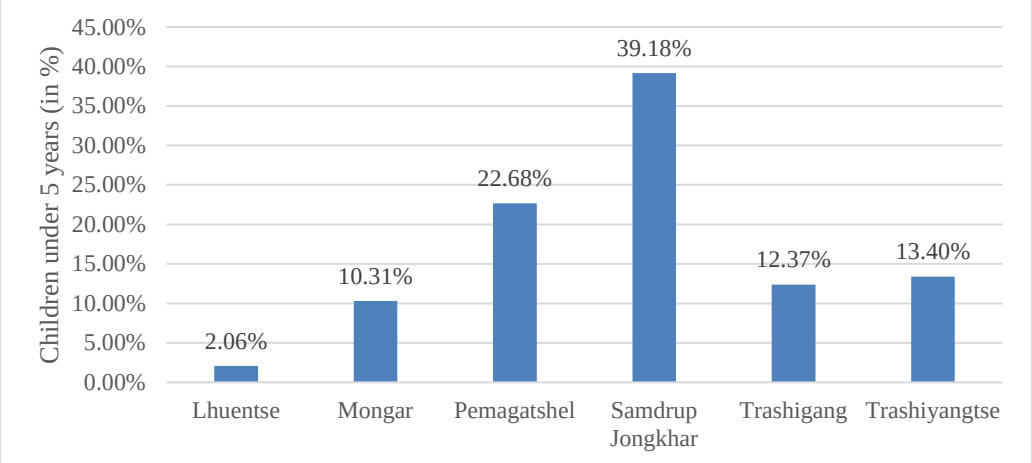


Fig.2. Children under age of 5 at households

As per the employment status of the respondents among the households, Pemagatshel and Samdrup Jongkhar has the highest number of people being employed formally by 15.13% and 13.42% respectively, whereas, 67.76% and 59.73% were employed informally. While the rest of the Dzongkhags have majority being unemployed indicating that majority of the respondents in Lhuentse, Mongar, Trashigang and Trashiyangtse are more into farming practices.

Table 7: Employment among respondents

	Formal	Informal	None	Total
Lhuntse	5.43%	4.35%	90.22%	100.00%
Mongar	2.00%	3.60%	94.40%	100.00%
P/gatshel	15.13%	67.76%	17.11%	100.00%
S/jongkhar	13.42%	59.73%	26.85%	100.00%
T/gang	3.80%	4.89%	91.30%	100.00%
T/yangtse	4.35%	14.13%	81.52%	100.00%
Average	**7.36%**	**25.74%**	**66.90%**	

6. Household settings

6.1 Family size

The majority of households (40.17%) consist of 3–4 persons, followed by 33.52% with 2 persons, indicating small-to-medium size family households across the surveyed regions. While the larger households with 5–6 members make up 16.92% but only 3.60% of households have more than 6 members, suggesting extended family structures are relatively uncommon in the families. On the other hand, single-person households are minimum comprising of just 5.79% of the total.

Among the Dzongkhags, Mongar has the highest proportion of all household sizes combined (27.29%), with strong representation of 3–4 persons (10.04%) and 2-persons (9.17%). Trashigang also shows a similar pattern (20.09%) with most households of 3–4 persons (9.72%) along with few larger or single-person households. Samdrup Jongkhar has almost even spread with 5–6 persons (4.26%) and above 6 persons (1.20%) while Pemagatshel is more concentrated with 2-persons (7.86%) and 3–4 persons (6.11%). Trashiyangtse and Lhuentse, though contributing fewer households, reflects similar trends, with 3–4 persons being the most common size, and very low percentages in the “above 6” category. Compared to baseline, there are increasing number of households with 2 to 4 members in each of the surveyed households. While it is in a decreasing trend for higher family members. This indicates migration of family members and availability of lesser people for farm activities.

Table 8: Size of households (in percent)

Dzongkhags		Total members in the household						Average person/HH
		1 only	2 only	3-4 Nos	5-6 Nos	>6 persons	Total	
Lhuentse	Endline	2.22	32.22	44.44	16.67	4.44	100	3.76
	Baseline	4.7	8.2	42.4	29.4	15.3	100	
Mongar	Endline	8.4	33.6	36.8	18.0	3.2	100	2.52
	Baseline	2.8	14.8	42.6	25.0	14.8	100	
Pemagatshel	Endline	0.67	48.32	37.58	10.07	3.36	100	3.32
	Baseline	2.2	11.2	40.4	23.6	22.5	100	
S/Jongkhar	Endline	4.7	26.17	35.57	26.17	7.38	100	4.08
	Baseline	2.3	4.5	34.1	25.0	34.1	100	
T/gang	Endline	7.07	31.52	48.37	11.41	1.63	100	3.43

	Baseline	0.0	9.0	41.4	33.8	15.8	100	
T/yangtse	Endline	7.61	27.17	41.3	21.74	1.63	100	3.73
	Baseline	0.0	3.8	37.7	35.8	22.6	100	
Average	**Endline**	**5.78**	**33.23**	**40.18**	**17.37**	**3.61**	**100**	**3.64**
	Baseline	**2.0**	**9.2**	**40.1**	**28.6**	**20.1**	**100**	

Information was also collected to see the people available for agricultural works in the households. Majority of households, about 57.43% reported of having 2 persons available for agricultural work, followed by 20.41% with 3–4 persons and 19.43% with single person. Households with larger groups of 5–6 persons are available for agricultural works only to 2.41% households and 0.33% for households have above 6 persons, indicating that most farming households operate with limited labor contribution from within the immediate family members. Even while comparing to baseline information, more households have 2 or less members in the family than in 2015.

Table 9. Households' members available for agricultural works (in percent)

Dzongkhags		**Household members available for agricultural works**					
		1 only	**2 only**	**3-4 Nos**	**5-6 Nos**	**>6 persons**	**Total**
Lhuentse	Endline	18.48	45.65	33.70	1.09	1.09	100
	Baseline	16.5	48.2	25.9	9.4	0.0	100
Mongar	Endline	18.40	53.60	24.40	3.60	0.00	100
	Baseline	13.9	53.7	31.5	0.9	0.0	100
Pemagatshel	Endline	9.40	70.47	19.46	0.67	0.00	100
	Baseline	7.9	49.4	37.1	3.4	2.2	100
S/Jongkhar	Endline	23.49	48.32	22.82	4.03	1.34	100
	Baseline	20.5	33.0	39.8	3.4	3.4	100
Trashigang	Endline	19.02	67.39	10.87	2.72	0.00	100
	Baseline	18.8	54.9	21.8	4.5	0.0	100
Trashiyangtse	Endline	33.70	53.26	13.04	0.00	0.00	100
	Baseline	11.3	49.1	30.2	9.4	0.0	100
Average	**Endline**	**20.41**	**56.45**	**20.72**	**2.02**	**0.40**	**100**
	Baseline	**15.3**	**48.7**	**30.4**	**4.7**	**0.9**	**100**

Among the Dzongkhags, Mongar has the highest family members available for agricultural works represented by 27.29% of households, particularly about 14.63% with 2 persons and 5.02% with single person. This is followed by Trashigang with 20.09% consisting of 13.54% with 2-person but lesser percentage with larger family members contributing for agricultural works. On the other hand, Samdrup Jongkhar and Pemagatshel each have 16.27% of households contributing to agricultural works specifically with 7.86% with 2-persons and 11.46% with 3–4 persons. Trashiyangtse and Lhuentse are the lowest with household members available for agricultural work of 10.04% each. Lhuentse has the lowest (3.38%) proportion of 3–4 persons available for agricultural work and very small share of only 0.11% with larger family groups.

6.2 Household Assets

Highly prevalent household assets are the consumables such as Rice/Curry Cooker represented by 99.24% (baseline 95.9%) followed by Water Boiler (90.39%), Electronics (89.08%), and TV (77.84% from 69.2% as per baseline) and then the Refrigerators (75.00% increased from 40.8% during baseline).

Moderately owned assets are Sprinklers (28.82%), Vehicles (27.40%), and Power Tillers (26.97%). This is followed by Flour mills (21.72%) and grass cutters (21.72%). Ownership of core mechanized farming tools such as paddy transplanters (0.22%), paddy threshers (1.09%), and paddy harvesters (0.00%) are extremely low. However, other assets like maize shellers (8.52%), power chains (32.31%), and chaff cutters (20.52%) show moderate to low ownership. The other assets like chips-making machines (0.11%), oil expellers (0.22%), and flake-making machines (3.06%) have minimal ownership. Overall, almost all assets owned have increased as compared to baseline data.

Table 10: Productive assets owned by households

Assets owned	Endline Count	Endline (%)	Baseline Count	Baseline (%)
Vehicle	251	27.40	74	13.3
Power Chain	296	32.31	119	21.4
Maize Sheller	78	8.52	3	0.5
Paddy thresher	10	1.09	1	0.2
Paddy harvester	0	0.00	2	0.4
Paddy transplanter	2	0.22	3	0.5
Improved plough	17	1.86	4	0.7
Chips making machine	1	0.11	1	0.2
Flour mill	199	21.72	44	7.9
Flake making machine	28	3.06	3	0.5
Rice huller	114	12.45	35	6.3
Sprayers	30	3.28	3	0
Sprinklers	264	28.82	27	4.9
Power tiller	247	26.97	32	5.8
Chaff cutter	188	20.52	0	0
Oil expeller	2	0.22	0	0
Grass cutter	199	21.72	0	0

Table 11: Consumable assets owned by households

Assets owned	Endline Count	Endline (%)	Baseline count	Baseline (%)
Electronics	816	89.08	547	98.4
Refrigerator	687	75.00	227	40.8
Water boiler	828	90.39	0	0

Rice/curry cooker	909	99.24	533	95.9
TV	713	77.84	385	69.2

The ownership of assets by gender shows notable patterns of disparity and joint control over different types of assets. Joint ownership by both men and women is highest in most categories such as livestock 72.93%, farm machinery and equipment 55.35%, and finance 59.39%, indicating a high level of shared management in these essential livelihood resources. Men have higher sole ownership than women across all other categories of assets such as electronics 32.64%, assets 30.90%, and farm machinery 29.26%. Women's sole ownership is most prominent in land 41.59%, slightly surpassing men, but considerably low in other categories such as livestock 14.63%, electronics 16.38%, and finance 16.70%. This can be due to cultural norms of eastern Bhutan where in most cases, assets like land is inherited to daughters which is governed by the Inheritance Act of 1980. The Act allows individuals to dispose of their property through wills or bequests, provided the property is not under government restrictions. In the absence of a will, the law provides for the equal distribution of property among children.

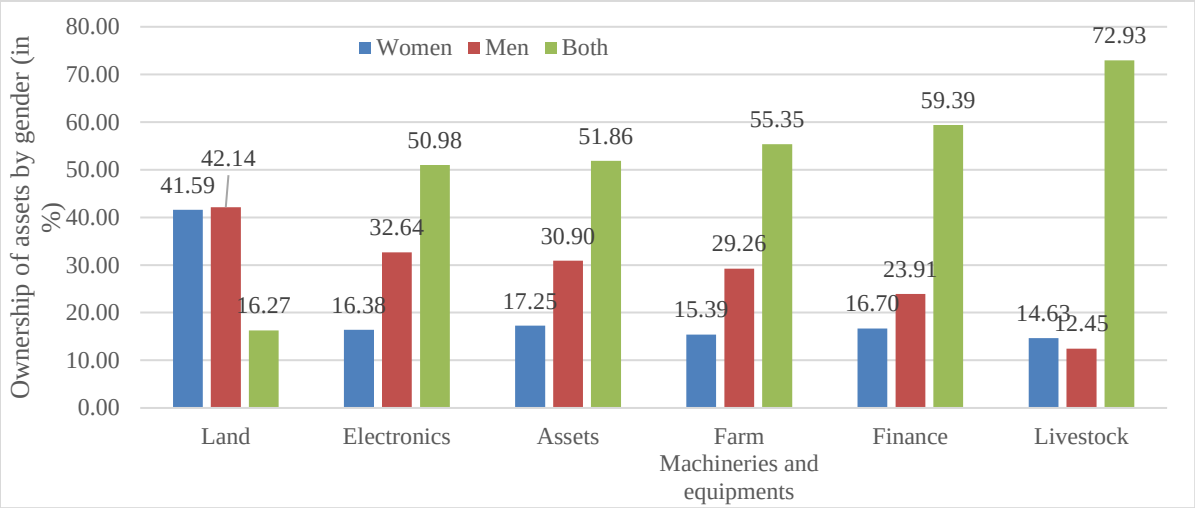


Fig.3: Ownership of assets by gender

In comparison with the baseline information, ownership of all types of assets has increased over the years especially electronics, vehicles, power chain, power tillers, sprinklers etc. Even in terms of consumables such as refrigerators, curry/rice cookers have also increased during the course of project implementation.

Table 12: Comparison of assets owned by households (in %)

		Lhuntse	Mongar	P/gatshel	T/gang	T/yangtse	S/jongkhar
Electronics	Endline	91.30	84.00	97.32	95.11	96.70	76.51
	Baseline	24.85	32.42	29.00	23.39	24.30	28.57
Vehicle	Endline	27.17	24.40	28.19	29.89	29.67	27.52
	Baseline	4.49	1.83	2.67	4.11	2.80	5.19
Power Chain	Endline	45.65	33.20	26.97	39.67	30.43	19.46
	Baseline	6.59	7.95	5.00	3.21	13.55	2.92

Maize Sheller	Endline	5.43	10.00	15.79	9.78	3.26	2.01
	Baseline	0.00	0.31	0.00	0.36	0.00	0.00
Paddy thresher	Endline	2.17	0.00	0.00	0.00	1.09	4.70
	Baseline	0.00	0.00	0.00	0.00	0.47	0.00
Paddy harvester	Endline	0.00	0.00	0.00	0.00	0.00	0.00
	Baseline	0.00	0.00	0.00	0.36	0.00	0.00
Paddy transplanter	Endline	0.00	0.00	0.00	0.00	1.09	0.67
	Baseline	0.00	0.00	0.00	0.36	0.47	0.00
Improved plough	Endline	0.00	1.20	0.66	2.17	7.61	1.34
	Baseline	0.60	0.61	0.00	0.00	0.00	0.00
Chips making machine	Endline	0.00	0.00	0.00	0.00	1.09	0.00
	Baseline	0.30	0.00	0.00	0.00	0.00	0.00
Flour mill	Endline	22.83	32.80	23.68	13.59	23.91	8.72
	Baseline	4.19	0.92	2.67	3.04	0.47	0.32
Flake making machine	Endline	1.09	6.00	0.00	1.63	7.61	1.34
	Baseline	0.30	0.31	0.00	0.00	0.00	0.32
Rice huller	Endline	33.70	12.40	0.00	14.67	27.17	0.00
	Baseline	3.29	0.61	0.33	3.04	1.40	0.32
Sprayers	Endline	0.00	2.40	4.61	2.17	8.70	3.36
	Baseline	0.00	0.00	0.00	0.36%	0.47	0.00
Sprinklers	Endline	35.87	46.40	21.05	13.59	19.57	26.85
	Baseline	2.10	1.22	0.67	1.96	1.40	0.00
Power tiller	Endline	44.57	39.20	7.24	21.74	36.96	15.44
	Baseline	2.10	2.14	1.00	1.61	1.40	0.97
Refrigerator	Endline	76.09	68.40	77.63	76.09	69.57	83.22
	Baseline	9.28	7.95	8.33	14.29	8.41	15.26
Chaff cutter	Endline	7.61	16.40	48.68	6.52	5.43	32.89
	Baseline	0	0	0	0	0	0
Oil expeller	Endline	0.00	0.00	0.66	0.54	0.00	0.00
	Baseline	0	0	0	0	0	0
Grass cutter	Endline	26.09	22.00	30.26	10.33	6.52	32.89
	Baseline	0	0	0	0	0	0
Water boiler	Endline	96.74	92.00	85.53	97.83	88.04	79.19
	Baseline	0	0	0	0	0	0
Rice/curry cooker	Endline	100.00	100.00	98.03	98.37	100.00	97.32
	Baseline	24.85	29.97	29.33	23.21	24.30	26.62
TV	Endline	73.91	77.20	72.37	91.85	80.43	66.44
	Baseline	17.07	13.76	21.00	20.71	20.56	19.48

6.3 Types of houses

Overall, mud and stone walls with corrugated galvanized iron (CGI) roofing are the most common type of houses owned, accounting for 47.16% of all houses, particularly dominant in Mongar (81.20%) and Lhuentse (77.17%). Concrete structures with shingle roofing are prevalent in Samdrup Jongkhar (61.07%) and Pemagatshel (28.19%), indicating higher investment in durable housing. Trashiyangtse stands out with 31.52% of houses built with concrete walls and CGI roofs, the highest among the Dzongkhags. Pemagatshel also has a notable proportion of thatched/bamboo or wooden wall houses with shingle roofs (18.79%), suggesting a higher presence of traditional housing. Meanwhile, Trashigang and Trashiyangtse show mixed patterns, with both modern and traditional types. On average, traditional structures such as wooden walls with CGI roofs (2.95%) and thatched/bamboo walls with CGI roofs (0.87%) make up a small portion, while concrete-walled houses with either CGI or shingle roofs comprise significantly with 33.95%. These patterns point to a gradual shift from traditional to more durable housing forms in some areas, while others continue to rely heavily on local and traditional materials.

Table 13: Types of houses owned (in %)

Types of houses		**Lhuentse**	**Mongar**	**P/gatshel**	**S/Jongkhar**	**T/gang**	**T/yangtse**	**Average**
Wooden wall with CGI roof	Endline	0.00	1.20	8.05	1.34	2.72	5.43	**2.95**
	Baseline	12.9	5.6	28.01	26.1	0.8	0.0	**11.9**
Mud and stone wall with CGI roof	Endline	77.17	81.20	7.38	4.70	56.52	39.13	**47.16**
	Baseline	81.2	81.5	53.9	31.8	88.7	83.0	**71.0**
Concrete (stone or brick wall) with shingle roof	Endline	3.26	2.00	28.19	61.07	27.17	18.48	**22.71**
	Baseline	0.0	0.0	4.5	1.1	0.8	3.8	**1.4**
Concrete (stone or brick wall) with CGI roof	Endline	11.96	12.80	2.01	5.37	10.87	31.52	**11.24**
	Baseline	1.2	4.6	3.4	29.5	9.0	3.8	**8.8**
Mud and stone wall with shingle roof	Endline	7.61	2.80	34.23	11.41	2.72	4.35	**9.93**
	Baseline	1.2	0.0	1.1	0.0	0.0	1.9	**0.5**
Thatched/bamboo wall with CGI roof	Endline	0.00	0.00	1.34	3.36	0.00	1.09	**0.87**
	Baseline	0.0	8.3	6.7	8.0	0.8	1.9	**4.3**
Wooden wall with shingle roof	Endline	0.00	0.00	18.79	12.75	0.00	0.00	**5.13**
	Baseline	0.0	0.0	2.2	1.1	0.0	0.0	**0.5**

A comparison of all baseline and end line results of households shows that there is increase of households with concrete (stone or brick wall) with shingle roof with 22.71% from 1.4% during the baseline. Similarly, concrete (stone or brick wall) with CGI roof houses have also increased from 8.8% during baseline to 11.24% now. Houses such as Mud and stone wall with shingle roof and Wooden wall with shingle roof have also slightly increased from 0.5% to 9.93% and 0.5% to 5.13% as compared to baseline data.

6.4 Land ownership and cultivation

The land ownership and cultivation across different acreage categories shows that the majority of land holdings are small, where most agricultural activities are concentrated in land below 2 acres. For instance, 57.22% of total dry land cultivated and 86.68% of total wet land cultivated fall within the range of 0–2 acre. Upland rice and cardamom cultivation are particularly concentrated in very small land holdings of 0.25 acres to about households of 78.93% and 81.22% respectively. Similarly, over two-thirds of total orchard (67.79%), citrus (65.50%), and mango (69.87%) land ownership is also under 0.25 acres, indicating fragmented land use for fruit crops. Potato and kitchen garden vegetables cultivation land is also small with about 0.25–0.5 acre to households of about 47.16% and 67.25% respectively. While improved pasture land shows a slightly broader spread across land sizes of 2 acres to about 77.32% of the households.

Table 14: Various types of land use pattern (in %)

Land Owned & cultivated		**Area (in acres)**									**Average area**
		0	<0.25	0.25-0.5	0.51-1	1.1-2	2.1-4	4.1-6	6.1-10	>10	
Dry land owned	Endline	0.44	1.31	8.30	17.69	29.48	22.16	10.81	6.33	3.49	2.42
	Baseline	3.1	7.0	11.3	24.3	20.3	22.7	6.8	3.2	1.3	
Dry land cultivated	Endline	2.62	7.86	17.25	21.18	24.24	17.03	6.44	2.62	0.76	2.19
	Baseline	5.6	12.6	17.4	32.0	22.7	7.2	1.8	0.7	0.0	
Wet land owned	Endline	44.87	6.66	13.65	14.74	12.34	6.00	0.98	0.44	0.33	1.89
	Baseline	52.5	10.1	11.9	14.0	7.6	3.1	0.5	0.0	0.4	
Wet land cultivated	Endline	56.99	8.95	10.04	10.70	8.08	4.69	0.22	0.22	0.11	0.36
	Baseline	60.8	9.9	9.4	12.2	5.0	2.0	0.2	0.0	0.5	
Upland rice cultivated	Endline	78.93	3.82	4.69	4.37	4.37	3.17	0.33	0.11	0.22	0.65
	Baseline	89.9	2.2	2.9	4.7	0.2	0.2	0.0	0.0	0.0	
Productive cardamom area	Endline	81.22	7.53	4.26	3.06	1.64	1.97	0.33	0.00	0.00	0.98
	Baseline	93.7	3.6	0.9	1.4	0.2	0.0	0.0	0.2	0.0	
Total orchard	Endline	67.79	16.92	4.91	4.48	3.38	1.64	0.55	0.22	0.11	0.36
	Baseline	0	0	0	0	0	0	0	0	0	
Maize cultivated	Endline	20.74	17.03	20.74	22.93	13.97	4.15	0.33	0.00	0.11	0.48
	Baseline	10.8	21.0	22.5	27.7	12.9	4.7	0.2	0.2	0.0	
Potato cultivated	Endline	21.40	47.16	17.36	9.83	3.38	0.76	0.11	0.00	0.00	0.52
	Baseline	16.5	40.8	28.4	11.0	2.2	1.1	0.0	0.0	0.0	
Kitchen garden vegetables	Endline	8.95	67.25	13.86	5.68	3.82	0.44	0.00	0.00	0.00	0.29
	Baseline	5.2	70.1	24.5	0.2	0.0	0.0	0.0	0.0	0.0	
Commercial vegetables cultivated	Endline	55.13	21.18	12.66	7.10	2.73	0.98	0.11	0.11	0.00	0.33
	Baseline	59.9	24.1	12.1	3.8	0.0	0.0	0.0	0.0	0.0	
Total citrus area	Endline	65.50	27.29	4.04	1.20	0.87	0.87	0.22	0.00	0.00	4.0
	Baseline	60.4	27.7	6.8	2.9	1.8	0.4	0.0	0.0	0.0	
Mango cultivation area owned	Endline	69.87	25.33	2.40	1.31	0.22	0.66	0.11	0.00	0.11	0.30

Total productive mango area	Endline	77.18	19.10	1.97	0.87	0.11	0.44	0.11	0.00	0.22	0.58
Total avocado cultivation area	Endline	66.92	28.82	2.73	0.87	0.11	0.44	0.11	0.00	0.00	0.46
Total cardamom cultivation area	Endline	83.19	8.30	3.49	1.86	1.53	1.42	0.11	0.00	0.11	1.01
	Baseline	72.8	17.1	4.9	3.2	1.4	0.4	0.0	0.2	0.0	
Improved pasture	Endline	53.71	23.69	10.92	5.68	4.04	1.42	0.22	0.33	0.00	0.74
	Baseline	82.6	11.7	3.6	1.4	0.5	0.0	0.0	0.2	0.0	
Total productive avocado cultivation area	Endline	81.22	15.39	1.75	0.55	0.22	0.76	0.11	0.00	0.00	0.38
Average		**52.04**	**19.64**	**8.61**	**7.45**	**6.36**	**3.83**	**1.18**	**0.58**	**0.31**	

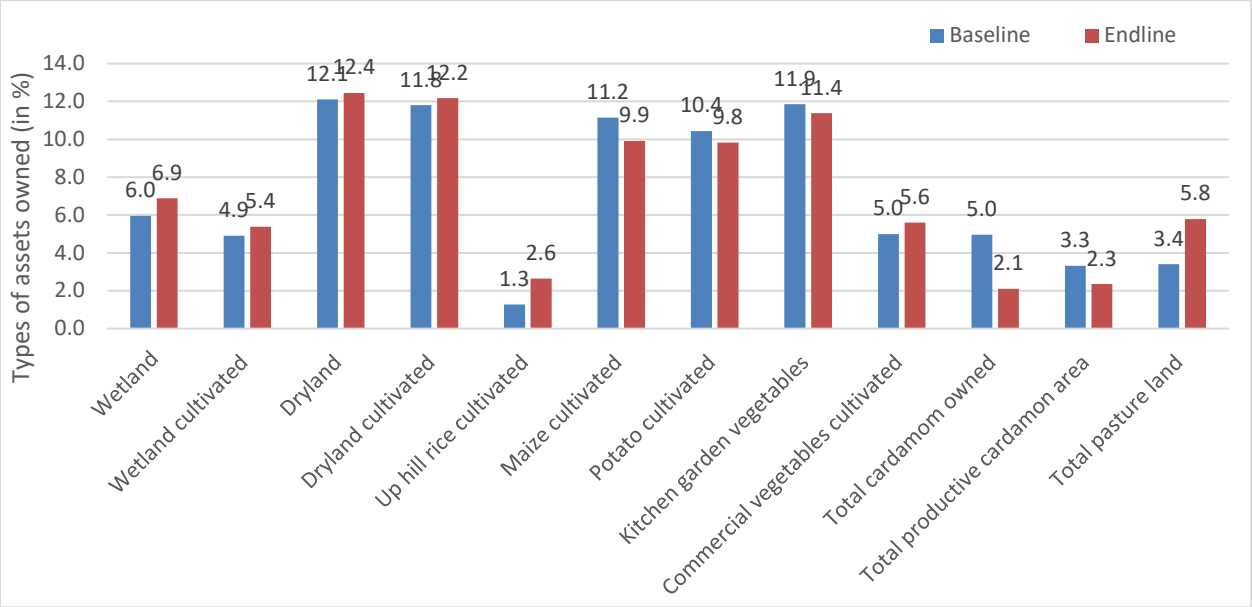


Fig.4: Type of assets owned (in percentage)

In comparison with the baseline data, there is not much of difference in the land use pattern of different Dzongkhags. However, there are exceptions such as wetland owned has slightly increased on average from 6% baseline to 6.9% now, wetland cultivation has also increased from 4.9% during baseline study to 5.4% now. Similarly, dry land ownership has increased on the average of 12.1% during baseline to 12.4% now and the corresponding dry land cultivation has also increased on average of 11.8% during baseline to 12.2% now. In the same way, uphill rice cultivation has also increased from 1.3% during baseline to 2.6% now. There is also increase of commercial

vegetable cultivation area from 5% at the time of baseline study to 5.6% now. On the other hand, there is increased of total pasture land on the average of 3.4% during baseline study to 5.8% now.

6.5 Ownership of livestock

Almost all of the respondents own livestock with an overall ownership rate of 98.58%. Among the Dzongkhags, Lhuentse, Mongar, Pemagatshel, and Trashiyangtse reported nearly 100% of the respondents' owning livestock while Samdrup Jongkhar stands at 98.66% and Trashigang at 94.02%. Only 5.98% of Trashigang and 1.3% of Samdrup Jongkhr reported not owning livestock.

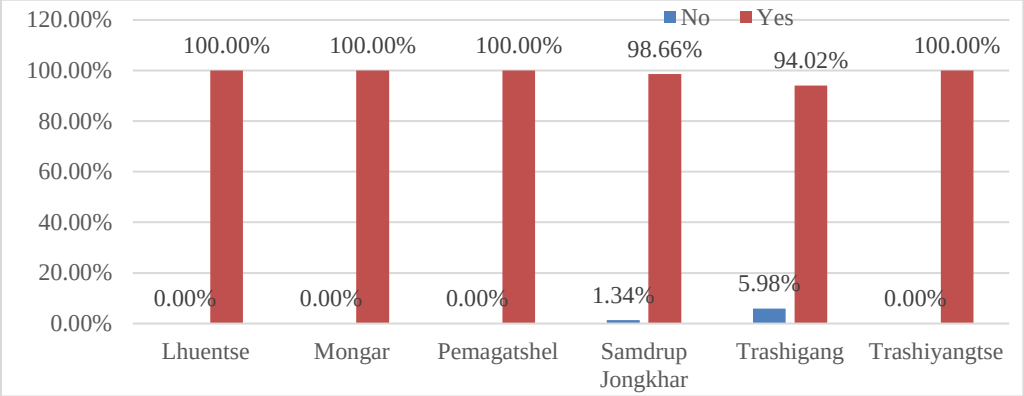


Fig.5: Ownership of livestock

The distribution of livestock ownership shows a clear trend of low to moderate numbers per household across all livestock types. Local cattle-milking, dry, pregnant, heifers, and calves are predominantly absent in most households, with over 60% reporting no ownership in each subcategory. For instance, 60.70% of households do not own milking cows, 67.69% lack dry cows, and nearly 80% report no pregnant cattle.

In terms of ownership of local cattle calves (male), only 19.43% of the households own single male calves while 53.60% do not own any. Even for improved cattle types follows a similar pattern, with 67%-88% of households not owning milking, dry, or pregnant animals. Ownership is even more limited for improved calves and heifers. Ownership of other animals such as fish, yaks, and pigs are owned by very few households and over 94% reported no ownership, although a small share (3–4%) raise more than five pigs or yaks. Sheep/goat ownership is also limited but slightly more distributed, with about 12% owning at least one and some owning up to eight.

On the other hand, poultry is most common among the farmers with 11% of the households owning more than two birds and 3.28% owning more than ten birds. Overall, livestock ownership is concentrated in small numbers with very minimum number of households holding larger number of livestock animals.

Table 15: Types of Livestock Owned (percentage)

Livestock	Count of livestock										
	None	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**>10**
Local cattle Milking	60.70	18.45	12.66	4.15	1.86	0.87	0.66	0.11	0.00	0.11	0.44
Local cattle Dry	67.69	13.76	9.72	2.84	1.20	1.09	1.42	0.55	0.22	0.11	1.42
Local cattle Pregnant	79.91	8.30	6.11	0.98	0.87	0.00	1.97	0.00	0.87	0.98	0.00
Local cattle heifers	95.09	2.07	1.42	0.44	0.11	0.11	0.44	0.22	0.00	0.00	0.11
Local cattle calf (male)	53.60	19.43	13.10	4.26	3.06	0.55	1.97	3.06	0.00	0.98	0.00
Local cattle calf (Female)	59.28	15.50	14.63	4.26	1.75	2.18	0.66	0.76	0.00	0.98	0.00
Improved cattle milking	67.69	17.47	9.28	3.17	1.20	0.55	0.44	0.00	0.00	0.00	0.22
Improved cattle Dry	88.21	6.33	3.17	1.42	0.11	0.22	0.22	0.00	0.00	0.11	0.22
Improved cattle pregnant	83.52	11.35	3.60	1.09	0.11	0.11	0.11	0.00	0.00	0.00	0.11
Improved cattle heifers	88.97	3.38	3.49	1.64	0.44	0.00	1.31	0.76	0.00	0.00	0.00
Improved cattle calf (male)	75.98	12.34	5.46	1.31	1.75	0.66	1.53	0.00	0.00	0.98	0.00
Improved cattle calf (female)	70.20	10.70	9.83	2.95	0.87	2.18	3.28	0.00	0.00	0.00	0.00
Fish	95.74	0.55	0.22	0.00	0.00	0.55	1.97	0.00	0.00	0.98	0.00
Yak	94.65	0.11	0.00	0.33	0.00	1.64	3.28	0.00	0.00	0.00	0.00
Pig	96.18	0.11	0.44	0.00	0.00	0.00	3.28	0.00	0.00	0.00	0.00
Sheep/goat	88.43	0.11	1.09	1.31	0.87	0.55	4.26	0.76	2.62	0.00	0.00
Poultry	88.97	1.42	1.09	0.66	1.09	1.31	0.98	0.55	0.55	0.11	3.28

Table 16: Comparison of Livestock Owned (in percentage)

		1	2	3	4	5	6	7	8	9	>10	None
Local cattle	Baseline	11.90	14.00	9.00	5.90	5.60	2.70	2.70	0.90	1.40	4.90	41.00
	Endline	12.92	6.77	1.76	0.76	0.44	0.55	0.24	0.07	0.09	0.33	76.07
Improved cattle	Baseline	11.20	10.30	4.70	2.70	0.20	0.20	0.00	0.00	0.00	0.40	70.50
	Endline	10.26	4.24	1.26	0.36	0.25	0.25	0.04	0.02	0.02	0.09	83.20
Yak	Baseline	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	99.60
	Endline	0.11	0.00	0.11	0.00	0.33	0.55	0.00	0.00	0.00	0.00	98.91
Buffalo	Baseline	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	99.30
	Endline											
Pigs	Baseline	3.20	0.50	0.00	0.00	0.20	0.00	0.00	0.00	0.20	0.20	95.70
	Endline	0.11	0.22	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	99.13
Horses/mules	Baseline	6.50	2.20	1.10	0.40	0.20	0.20	0.00	0.00	0.40	0.40	88.80
	Endline											
Sheep/goats	Baseline	0.50	0.70	0.00	0.20	0.00	0.00	0.00	0.00	0.20	0.90	97.10
	Endline	0.11	0.55	0.44	0.22	0.11	0.55	0.11	0.33	0.00	0.00	97.60
Poultry birds	Baseline	2.00	4.70	5.00	2.30	2.90	2.00	2.30	1.60	1.60	9.70	65.80
	Endline	1.42	1.09	0.66	1.09	1.31	0.98	0.55	0.55	0.11	3.28	88.97

In comparison with the baseline data, there is not much of increase in the number of overall livestock ownership but the type/breed of cattle has been introduced through the project mainly those of improved cattle. Thus, with the improvement of both local and improved cattle, the overall houses not owning any cattle in 2015 was 76% which has been narrowed to 41% now. Further, as per the details of the livestock ownership, majority are concentrated of having 1 to 2 cattle such as 710 households owning single cattle, 372 owning 2 cattle of local variety while for improved cattle, it is 564 households owning single and 233 owning 2 cattle.

Table 17: Detail break up of livestock ownership

	Count of livestock										
Type of cattle own	1	2	3	4	5	6	7	8	9	>10	None
1. Local cattle											
a) Milking	169	116	38	17	8	6	1	1	1	4	556
b) Dry	126	89	26	11	10	13	5	2	1	13	620
c) Pregnant	76	27	3	2	0	3	0	1	1	0	802
d) Heifers	19	13	4	1	1	4	2	0	0	1	871
e) Calf											
i. Male	178	60	13	7	1	3	4	0	1	0	649
ii. Female	142	67	13	4	4	1	1	0	1	0	683
Total local cattle	**710**	**372**	**97**	**42**	**24**	**30**	**13**	**4**	**5**	**18**	**4181**
2. Improved cattle											
a) Milking	160	85	29	11	5	4	0	0	0	2	620
b) Dry	58	29	13	1	2	2	0	1	0	2	808
c) Pregnant	104	33	10	1	1	1	0	0	0	1	765
d) Heifers	31	16	5	1	2	1	0	0	0	0	860
e) Calf											
i. Male	113	25	3	4	0	1	2	0	1	0	766
ii. Female	98	45	9	2	4	5	0	0	0	0	753
Total improved cattle	**564**	**233**	**69**	**20**	**14**	**14**	**2**	**1**	**1**	**5**	4572
3. Yak	1	0	1	0	3	5	0	0	0	0	906
4. Pig	1	2	0	0	0	5	0	0	0	0	908
5. Sheep/Goat	1	5	4	2	1	5	1	3	0	0	894
6. Poultry	13	10	6	10	12	9	5	5	1	30	815
7. Fish	5	1	0	0	1	3	0	0	1	0	905

During the baseline, cattle shed consists of 18% of the HHs with separate mud floor shed and CGI roof, 17.8% had separate mud floor shed with shingle roof, 9% have separate concrete floor shed with shingle roof, 11.9% with separate concrete floor shed with CGI roof and 9% had temporary sheds with plastic roof. Comparatively, endline shows that most of the households are owning cattle sheds that are either improved (42.79%) or conventional/traditional (41.59%), with a slightly higher preference for improved shelters featuring concrete floors, roofs, and troughs. However, 15.61% of households reported not owning any type of cattle shed. In absolute terms, 250 owned conventional type of cattle shed in 2015 which now stands at 381. Similarly for the improved cattle shed, it was 116 in 2015 and now it is 392. Even in terms of those now owning the cattle shed, it

has been reduced from 190 to 143, which means that the project impact has brought about a change in the lives of the rural homes of the targeted areas.

Table 18: Types of cattle shed owned

	Conventional/Traditional		Improved		None	
Dzongkhags	Baseline	Endline	Baseline	Endline	Baseline	Endline
Lhuentse	33	55	11	30	41	7
Mongar	31	131	24	113	53	6
Pemagatshel	50	14	29	99	10	36
S/Jongkhar	28	28	9	87	51	34
T/gang	80	91	28	48	25	45
T/yangtse	28	62	15	15	10	15
Total	**250**	**381**	**116**	**392**	**190**	**143**

In terms of average milk yield for both local and improved breeds of cattle for winter and summer periods are shown in the table below. The yield of milk is better for improved breeds compared to local breeds where the average milk yields are 2.5 litre/day to 5.50 litre/day during winter months respectively. During summer months, the average milk yields are 3.47 litre/month by local breeds and 6.57 litre/month by improved breeds. The yield of milk during summer months are better than those during winter months for both local and improved breeds. When compared to baseline data, the average milk yield during summer months was 3 litre/day which is increased to now 3.47 litre/day. Similarly, for the improved breed during the summer months, the average milk yield was 6 litre/day in 2015 which is being increased to 6.57litre/day now.

Table 19: Average milk yield (litre/day)

	Average milk yield in winter months (litre/day)				**Average milk yield in summer months (litre/day)**			
	Local breed		Improved breed		Local breed		Improved breed	
Dzongkhags	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline
Lhuentse	0	2.71	0	5.65	3.0	3.56	3.0	6.63
Mongar	0	2.50	0	5.09	4.0	3.40	10.0	6.39
Pemagatshel	0	2.50	0	5.10	2.0	3.43	5.0	6.87
S/Jongkhar	0	2.50	0	5.80	3.0	3.51	3.0	6.99
Trashigang	0	2.36	0	5.43	2.0	3.70	3.0	6.34
Trashiyangtse	0	2.43	0	5.92	4.0	3.19	12.0	6.17
Average		**2.50**		**5.50**	**3.0**	**3.47**	**6.0**	**6.57**

In terms of new cattle breeds received from the project, Pemagatshel, Mongar and Lhuentse are the Dzongkhags which have received higher number of supports compared to other Dzongkhags. However, those who received cattle breeds are comparatively lesser than those who did not, take the case of Lhuentse and Mongar, where 20.65% and 25.60% have received cattle breeds respectively while 79.35% and 74.40% have not.

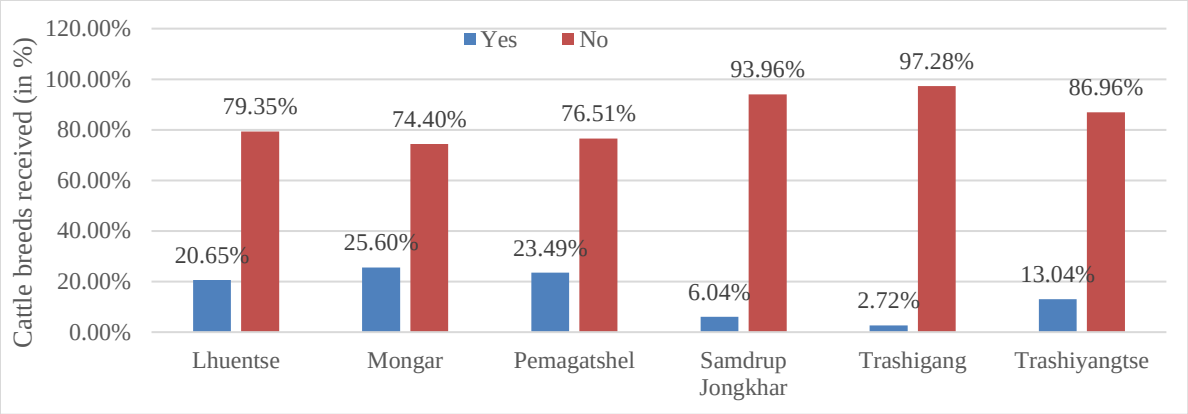


Fig 6: New cattle breeds received from the project

6.6 Fodder cultivation

The project was able to support fodder cultivation to various villages in the six eastern Dzongkhags to improve milk production. Overall, improved fodder has been cultivated to 191.93 acres of land and winter fodder to 70.5 acres of land. Among the Dzongkhags, highest cultivation are the Samdrup Jongkhar with over 73.88 acres and Pemagatshel with 62.72 acres for improved fodder while for winter fodder, again Samdrup Jongkhar has over 28.23 acres. The lowest is Trashiyangtse with 10.26 acres for improved fodder and Lhuentse for 1.95 acres for winter fodder. In terms of fodder conservation, highest is Trashigang with 67,740 kgs and the lowest is Lhuentse with 500kgs. Similarly, Pemagatshel has purchased the highest commercial feeds of about 81,890kgs and the lowest is Lhuentse with 5,100kgs.

Table 20: Fodder cultivation

Dzongkhags	Improved fodder grass (acres)	Winter fodder grass (acre)	Fodder conservation (kgs)	Purchase of commercial feeds (kg)
Lhuentse	11.64	1.95	500	5,100
Mongar	15.28	8.01	7,146.5	45,000
P/gatshel	62.72	11.9	2,000	81,890
S/Jongkhar	73.88	28.23	6,100	69,450
T/gang	18.15	12.5	67,740	31,950
T/yangtse	10.26	7.91	3,720.25	12,300
Total	**191.93**	**70.5**	**87,206.75**	**245,690**

The fodder cultivation in general have improved after the project intervention among the targeted Dzongkhags compared to baseline information as shown in the table below.

Table 21: Percent of HHs cultivating fodder

	Lhuentse	Mongar	P/gatshel	S/jongkhar	T/gang	T/Yangtse
Baseline	1.5	0.2	6.8	1.9	2.0	1.1
Endline	25.0	31.60	48.68	40.27	3.26	3.26

7. Irrigation facility

7.1 Irrigation and impact

Overall, 70.74% of the respondents have access to proper irrigation facility while 29.26% do not. Among the Dzongkhags, Samdrup Jongkhar, Trashigang and Trashiyangtse have higher coverage of irrigation facility with 75% or more, followed by other Dzongkhags with about 67% coverage.

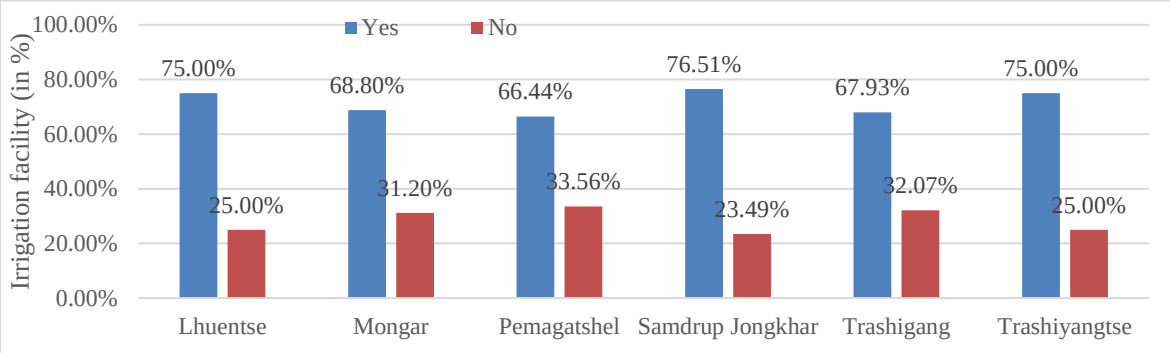


Fig 7: Access to irrigation facility

While comparing with the baseline with regard to access to irrigation facility by the households, majority of the regions have increased their access to irrigation except Trashigang and Tashiyangtse.

Table 22: Percent of HHs with access to irrigation

	Lhuentse	Mongar	P/gatshel	S/jongkhar	T/gang	T/Yangtse
Baseline	72.91	35.13	28.41	50.34	74.33	80.09
Endline	75.00	68.80	66.44	76.51	67.93	75.0

The impact of irrigation support on reducing water shortages varies across the Dzongkhags. Among the Dzongkhags, Pemagatshel shows the least benefit, with 61.07% followed by Samdrup Jongkhar with 59.06% reporting no improvement in water supply. In contrast, Trashigang and Lhuentse have the most positive responses, with 51.09% and 46.15% respectively reporting partial reduction in water shortages. On the other hand, if partial and significant are combined, then 56.04% in Lhuntse, 45.6% in Mongar, 55.98% in Trashigang and 35.87% in Trashiyangtse have witnessed reduction of water shoratges due to various irrigation interventions. There are also about 23% to 33% of the respondents in each of the Dzongkhags who are not able to provide their views on the impact of irrigation technologies towards reducing water shortages.

Table.23: Impact of irrigation on reducing water shortages (in percent)

	Not at all	**Partially**	**Significantly**	**Neutral**
Lhuentse	18.68	46.15	9.89	25.27
Mongar	23.20	33.20	12.40	31.20
Pemagatshel	61.07	5.37	0.00	33.56
Samdrup Jongkhar	59.06	12.75	4.70	23.49
Trashigang	11.96	51.09	4.89	32.07
Trashiyangtse	39.13	28.26	7.61	25.00

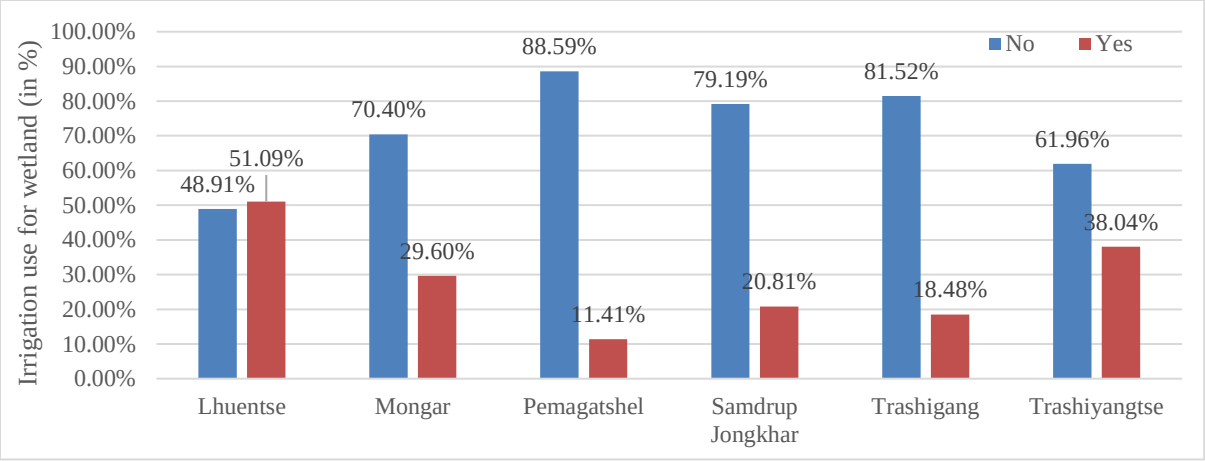


Fig 8: Use of open canal/pipe irrigation for wetland

In terms of use of open canal or pipe irrigation system for wetland, most of the Dzongkhags are not using much except 51% in Lhuentse and 38% in Trashiyangtse, followed by Mongar with 29.6% and Samdrup Jongkhar by 20.81%. This is because most people prefer to carry out farming where there are quick returns such as vegetable production. Even the cost of production is higher for paddy cultivation with lot of manual input compared to vegetable or other cash crops. Further, it is easier to buy rice from the market than growing in the wetland. This were pointed out during the stakeholder consultations in the regions.

Table 24: Increased in production with water supply

		Vegetables		Cereals		Fruit	
Dzongkhags		Yes	No	Yes	No	Yes	No
Lhuentse	Count HH	107	23	34	23	21	23
	Percent	67.39	32.61	36.96	63.04	22.83	77.17
Mongar	Count HH	183	60	70	60	50	60
	Percent	73.20	26.80	28.00	72.00	20.00	80.00
Pemagatshel	Count HH	51	97	1	97	48	97
	Percent	34.23	65.77	0.67	99.33	32.21	67.79
S/Jongkhar	Count HH	62	87	0	87	21	87
	Percent	41.61	58.39	0.00	100.00	14.09	85.91
Trashigang	Count HH	109	53	46	53	6	53
	Percent	59.24	40.76	25.00	75.00	3.26	96.74
Trashiyangtse	Count HH	65	13	36	13	0	13
	Percent	70.65	29.35	39.13	60.87	0.00	100.00

The irrigation support has led to varying degrees of production increase across Dzongkhags leading to introduction of food diversity. Mongar reported the highest contribution to increase in production across various crops such as fruits (27.35%), cereals (27.29%), and vegetables (27.29%), indicating stronger impact of irrigation. Trashigang follows with increase of 20.13% in fruits and 20.09% in both cereals and vegetables. Pemagatshel and Samdrup Jongkhar each recorded increase of 16.3% and 16.1% across all types of crops, reflecting moderate gains from

irrigation. Lhuentse and Trashiyangtse shows the lowest impact of about 10.04% to 10.07%, suggesting comparatively limited production gains from irrigation.

7.2 Adoption of irrigation systems

Among the six Dzongkhags, there are various types of irrigation technology adoption. Pipe networking systems are most common in Pemagatshel (27.67%) and Samdrup Jongkhar (23.12%), followed by Mongar (22.33%) and Lhuentse (11.46%). Drip irrigation is used more in Mongar (30.56%) and Lhuentse (27.78%), while Trashiyangtse shows a notable share (22.22%). Reservoir tanks (e.g. Sintex) are prevalent in Samdrup Jongkhar (28.07%) and Pemagatshel (24.56%), while Lhuentse and Mongar shows moderate usage by 8.77% and 10.53% respectively. Sprinkler systems are highly used in Mongar (52.63%), followed by Pemagatshel and Samdrup Jongkhar by 11.84% of the households of each Dzongkhag.

Surface irrigation is dominant in Mongar (48.53%) and Lhuentse (19.12%) and none in Pemagatshel. Rain water harvesting is mostly reported in Mongar (47.10%), followed by Trashigang (15.94%) and Lhuentse (13.04%). Hand watering is more common in Trashigang (22.65%), Pemagatshel (27.86%) and Trashiyangtse (13.43%). Rain-fed irrigation is notably high in Mongar (56.18%) and Lhuentse (20.22%) but absent in Trashigang. Drinking water taps are used for irrigation purposes mostly in Trashigang (27.44%), Pemagatshel (22.41%) and Samdrup Jongkhar (22.26%).

Table 25: Percentage of irrigation system used

Types of irrigation		**Lhuentse**	**Mongar**	**P/gatshel**	**S/Jongkhar**	**T/gang**	**T/yangtse**
Pipe Networking System	Endline	11.46	22.33	27.67	23.12	8.70	6.72
	Baseline	0	0	0	0	0	0
Drip Irrigation	Endline	27.78	30.56	8.33	5.56	5.56	22.22
	Baseline	15.6	6.3	3.4	9.8	12.8	25.8
Syntax and reservoir tank	Endline	8.77	10.53	24.56	28.07	16.67	11.40
	Baseline	0	0	0	0	1.1	0
Sprinkler System	Endline	10.53	52.63	11.84	11.84	7.46	5.70
	Baseline	0	0	0	0	2.1	1.1
Surface irrigation	Endline	19.12	48.53	0.00	11.76	14.71	5.88
	Baseline	54.2	20.7	5.7	23.9	33.2	32.3
Rain Water Harvesting	Endline	13.04	47.10	7.25	5.80	15.94	10.87
	Baseline	0	0	0	0	0	0
Hand Watering	Endline	6.01	15.23	27.86	14.83	22.65	13.43
	Baseline	0	0	0	0	0	0
Rain fed irrigation	Endline	20.22	56.18	2.25	5.62	0.00	15.73
	Baseline	3.1	8.1	19.3	20.7	18.2	23.7
	Endline	4.57	9.91	22.41	22.26	27.44	13.41

Drinking water taps	Baseline	0	0	0	0	7.0	4.3

Comparison of various irrigation facilities adopted in the project target areas shows that there are significant changes in terms of sprinklers, rain water harvesting, water storage tanks and use of drinking for irrigation purposes compared to baseline data. For instance, use of water storage tanks has increased from 0.4% during the baseline study to 21.67% after the support provided from the project. Even in terms of Dzongkhags, drip irrigation systems are mostly adopted in Lhuentse, Mongar and Pemagatshel while the surface irrigation is more prevalent in Mongar as compared to baseline data.

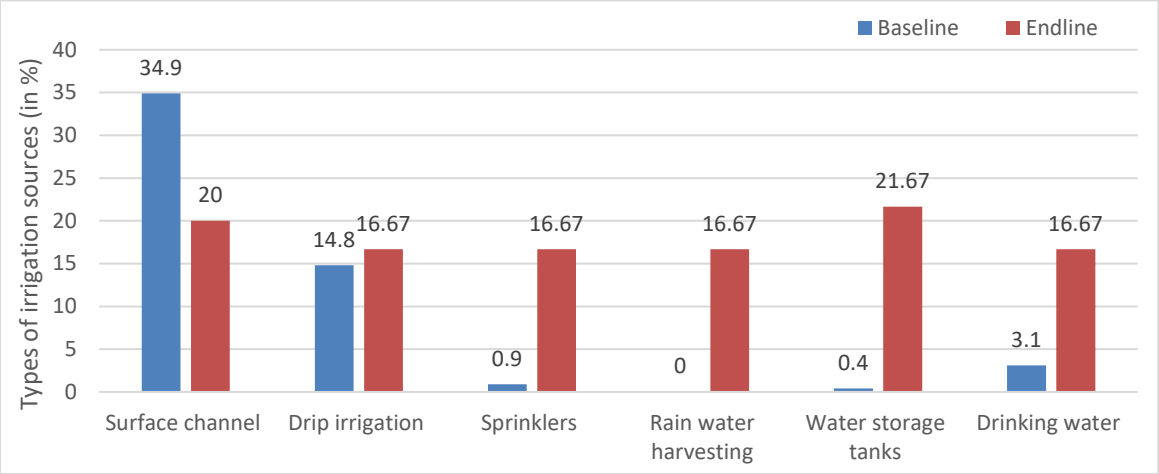


Fig.9: Types of irrigation system comparison

Table 26: Number of Irrigation system adopted by households

Types of irrigation	**Lhuentse**	**Mongar**	**P/gatshel**	**S/Jongkhar**	**T/gang**	**T/yangtse**
Pipe Networking System	58	113	140	117	44	34
Drip Irrigation	10	11	3	2	2	8
Syntax and reservoir tank	10	12	28	32	19	13
Sprinkler System	24	120	27	27	17	13
Surface irrigation	13	33	0	8	10	4
Rain Water Harvesting	18	35	10	8	22	15
Hand Watering	30	76	139	74	113	67
Rain fed irrigation	18	50	2	5	0	14
Drinking water taps	30	65	147	146	180	88
Total	**211**	**515**	**496**	**419**	**407**	**256**

In absolute terms, pipe networking system of irrigation are more in Mongar (113), Pemagatshel (140) and S/Jongkhar (117). Similarly, sprinkler irrigation system is more prominent in Mongar (120) followed by Pemagatshel (27) and Samdrup Jonakhar (27). The less prominent ones are the rain water harvesting (Mongar 35 and Trashigang 22) and drip irrigation is only 11 in Mongar and 10 in Lhuentse.

7.3 Land under irrigation

The distribution of agricultural land under irrigation across various Dzongkhags shows that most households operate on small plots. Overall, 53.82% of the households do not have land under irrigation such as Pemagatshel (97.32%) and Samdrup Jongkhar (85.91%) are the highest in this category with limited irrigation access. The proportion of households with very small irrigated plots (<0.25 acres) is highest in Trashigang (31.52%) and Trashiyangtse (27.17%), while Mongar stands out with relatively more households owning 0.25–0.5 acres (25.20%) under irrigation. Lhuentse has about 30.43% of the households with 0.25-0.5 acres of land under irrigation. Larger irrigated land holdings of 1.1–2 acres and above are generally limited, with the exception of few pockets in Trashiyangtse and Lhuentse with 9.78% and 8.7% of households reported such holdings. As compared to baseline result, there are slight changes in the land under irrigation mainly those of 0.25 acre to 1acre and in some cases, few households have more than acres under irrigation (Lhuentse, Mongar, Trashigang and Trashiyangtse).

Table 27: Land under irrigation (in percent)

Dzongkhags		**Agriculture land under irrigation in acres**						
		0	**<0.25**	**0.25-0.5**	**0.51-1**	**1.1-2**	**2.1-4**	**>4**
Lhuentse	Endline	32.61	7.61	30.43	17.39	8.70	3.26	0.00
	Baseline	33.0	18.8	23.5	5.9	0	0	0
Mongar	Endline	31.60	22.40	25.20	16.40	3.60	0.80	0.00
	Baseline	69.5	8.3	11.1	0.9	1.9	0	0
Pemagatshel	Endline	97.32	0.00	0.67	2.01	0.00	0.00	0.00
	Baseline	73.0	12.4	9.0	2.2	2.2	1.1	0
S/Jongkhar	Endline	85.91	4.03	0.67	1.34	2.68	4.70	0.67
	Baseline	57.9	13.6	11.4	1.1	5.7	6.8	3.3
Trashigang	Endline	42.93	31.52	15.76	6.52	2.17	1.09	0.00
	Baseline	36.1	39.8	9.8	12.0	1.5	0.8	0
T/yangtse	Endline	34.78	27.17	9.78	14.13	9.78	4.35	0.00
	Baseline	22.6	39.6	24.5	3.8	9.4	0	0
Average	Endline	**54.19**	**15.46**	**13.75**	**9.63**	**4.49**	**2.37**	**0.11**
	Baseline	**50.2**	**21.9**	**12.4**	**9.5**	**3.6**	**1.8**	**0.6**

Table 28: Land under irrigation (count)

Dzongkhags		**Agriculture land under irrigation in acres**						
		0	**<0.25**	**0.25-0.5**	**0.51-1**	**1.1-2**	**2.1-4**	**>4**
Lhuentse	Endline	30	7	28	16	8	3	0
	Baseline	26	16	16	20	5	0	0
Mongar	Endline	79	56	63	41	9	2	0
	Baseline	72	9	9	12	1	2	0
Pemagatshel	Endline	145	0	1	3	0	0	0

	Baseline	63	11	8	2	2	1	0
S/Jongkhar	Endline	128	6	1	2	4	7	1
	Baseline	42	12	10	1	5	6	3
Trashigang	Endline	79	58	29	12	4	2	0
	Baseline	48	53	13	16	2	1	0
T/yangtse	Endline	32	25	9	13	9	4	0
	Baseline	12	21	13	2	5	0	0
Average	Endline	**82.17**	**25.33**	**21.83**	**14.5**	**5.67**	**3.0**	**0.17**
	Baseline	**43.83**	**20.33**	**11.5**	**8.83**	**3.33**	**1.67**	**0.5**

A total of 96.34 acres of fallow land were brought under cultivation with the support of irrigation supply in the past six years across the six eastern Dzongkhags. Trashigang recorded the highest with converted land of 41 acres, followed by Samdrup Jongkhar with 26 acres, while Mongar and Lhuentse accounts around 10 acres each. In contrast, Pemagatshel and Trashiyangtse had relatively smaller areas of conversion of about 5 acres and 4 acres respectively. This reflects revival of un-used land for agricultural production with improved water access which has enabled farmers to grow cash crops and winter vegetables. For example, Wamakhar in Mongar, through a dryland irrigation scheme funded by CARLEP has brought 72 acres of fallow land under cultivation, benefitting 46 households to grow commercial winter vegetables.

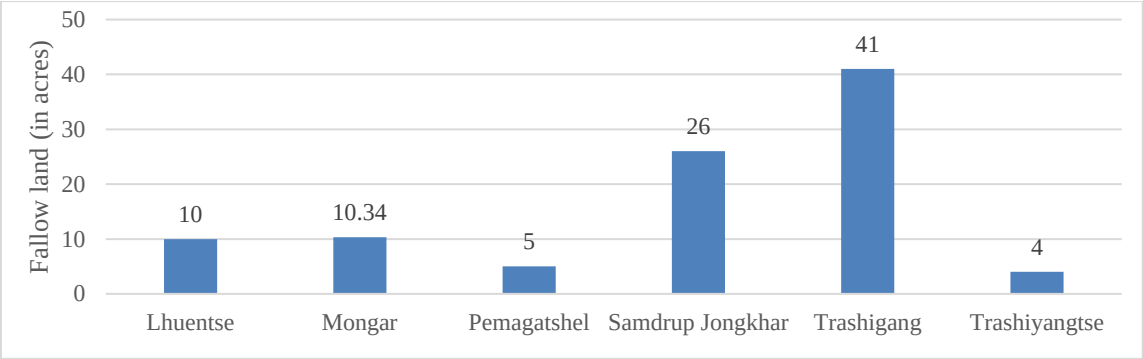


Fig 10: Fallow land brought under irrigation (acres)

7.4 Water sources and adequacy

Even after the support provided through the project for irrigation system, some of the households are still facing water shortages. Among the Dzongkhags, about 60% are reported from Trashiyangtse, 54% in Trashigang and 45% in Mongar followed by other Dzongkhags which also reported water shortage by about 35% of the households. Most of the programme areas had large network of irrigation systems designed primarily to meet water demand for paddy cultivation but due to inadequate maintenance, use of inappropriate technology and inappropriate design, most of those irrigation systems were found to have low water delivery efficiency. To address those issues, the project has been supporting new construction as well as rehabilitation of existing schemes. Accordingly, project was able to support 6.85km in Mongar, 8km in Trashigang and 4km in Trashiyangtse through renovation. Thus, the project interventions may not have reached to every

household of the target population which may be causing water shortage or it can be seasonality issue of water.

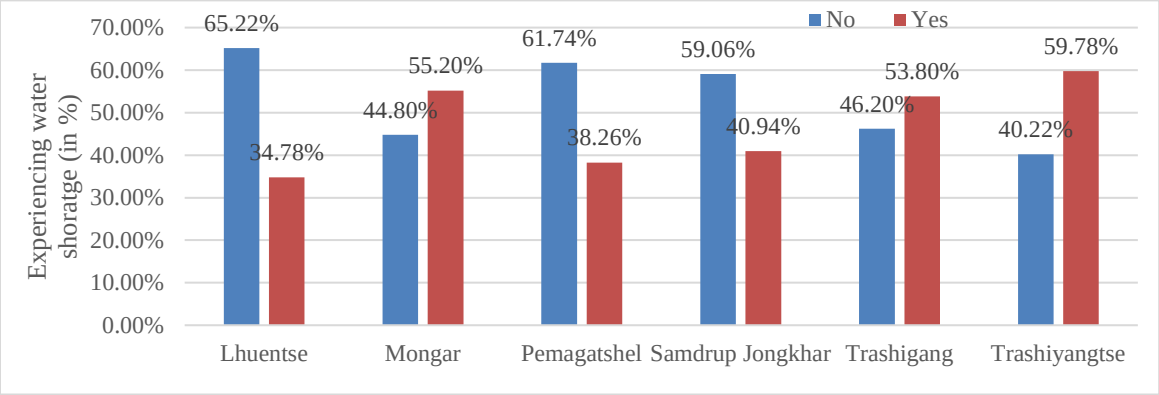


Fig 11: HHs experiencing water shortage

Before the implementation of the project, the primary sources of water for irrigation varies across dzongkhags. In Pemagatshel, 85.91% of the households relied on drinking water taps, while in Trashigang and Trashiyangtse, rainwater was the main source as used by 83.15% and 67.39% respectively. Samdrup Jongkhar and Lhuentse were without any irrigation water source as indicated by 47.65% and 46.74% respectively. In Mongar, 42.8% of the households did not have water source. Overall, across all six dzongkhags, rainwater (36.35%) and drinking water taps (25.44%) were the most common sources, with very few households using water canals (0.44%), reflecting limited infrastructure for dedicated irrigation before the project.

Table 20: Sources of water before the project (percent)

Dzongkhags	Drinking water tap	Natural Stream	No source	Rain Water	Water canal
Lhuentse	14.13	9.78	46.74	26.09	3.26
Mongar	20.40	14.80	42.80	22.00	0.00
Pemagatshel	85.91	1.34	10.74	2.01	0.00
Samdrup Jongkhar	26.17	2.01	47.65	24.16	0.00
Trashigang	0.54	5.43	10.87	83.15	0.00
Trashiyangtse	1.09	19.57	10.87	67.39	1.09
Grand Total	**24.71**	**8.82**	**28.28**	**37.47**	**0.44**

About 69.43% of the respondents reported that the water supplied through the irrigation system is inadequate for agricultural production, while only 30.57% considered it sufficient. The issue of inadequacy of water is particularly pronounced in Pemagatshel by 98.66% and Samdrup Jongkhar by 86.58%, suggesting need of further enhancement in the irrigation system in these Dzongkhags. In contrast, Trashigang is the only dzongkhag where about 51.09% found that the irrigation water is adequate.

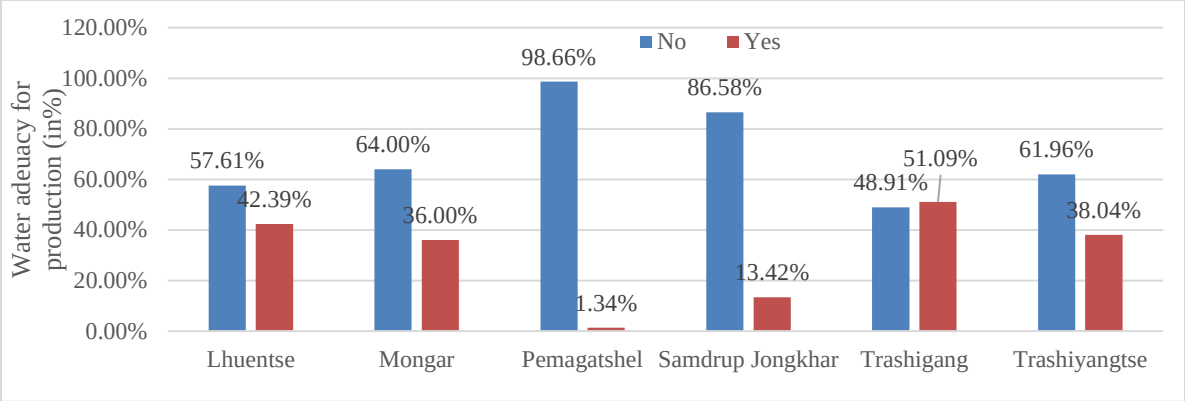


Fig 12: Adequacy of water for production

8. Production and productivity

According to respondents, vegetable cultivation is practiced in nearly all project Dzongkhags. The highest rates were reported in Lhuentse, Mongar and Pemagatshel, where 97% to 99% of households are engaged in growing vegetables. The lowest was from Trashigang with 89.67% of the households' growing vegetables.

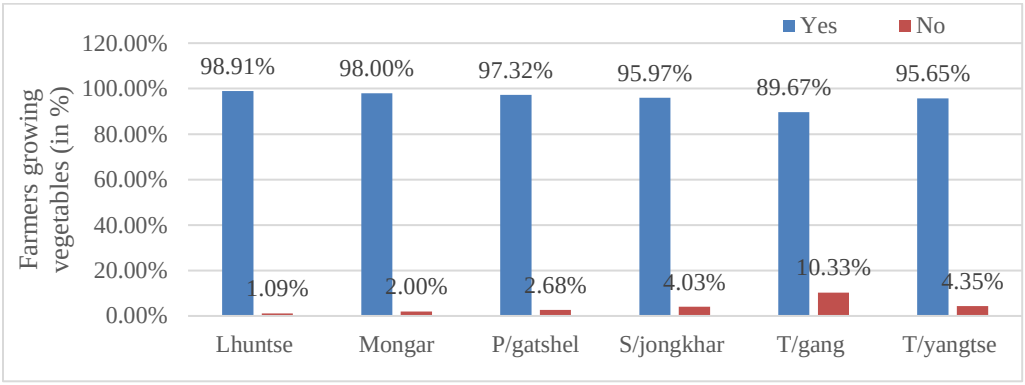


Fig.13: Growing of vegetables

In 2024, among the households, there is notable growth of vegetable production such as potatoes of 458,737kg from 181.3 acres of land with the income generation of Nu. 8.88 million. This is followed by 92,463kg of chilli from 165.99 acres with the income generation of Nu. 5.05 million and 45,126kg of beans from 86.69 acres earning an income of Nu. 1.47 million. The lowest production was asparagus grown over a minimal area of 1.36 acres, producing 1,238 kg but was able to generate an income of Nu. 27,400.

Among the fruits, the highest production was mandarin with 67,928 kg from 32.04 acres of land and earning an income of Nu. 2.48 million. This is followed by areca nut and cardamom production of 83,541kg and 5,476kg, earning income of Nu. 3.56 million and Nu. 3.71 million respectively. On the other hand, avocado is a high value fruit which has generated Nu. 927,200 from selling just 6,232kg.

For cereals, maize is the most grown product cultivated over 836.6 acres, producing 517,064.2 kg and were able to earned Nu. 2.94 million. This is followed by rice earning an income of Nu. 1.27million from production of 501,388kgs from 433.5 acres. Other cereals like quinoa, wheat, buckwheat, and mustard etc. were produced very minimum with the corresponding minimum income earning. Overall, vegetables dominate production and income, while selected fruits and spices like mandarin, cardamom, and areca nut showed stronger commercial potential.

Table 30: Production and income earned from various products

	Harvest area (acre)	HHs	Production (kg)	HHs	Yield (Kg/acre)	Sold (kg)	HHs	Earning (Nu.)	Earning /HH
Vegetables									
Radish	33.63	322	44637	300	1327.30	15635	95	284130	2990.84
Carrot	24.08	335	18219	327	756.60	11618	122	959920	7868.20
Broccoli	63.76	584	40527	546	635.62	35040	196	1384455	7063.55
Tomato	33.44	276	7972	259	238.40	1665	43	81840	1903.26
Onion	30.34	301	8113	274	267.40	3819	29	174575	6019.83
Cabbage	89.47	687	65833	639	735.81	48715	234	1197845	5119.00
Beans	86.69	649	45126	614	520.54	34403	215	1472235	6847.60
Asparagus (bundle)	1.36	24	344	19	252.94	1238	8	27400	3425.00
Chilli	165.99	746	92463	693	557.04	69099	218	5048800	23159.63
Peas	8.86	119	4868	108	549.44	3112	45	150126	3336.13
Cauliflower	53.76	475	32851	51	611.07	20886	157	942220	6001.40
Green leaves (bundle)	86.32	653	31117	586	360.48	16652	152	448430	2950.20
Ginger	62.36	624	41437	242	664.48	34146	74	1268990	17148.51
Potato	181.302	649	458737	626	2530.24	408628	287	8882861	30950.74
Cereals									
Buckwheat	4.79	15	1320.8	15	275.74	0	0	0	0.00
Wheat	12.37	23	5727	21	462.97	75	1	3000	3000.00
Quinoa	4.671	25	2118	13	453.44	1013	8	73000	9125.00
Maize	836.56	726	517064.2	669	618.08	56416	88	2929450	33289.20
Rice	433.517	294	501388	285	1156.56	97983	39	1266750	32480.77
Fruits									
Avocado	28.653	157	5151	76	179.77	6232	48	927200	19316.67
Pineapple	15.92	72	2175	64	136.62	999	12	63300	5275.00
Persimmon	0.62	6	1183	6	1908.06	800	3	35000	11666.67
Mango	50.392	215	11683	150	231.84	6940	29	313400	10806.90
Mandarin	32.04	146	67928	115	2120.10	62059	84	2422570	28840.12
Passion fruit	4.36	33	790	25	181.19	220	2	12000	6000.00
Kiwi	3.24	62	748	62	230.86	120	2	18000	9000.00
Cash crop									
Areca nut	94.75	119	83541	89	881.70	716544	75	3561368	47484.91

Cardamom	57.49	89	5476	70	95.25	5412	68	3705380	54490.88
Mustard	8.42	15	890	14	105.70	175	2	13000	6500.00

While comparing the production of vegetables, fruits and cereals, there is significant changes in production of major products such as rice from 15,026kgs in 2015 to 501,388 kgs in 2024, maize production from 45,566kgs in 2015 to 517,064kgs in 2024. Similarly, potato production has increased from 16,067kgs in 2015 to 458,737kgs in 2024 and also cauliflower has increased from 755kgs in 2015 to 32,851kgs in 2024.

Table 31: Comparison of production by major products

	Baseline		Endline	
	Harvest area (acre)	Production (kg)	Harvest area (acre)	Production (kg)
Rice	10,504	15,026	433.517	501,388
Maize	29,082	45,566	836.555	517,064
Chilli	1,865	2,580	165.992	92,463
Cabbage	1,058	1,721	89.472	65,833
Radish	1,307	2,201	84.205	72,005
Broccoli	229	284	63.761	40,527
Beans	1,156	1,155	86.694	45,126
Cauliflower	545	755	53.762	32,851
Ginger	1,042	2,063	62.356	41,437
Potato	5,589	16,067	181.303	458,737
Cardamom	172	9	57.49	5,476
Areca nut	63,667	953	94.75	83,541
Mango	8,011	250	50.393	11,683
Mandarin	0	0	32.043	67,928

Even in terms of yield of the production of major vegetables, cereals and fruits, it is observed that the yield has increased from 2015 baseline. For example, among the cereals, yield of maize has increased from 1567 kgs/acre to 1803kgs/acre, Chilli from 1383kgs/acre to 1691kgs/acre (details shown in table 32 below).

Table 32: Production and yield comparison

	Endline			Baseline		
Crops	Harvested (acre)	Production (MT)	Yield (Kgs/acre)	Harvested (acre)	Production (MT)	Yield (Kgs/acre)
Paddy	3909	6571	1681	10504	15026	1431
Maize	9751	17579	1803	29082	45566	1567
Potato	2758	11112	4029	5589	16067	2875
Cardamom	969	184	190	172	9	55
Chilli	954	1613	1691	1865	2580	1383
Cabbage	277	806	2910	1058	1721	1627
Cauliflower	172	279	1622	545	755	1385

Radish	335	703	2099	1307	2201	1684
Beans	372	510	1371	1156	1155	999
Carrot	48	70	1458	173	205	1185
Peas	101	120	1188	363	464	1278
Tomato	37	45	1216	144	163	1132
Onion	67	68	1015	368	400	1087
Broccoli	212	327	1542	229	284	1240
Garlic	110	102	927	816	589	722
Green leave	0	432	0	980	859	877
Ginger	1109	2600	2344	1042	2063	1980
Fruits	Bearing trees	Production (MT)	Yield (Kgs/tree)	Bearing trees	Production (MT)	Yield (Kgs/tree)
Apple	2966	45	15	2834	65	23
Areca nut	114730	1708	15	63667	953	15
Mango	12163	218	18	8011	250	31

Source: Agriculture statistics 2015 and 2021, NSB

Among the households, the livestock products have made substantial contributions to the household income, particularly from dairy products and poultry. Among all, milk is the highest contributor with over 658,000 litres produced and earned Nu. 25.35 million from the sale of 377,765 litres fetching on average unit price of Nu. 67.08 per litre. Butter also recorded a high unit price of Nu. 350.50 per kg, earning Nu. 7.14 million from 20,389 kg sold, despite smaller production of butter. In terms of cheese, about 279,058 balls have been produced fetching a unit price of Nu. 46.03 per ball, generating nearly Nu. 11.64 million. In the poultry sector, eggs saw substantial production of nearly 195,000 dozen, with sales of over 181,000 dozen earning Nu. 3.97 million, fetching on average of Nu. 219.33 per dozen. Chicken though limited in volume, earned Nu. 294,000 from 3,010 kg sold at a modest price of Nu. 97.68 per kg. Among meat, pork fetched higher price at Nu. 433.33 per kg with the overall sales of Nu. 585,000 from selling 1,350 kg. Other products like fish, though less in quantity was able to fetch high unit price of Nu. 153.33 per kg.

Table 33: Dairy and poultry production

	Production in 2024	**Quantity sold**	**Amount earned (Nu)**
Egg (dozen)	194,679.00	181,164.00	3,973,440.00
Cheese (balls)	279,058.00	252,845.00	11,637,840.00
Butter (kg)	32,958.00	20,389.00	7,143,955.00
Chevon (kg)	8	0	0
Milk (litre)	658,884.00	377,765.00	25,347,614.00
Fish (kg)	61	45	6,900.00
Pork (kg)	1,900.00	1,350.00	585,000.00
Chicken (kg)	3,053.00	3,010.00	294,000.00

9. Market

9.1 Market information and access

With regard to access to market information via smartphones, only about 36% of respondents reported being able to access such information, while 64% do not have access. The highest smartphone-based market access is observed in Mongar (46.80%) and Trashiyangtse (45.65%), indicating slightly better digital connectivity or literacy in these areas. Conversely, Samdrup Jongkhar has the lowest rate of smartphone-based market access at just 16.11%, highlighting a major gap in digital information access. Pemagatshel, Lhuentse, and Trashigang also show lower access with over 60% of respondents reporting limited access to market information through smartphones.

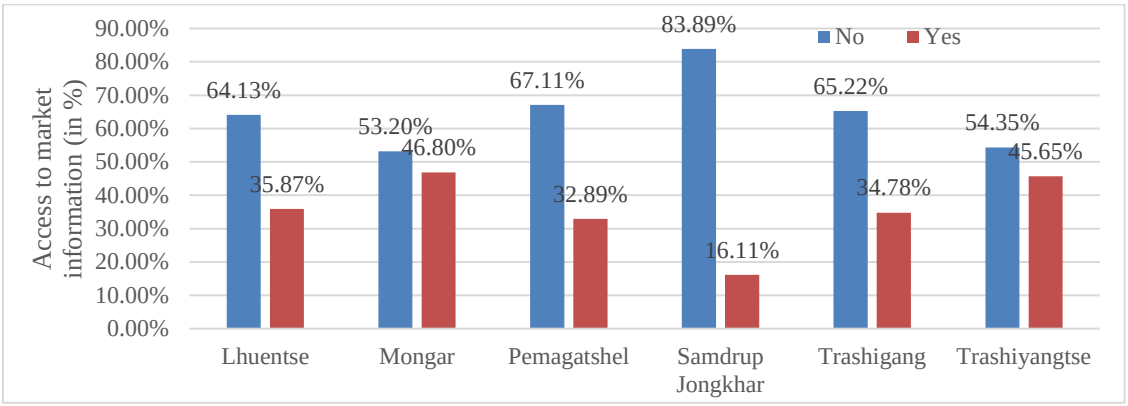


Fig.14: Access to market information via smart phones

Despite some access to market information through smartphones, the actual use of information in making investment decisions is limited since only 25.33% of respondents reported using market information to guide their investments while a substantial 74.67% do not. Mongar has the highest rate of usage at 36.80%, followed by Trashigang (26.63%) and Pemagatshel (26.17%). In contrast, Samdrup Jongkhar shows the lowest usage with only 9.40% using market data for investment decisions.

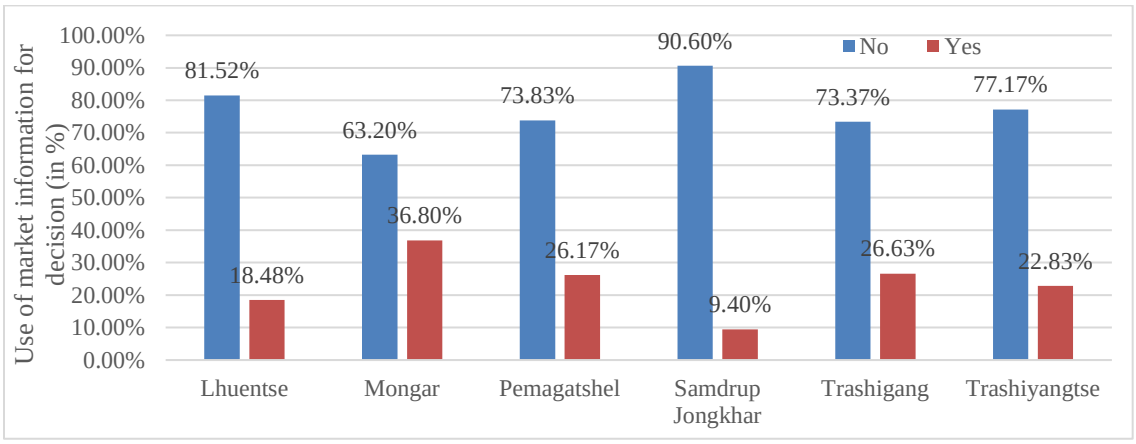


Fig 15: Use of market information for decision making

Access to weather information among farmers across the six eastern dzongkhags is high, with 98.91% reporting that they receive such information from various sources. This indicates a strong penetration of weather-related communication channels in the region.

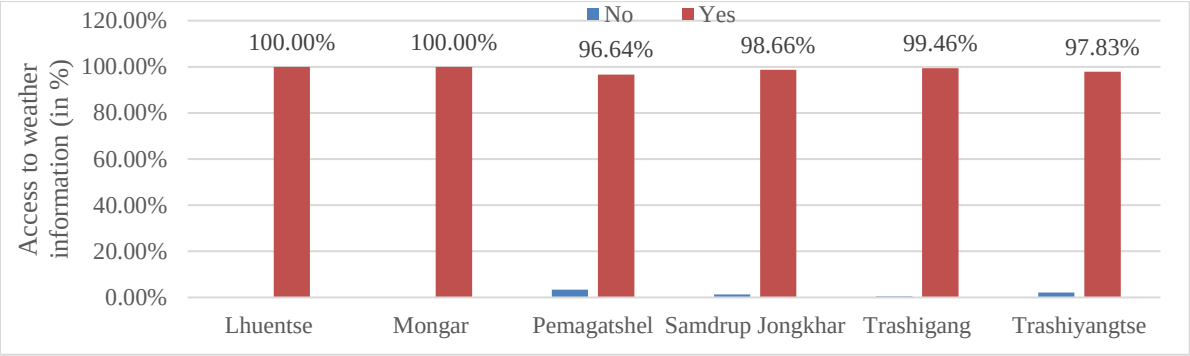
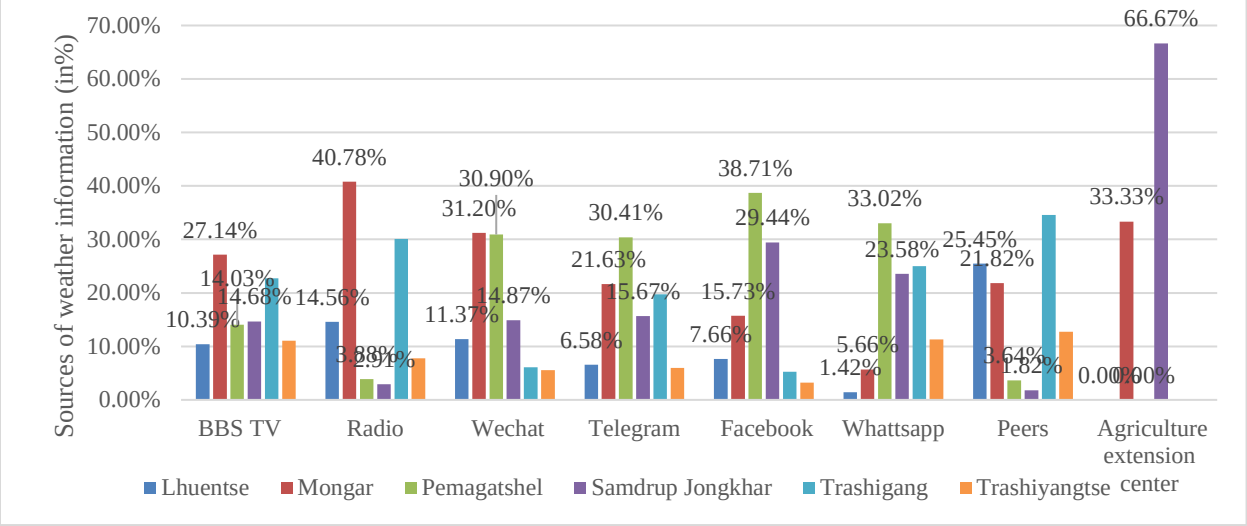


Fig.16: Access to weather information

The sources of information vary by location and reflect a mix of traditional and modern platforms. Radio and BBS TV remain important in areas like Mongar (40.78% radio, 27.14% BBS TV) and Trashigang (30.10% radio, 22.73% BBS TV), while social media platforms such as Facebook (38.71% in Pemagatshel, 29.44% in Samdrup Jongkhar), WeChat (31.20% in Mongar, 30.90% in Pemagatshel), WhatsApp (33.02% in Pemagatshel, 25.00% in Trashigang), and Telegram (30.41% in Pemagatshel, 21.63% in Mongar) are increasingly used. Peer-to-peer communication is significant in Trashigang (34.55%) and Lhuentse (25.45%), reflecting strong informal networks. Additionally, agriculture extension centers play a crucial role in Samdrup Jongkhar (66.67%) and Mongar (33.33%) but are not used in Lhuentse, Trashigang, or Trashiyangtse.



Overall satisfaction with market information, incentive distribution, and related aspects remains moderate among respondents across the six eastern dzongkhags. On average, 76.16% reported being moderately satisfied, while only 7.90% expressed high satisfaction. The highest rate of satisfaction was reported in Mongar by 21.60%, whereas the other dzongkhags, including

Lhuentse, Trashigang, and Trashiyangtse, about 4.35% were satisfied. Dissatisfaction levels were relatively high in Samdrup Jongkhar (34.23%) and Pemagatshel (31.54%).

Table 34: Satisfaction level of market information (in percent)

Dzongkhags	Highly satisfied	Moderately satisfied	Not satisfied
Lhuentse	4.35	92.39	3.26
Mongar	21.60	69.20	9.20
Pemagatshel	4.03	64.43	31.54
Samdrup Jongkhar	8.72	57.05	34.23
Trashigang	4.35	89.13	6.52
Trashiyangtse	4.35	84.78	10.87
Average	**7.90**	**76.16**	**15.94**

9.2 Primary markets for vegetables

There are diverse range of primary markets for vegetables in the six eastern dzongkhags through various distribution channels. Local markets within a short vicinity of the villages are mostly utilized by the communities which makes about 51.05% of vegetable sales in Mongar, 13.50% in Lhuentse, and smaller proportions in other Dzongkhags. Thromde markets within the regions are also significant in the case of Mongar (53.54%) and Trashiyangtse (23.62%). Aggregators or contract buyers dominate in Mongar (58.77%), followed by Trashigang (13.60%) and Lhuentse (7.89%). This indicates that there is stronger reliance on informal market linkages by the communities. The other market is that of institutions such as schools, monastic institutions or project offices which makes a major share of market for vegetables such as in Trashigang (29.45%) and Mongar (37.45%).

Table 35: Vegetable market distribution (in percent)

	Lhuentse	Mongar	P/gatshel	S/Jongkhar	T/gang	T/yangtse
Self-Consumption	12.08	9.90	24.15	30.19	16.91	6.76
Out of the Region	0.00	40.00	20.00	20.00	0.00	20.00
Export to India	0.00	40.00	0.00	40.00	0.00	20.00
Local Farm Shops (FCBL)	0.00	18.18	0.00	9.09	45.45	27.27
Thromde Market	0.79	53.54	7.87	6.30	7.87	23.62
Local Market	13.50	51.05	10.55	6.75	9.28	8.86
Middle man or regular contract buyer	7.89	58.77	8.33	1.75	13.60	9.65
Schools and institutions	8.36	37.45	12.00	1.45	29.45	11.27

Dzongkhags like Mongar and Samdrup Jongkhar also reported about 40% export of vegetables to India. This may be true because of the easy access of Mongar through Nganglam and Samdrup Jongkhar just being adjacent to Indian border. On the other hand, Trashigang (45.45%) and Trashiyangtse (27.27%) depend heavily on the Food Corporation of Bhutan Limited (FCBL) farm

shops for distribution. There are also others about 30.19% in Samdrup Jongkhar and 24.15% in Pemagatshel who are mostly using for their own consumption.

9.3 Primary markets for dairy

The distribution of dairy product market varies across the six eastern dzongkhags. Mongar shows a stronger reliance on the KIL (Chenery) facility, with 63.64% of households supplying milk to KIL followed by the use of middlemen or regular contract buyers reported by 55.50% of the households. Samdrup Jongkhar stands out to be the highest exporter of milk to India as reported by 88.89% and also selling out-of-region as reported by 57.14%.

Trashigang also shows notable sales of milk to KIL as reported by 36.36% and dairy products to schools and institutions by 26.94%. Local farm shops operated by FCBL are also used moderately by around 22% in each of the Dzongkhags of Samdrup Jongkhar, Trashigang, and Trashiyangtse. Sale of dairy products to local markets within the close vicinity are more common in Mongar (37.03%) and Trashigang (23.42%) as compared to other dzongkhags. There are also others who use mainly for self-consumption as represented by 28.14% in Samdrup Jongkhar and 19.52% in Pemagatshel.

Table 36: Dairy market distribution (in percent)

	Lhuentse	Mongar	P/gatshel	S/Jongkhar	T/gang	T/yangtse
Self-consumption	8.37	14.19	19.53	28.14	18.84	10.93
KIL (Chenery)	0.00	63.64	0.00	0.00	36.36	0.00
Out of the Region	0.00	42.86	0.00	57.14	0.00	0.00
Export to India	0.00	0.00	0.00	88.89	0.00	11.11
Local Farm Shops (FCBL)	0.00	33.33	0.00	22.22	22.22	22.22
Thromde Market	0.00	38.21	17.89	6.50	13.82	23.58
Local Market	14.56	37.03	13.61	4.75	23.42	6.65
Middle man or regular contract buyer	9.17	55.50	17.43	0.92	11.93	5.05
Schools and institutions	8.57	36.73	19.59	1.22	26.94	6.94

9.4 Involvement of aggregators or traders

There are presence of aggregators or traders, who regularly purchases agricultural produces from the farmers. Accordingly, about 72.16% of households reported not using such services while 27.84% are making use of them. The presence of such aggregators or traders varies among the Dzongkhags like Mongar has the highest percentage as responded by 49.20%, followed by 35.87% in Trashiyangtse and 22.15% in Pemagatshel. In contrast, Lhuentse (7.61%), Samdrup Jongkhar (9.40%), and Trashigang (24.46%) involves lesser aggregators or traders.

The respondents were also asked whether involvement of aggregators or traders have improved their access to markets. Overall, 94.02% of the households reported that it did help their market access as they are able to sell their produce in bulk quantities. Among the Dzongkhags, Trashigang,

Mongar, Pemagatshel, and Trashiyangtse reported higher response on improvement of market access due to such arrangement as reported by 87% and above in these Dzongkhags. In Lhuentse, 66.67% says that there are improvements in the access to market with such arrangement while 33.33% feels otherwise.

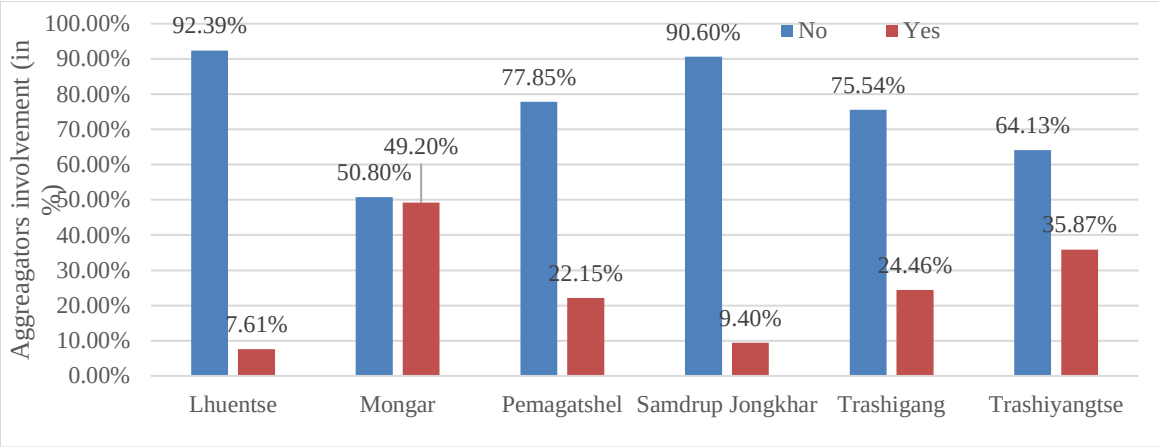


Fig.18: Involvement of aggregators or traders

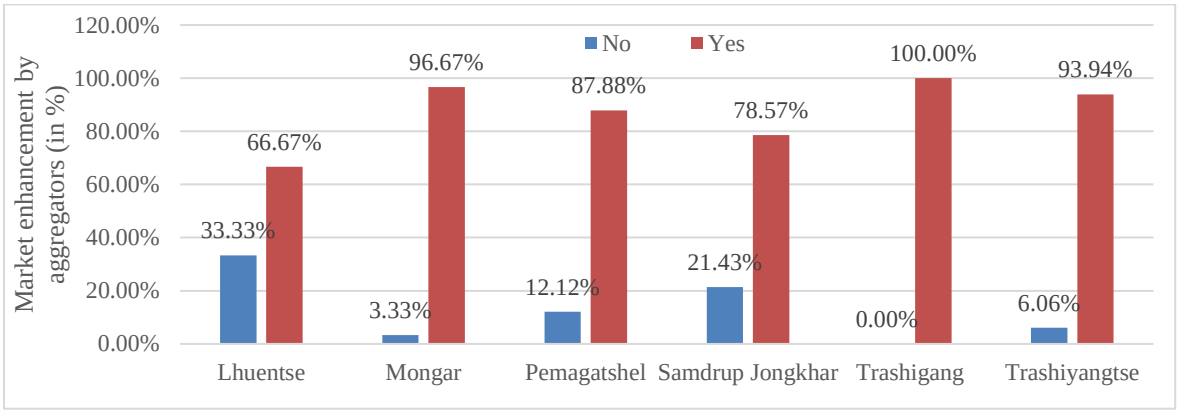


Fig.19: Improvement of market by aggregators or traders

10. Main sources of income

The sources of income across various Dzongkhags varies. The highest total income from the sale of vegetables is in Mongar, amounting to over Nu. 11.16 million, followed by Trashigang and Trashiyangtse with Nu. 3.06 million and Nu. 2.52 million respectively. Livestock dairy products generate substantial income totaling to more than Nu. 31.67 million, with Pemagatshel (Nu. 10.05 million) and Mongar (Nu. 9.82 million) leading in this category. Income from cereals is comparatively lower, with Mongar again leading at Nu. 1.75 million, and Trashigang and Trashiyangtse showing moderate earnings. Salary earnings are highest in Samdrup Jongkhar, amounting to Nu. 4.38 million, indicating more formal employment engagement of those rural farmers. Sale of eggs contributes to over Nu. 3.54 million with significant contributions from Samdrup Jongkhar and Pemagatshel. Cash crop income totals to nearly Nu. 18.6 million, mainly from Samdrup Jongkhar and Mongar Dzongkhags. Farm labor and off-farm wages also provide considerable income, particularly in Mongar and Pemagatshel. Other sources of income contribute

over Nu. 12.3 million with major contributions from Pemagatshel and Samdrup Jongkhar. Enterprise income totals to over Nu. 4.28 million, mainly concentrated in Pemagatshel and Samdrup Jongkhar. Remittance income, though relatively smaller around Nu. 1.14 million makes a key contribution towards supporting households across all dzongkhags.

Overall, total income is highest from the sale of vegetables about Nu. 22.6 million and livestock dairy products Nu. 31.6 million, indicating that these two sectors are the livelihoods of the farmers. Income from cereals is about Nu. 3 million, salary earnings nearly Nu. 9.75 million which suggest that there is significant engagement in formal employment or regular wage activities from the respective households. Income from sale of eggs contribute over Nu. 3.5 million, while cash crop income totals to almost Nu. 18.6 million. Farm labour and off-farm wages provide substantial supplementary income, totaling to over Nu. 9.5 million. Other sources of income contribute over Nu. 12.3 million, and enterprise-related activities generate more than Nu. 4.2 million. Remittances, though smaller in comparison is just over Nu. 1.1 million which still supports most of the households.

Table 37: Comparison of HHs income from various sources (in percent)

		Lhuntse	Mongar	P/gatshel	T/gang	T/yangtse	S/jongkhar
Agriculture	Endline	13.61	38.36	16.68	20.68	32.84	17.90
	Baseline	51.9	41.8	37.4	34.7	42.6	40.7
Livestock	Endline	31.95	32.82	31.37	16.88	17.91	29.18
	Baseline	11.5	13.9	35.2	17.9	23.0	22.8
Wages/skill	Endline	14.20	10.20	9.96	0.84	3.73	9.73
	Baseline	28.2	26.0	15.4	30.1	10.7	23.4
Remittances	Endline	3.55	1.55	1.85	3.38	4.48	1.17
	Baseline	0.8	10.1	6.6	11.3	9.0	6.6
Business	Endline	0.59	0.00	1.85	1.27	5.22	1.95
	Baseline	5.3	1.4	3.3	2.3	1.4	4.8
Don’t have	Endline	36.09	17.07	38.01	56.96	35.82	40.08
	Baseline	2.3	3.8	0	0.3	0	0.6

Compared to baseline survey, it was found that income source from livestock products have increased for Lhuentse (11.5% to 31.95%), Mongar (13.9% to 32.82%) and Samdrup Jongkhar (22.8% to 29.18%). However, from other sources, there is not much of significant differences from the baseline data. Again, in terms of income slabs, during the baseline study, most of the HHs has annual income up to Nu. 100,000 by 10 to 20%, followed by annual income up to Nu. 200,000 by about 8% and there are few others with annual income of more than Nu. 200,000 by about 4%. However, with the project intervention, the annual household income has already cross millions. About 15% to 24% are already earning between Nu.50,000 to Nu.100,000, about 10% to 36% are earning in between Nu.100,000 to Nu.200,000 and about 5% to 36% are earning more than Nu.200,000 in a year. This indicates the impact of CARLEP programme changing the lives of the rural population for enhancement in their livelihood and standard of living.

Table 38: Comparison of HHs income slabs (in percent)

		Lhuntse	Mongar	P/gatshel	T/gang	T/yangtse	S/jongkhar
Less than Nu.5000	Endline	0.00	0.40	0.68	1.63	2.17	0.00
	Baseline	14.1	11.1	0.9	0.8	3.8	4.5
Nu.5001 to Nu.15,000	Endline	11.96	2.79	1.35	3.26	2.17	4.03
	Baseline	25.9	16.7	20.2	22.6	18.9	17
Nu.15,001 to Nu.30000	Endline	13.04	4.78%	0.00	10.87	9.78	7.38
	Baseline	20.0	19.4	25.8	23.3	17	29.5
Nu.30,001 to Nu.50,000	Endline	11.96	9.96	11.49	7.61	8.70	11.41
	Baseline	7.1	9.3	27	21.8	32.1	11.4
Nu.50,001 to Nu.100,000	Endline	20.65	24.30	14.86	14.13	15.22	21.48
	Baseline	12.9	13.9	6.7	23.3	18.9	21.6
Nu.100,001 to Nu.200,000	Endline	23.91	29.88	36.49	9.78	18.48	20.13
	Baseline	9.4	11.1	6.7	6.8	5.7	3.4
Above Nu.200,000	Endline	10.87	20.32	29.73	4.89	9.78	26.85
	Baseline	4.7	0	4.5	0.8	3.8	0
No income	Endline	7.61	7.57	5.41	47.83	33.70	8.72
	Baseline	5.9	18.5	0	0.8	0	1.1

Table 39: Annual household income from various sources

Source of income (Nu.)	Lhuentse	Mongar	P/gatshel	S/Jongkhar	T/gang	T/yangtse	Total
Other source of income	2,332,000.00	750,000.00	6,138,100.00	2,963,000.00	45,000.00	75,000.00	**12,303,100.00**
Remittance	145,000.00	285,000.00	160,000.00	105,000.00	270,000.00	170,000.00	**1,135,000.00**
Cereals	30,000.00	1,751,250.00	405,000.00	-	558,000.00	235,000.00	**2,979,250.00**
Sale of vegetables	1,669,105.00	11,160,780.00	1,720,100.00	2,515,800.00	3,060,900.00	2,520,000.00	**22,646,685.00**
Employee salary	550,000.00	984,000.00	2,876,000.00	4,380,000.00	240,000.00	715,000.00	**9,745,000.00**
Poultry-eggs sold	130,700.00	512,010.00	641,400.00	2,205,600.00	-	54,900.00	**3,544,610.00**
Fruit	47,000.00	3,937,250.00	595,500.00	44,200.00	1,051,300.00	269,000.00	**5,944,250.00**
Livestock (Meat sold)	-	-	12,600.00	620,000.00	-	-	**632,600.00**
Cash crop	1,006,650.00	4,562,670.00	3,749,270.00	6,741,715.00	1,405,800.00	1,130,750.00	**18,596,855.00**
Farm labour/off farm activities	1,252,500.00	4,082,000.00	2,275,400.00	1,764,400.00	20,000.00	130,000.00	**9,524,300.00**
Processed products sold	-	1,722,000.00	-	60,000.00	-	70,000.00	**1,852,000.00**
Enterprise	135,000.00	-	1,740,000.00	1,428,000.00	74,000.00	910,000.00	**4,287,000.00**
Livestock (Dairy products sold)	1,733,540.00	9,816,424.00	10,049,120.00	5,555,890.00	3,691,000.00	824,750.00	**31,670,724.00**
Total	**9,031,495.00**	**39,563,384.00**	**30,362,490.00**	**28,383,605.00**	**10,416,000.00**	**7,104,400.00**	

Note: Other sources of income mean any other source besides the sale of farm produce, labour contribution, salary, remittance as mentioned above.

11. Resilient agricultural production

11.1 Adoption of sustainable agricultural practices

The table below presents the frequency of different types of agricultural practices reported across various areas. Among the households, crop rotation (731) and double cropping (584) are the most commonly used agricultural practices indicating a strong focus on maximizing land productivity and maintaining soil fertility. Use of local seeds (602) slightly surpasses that of improved seeds (504), showing preference on traditional seed varieties rather than imported ones. Manure application (669) is more widely adopted than fertilizer application (365), suggesting a tendency toward organic or semi-organic practices in agriculture.

Plain dry land cultivation (439) is more frequent than wet land cultivation (287), possibly due to regional topography and water availability. Pasture cultivation is 245 and local cow breeds is only 155. Use of organic pesticide (94) is more common than utilization of chemical pesticides (17), indicating more sustainable approach of pest management.

Practices like hedge row plantation (46), contour farming (6), and ridge (bed) cultivation (263) are less common, possibly due to knowledge gaps, terrain unsuitability or resource constraints. Overall, there is more sustainable practices like crop rotation, use of local seeds, manure application, and use of minimum pesticides, while technical practices like soil conservation methods are less prevalent.

As coping mechanisms, several activities were undertaken by the project such as encouraging farmers to plant pasture and fodder; supply of drought and pest resistant variety of seeds; diversification of crop cultivation; encouraging organic cultivation; undertaking crop rotation and intercropping; encouraging cultivation of high value crops and agro-forestry practices. Then in terms of sustainable land management and practices related to coping with climate change and its effects, project undertook diverse practices such as crop rotation, intercropping, contour farming, manure application, use of leaf litter, use of compost, stall feeding of cows, using drought and pest resistant seeds, dryland terracing, dryland conversion to wetland, mulching, using bio-gas for cooking, using proper cultivation technologies to prevent pest and diseases, practicing rain water harvesting etc.

In comparison with the baseline data, hedge row cultivation has increased in Pemagatsel, Samdrup Jongkhar and Trashiyangtse Dzongkhags. Similarly, Manure application has increased in most of the Dzongkhags except in Lhuentse and Samdrup Jongkhar. Even in the case of local seeds or improved seeds application, Mongar and Trashigang have enhanced its utilization from the baseline stage. Further, double cropping and crop rotation practices are more prominent in most of the Dzongkhags compared to baseline data. Similar are the cases for enhanced application of most of the agriculture practices and technology adoption being observed as shown in the table below.

Table 40: Agricultural practices adoption

		Lhuentse		Mongar		P/gatshel		S/Jongkhar		T/gang		T/yangtse		Total (endline)	Total (baseline)
		Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline		
Ridge cultivation	Count	10	6	18	14	24	69	23	88	92	44	33	42	263	200
	Percent	2.5	6.5	4.0	5.6	5.1	46.3	6.1	59.0	8.6	23.9	8.7	45.6	31.1	6.3
Manure application	Count	77	62	96	192	64	126	68	63	129	143	52	83	669	486
	Percent	18.9	67.3	21.3	76.8	13.7	84.5	18.0	42.2	12.1	77.7	13.8	90.2	73.1	15.4
Fertilizer application	Count	44	35	37	99	53	50	14	10	38	104	93	67	365	279
	Percent	10.8	38.0	8.2	39.6	11.3	33.5	3.7	6.7	10.1	56.5	8.7	72.8	41.2	8.9
Local seeds	Count	78	72	102	179	70	49	76	70	128	161	50	71	602	504
	Percent	19.1	78.2	22.7	71.6	15.0	32.8	20.2	46.9	12.0	87.5	13.2	77.1	65.7	16
Improved seeds	Count	78	72	94	195	72	54	62	29	37	90	20	64	504	363
	Percent	19.1	78.2	20.9	78.0	15.4	36.2	16.4	19.4	3.5	48.9	5.3	69.5	55.0	11.5
Double cropping	Count	1	66	6	186	24	132	36	89	86	72	27	39	584	180
	Percent	0.2	71.7	1.3	74.4	5.1	88.5	9.5	59.7	8.0	39.1	7.1	42.3	62.6	5.7
Crop rotation	Count	41	68	45	188	20	140	8	11	69	148	22	66	731	205
	Percent	10.0	73.9	10.0	75.2	4.3	93.9	2.1	7.3	6.4	80.4	5.8	71.7	67.1	6.5
Wetland cultivation	Count	47	51	19	52	9	18	20	60	69	71	34	35	287	198
	Percent	11.5	55.4	4.2	20.8	1.9	12.0	5.3	40.2	6.4	38.5	9	38.0	34.2	6.3
Dry land cultivation	Count	3	52	17	126	53	105	47	66	55	54	13	36	439	188
	Percent	0.7	56.5	3.8	50.4	11.3	70.4	12.5	44.3	5.1	29.3	3.4	39.1	48.3	6
Contour farming	Count	5	0	2	0	3	2	1	0	98	2	22	2	6	131
	Percent	1.2	0	0.4	0	0.6	1.3	0.3	0	9.2	1.0	5.8	2.1	0.7	4.2
Hedge row plantation	Count	10	0	8	1	8	42	1	0	75	0	10	3	46	122
	Percent	2.5	0	1.8	0.4	1.7	28.1	0.3	0	7	0	2.6	3.2	5.3	3.6
Use of organic pesticides	Count	1	0	4	8	27	12	14	35	27	29	23	10	94	96
	Percent	0.2	0	0.9	3.2	5.8	8.0	3.7	23.4	2.5	15.7	6.3	10.8	10.2	3
	Count	7	0	1	2	9	0	0	0	91	4	30	11	17	138

Use of chemical pesticides	Percent	1.7	0	0.2	0.8	1.9	0	0	0	8.5	2.1	7.9	11.9	2.4	4.4
Pasture cultivation	Count	6	23	1	79	32	74	7	60	21	6	4	3	245	71
	Percent	1.5	25.0	0.2	31.6	6.8	49.6	1.9	40.2	2	3.2	1.1	3.2	25.5	2.3

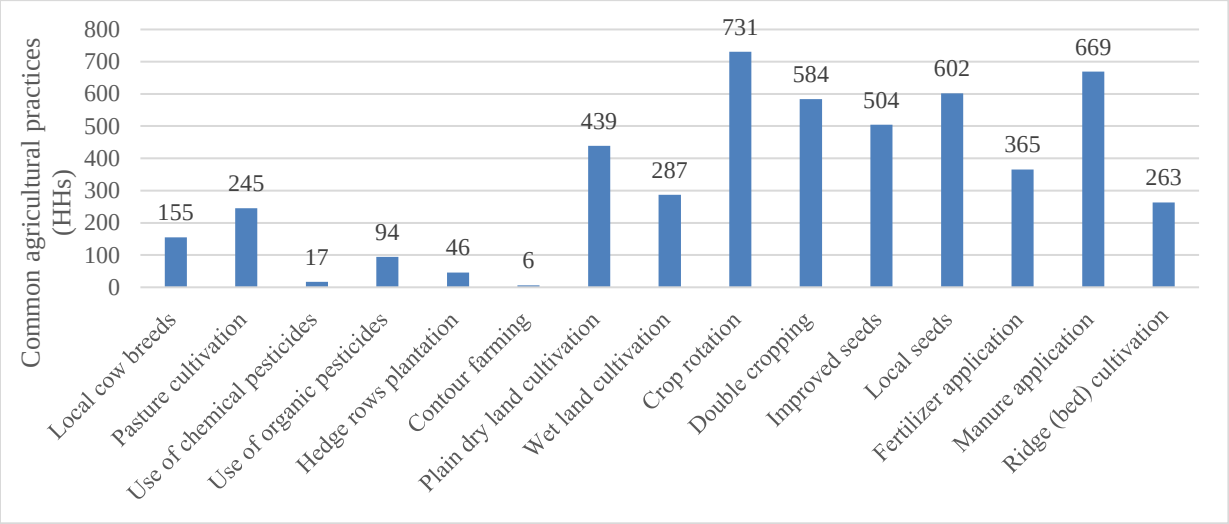


Fig.20: Common agricultural practices

11.2 Adoption of livestock technology practices

The frequency of adoption of various livestock production technologies across six dzongkhags are mostly improved cattle shed construction (228) followed by bio-gas use (161), clean milk production (136), and improved fodder grass plantation (183). Mongar leads in adoption of almost all types of technologies, notably 89 improved cattle sheds, 83 improved fodder grass plantations, and 69 bio-gas units. Pemagatshel and Samdrup Jongkhar follows a moderate adoption in clean milk production of 36 and 16 and bio-gas (26 and 30). Trashigang stands out for its high uptake of winter fodder cultivation (50) but lesser adoption of other technologies.

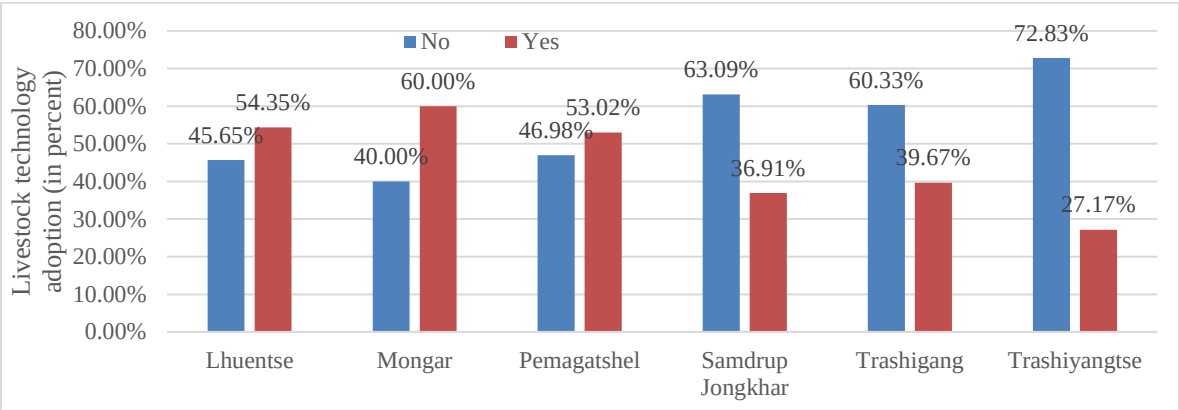


Fig 21: Adoption of livestock technologies

Lhuentse has moderate levels of adoption in bio-gas (17), clean milk production (16), and improved cattle sheds (25), but relatively less in winter fodder cultivation (3) and total mixed ration (1). Trashiyangtse shows the lowest overall adoption of technology such as milk processing (4), clean milk production (2), and total mixed ration (2), but a relatively better for winter fodder cultivation (15).

Total mixed ration, a more advanced feeding technique, has seen minimal uptake across all dzongkhags, with only 8. Milk processing and packaging technology has been adopted by 64 suggesting relatively low investment in value addition. Overall, the technology adoption in livestock suggests stronger emphasis on infrastructure and basic nutritional interventions (like improved cattle sheds and fodder cultivation), with less focus on advanced feeding and processing technologies.

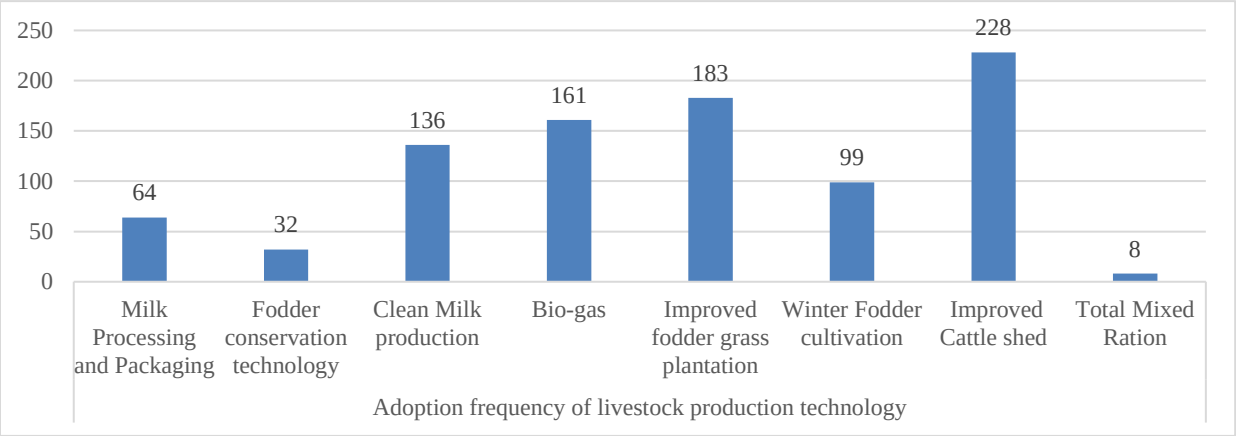


Fig.22: Adoption of livestock production technology

Overall, 884 bio gas were adopted along with support provided for dairy shed construction of 2456. About 80 breeding bulls were also provided along with fodder slips propagation of 997.01 acres and improved pasture development of 3,729.7 acres as shown in table below.

Table 41: Adoption of livestock technologies

	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	24-25	Total
Biogas	0	0	3	266	160	196	190	31	36	2	884
Dairy shed	20	373	265	186	568	394	147	50	134	319	2456
Breeding bull	0	0	0	0	14	2	20	0	16	28	80
Fodder slips propagation (acre)	0	72.28	0	49.9	30.6	181.9	188	152.5	74.33	247.5	997.01
Improved pasture (acre)	187	418	73	560	726.5	997.2	358	80	290	40	3729.7

Source: Progress reports)

11.3 Adoption of agriculture technologies

In terms of adoption of agricultural production technologies, most widely adoption are the sprinklers (199) followed by soil and water management (176) and greenhouse or poly-tunnel usage (170), indicating stronger interest in water-efficient and climate-resilient practices. Plant protection methods also show higher adoption (142), reflecting awareness of pest and disease control. New vegetable production techniques (135) and composting (98) are moderately adopted, suggesting growing attention to both productivity and soil fertility.

In contrast, adoption of post-harvest technologies (34), farm mechanization and land development (33), and orchard management (42) are less indicating potential gaps in value addition, labour-saving technologies, and perennial crop care. Drip irrigation, while more efficient than sprinkle systems, has been adopted only by 60 which may be due to higher initial cost of investment or limited technical support. Among the post-harvest technologies, solar dryers (10) and Internet of Things (IoT)-based automation (3) is very minimum.

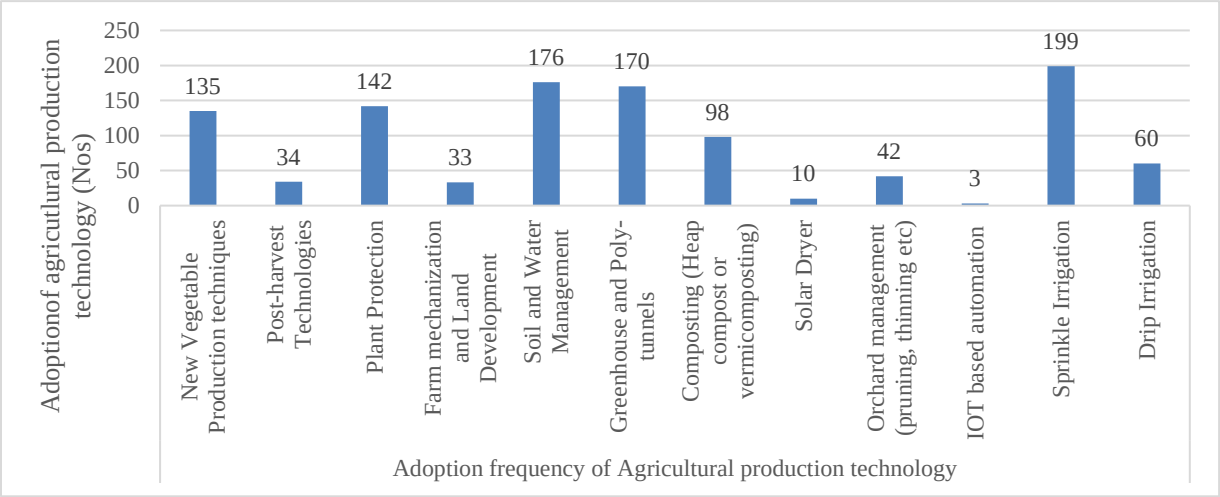


Fig.23: Adoption of agricultural production technology

11.4 Environmentally sustainable technologies

The percentage of respondents who have received support for environmentally sustainable and climate-resilient technologies and practices across six dzongkhags shows that Lhuentse (63.04%) and Mongar (61.60%) have relatively higher outreach or access to such initiatives.

In contrast, Samdrup Jongkhar (7.38%), Trashigang (11.41%), Pemagatshel (13.42%), and Trashiyangtse (17.39%) have lesser exposure or support. Overall, only 30.57% of respondents across all dzongkhags received support on environmentally sustainable and climate resilient technologies and practices while 69.43% did not.

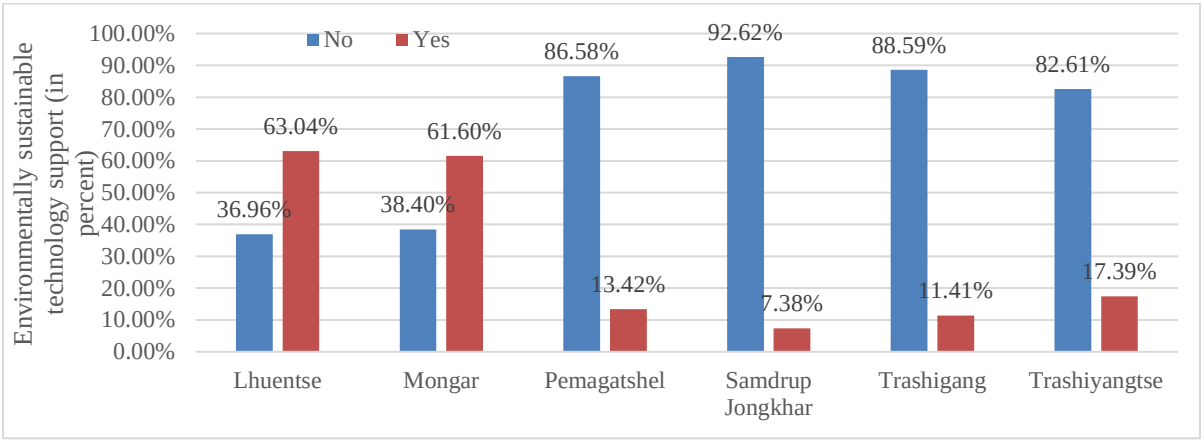


Fig 24: Environmentally sustainable and technology support

The most common form of support received was for improved pasture seeds (149) followed by efficient irrigation systems (116) and stress-tolerant seeds and seedlings (93), reflecting a strong emphasis on enhancing resilience to climate variability and water scarcity. Rainwater harvesting (74) and land management practices (58) were also supported to certain degree indicating promotion of better water conservation and soil fertility. The other areas such as support for crop diversification (51) and fodder slips (25) were moderate, suggesting some effort toward agricultural diversification and livestock feed sustainability. Others such as mushroom cultivation (14), upland paddy production (11), and native poultry (16) have the lowest levels of support.

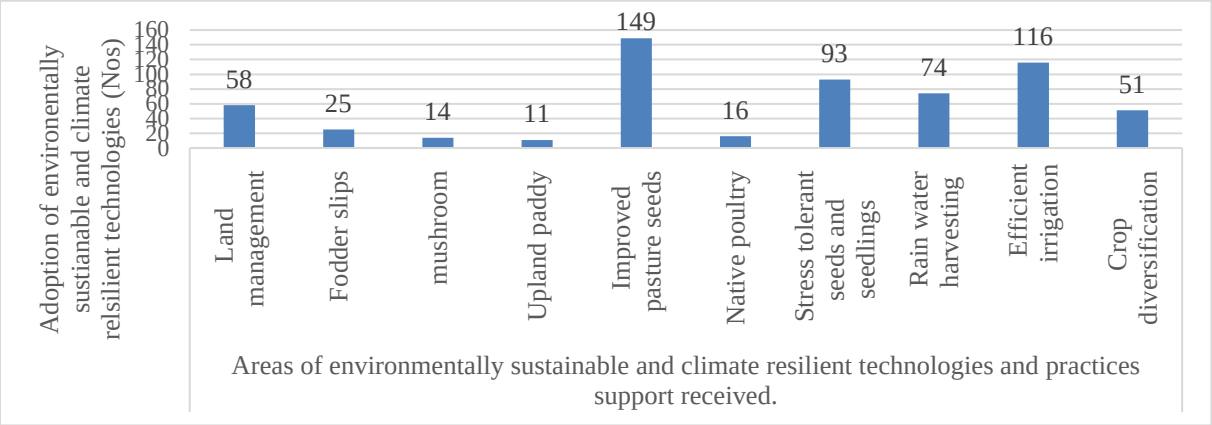


Fig.25: Environmentally sustainable and climate resilient technologies

12. Producer groups or enterprises

12.1 Member of groups

Among the Dzongkhags, the highest percentage of members of the farmer's group are from Mongar, Pemagatshel and Samdrup Jongkhar ranging from 42.95% to 48.80%. The lowest group members are from Trashigang with 22.28% followed by Lhuentse with 28.26%.

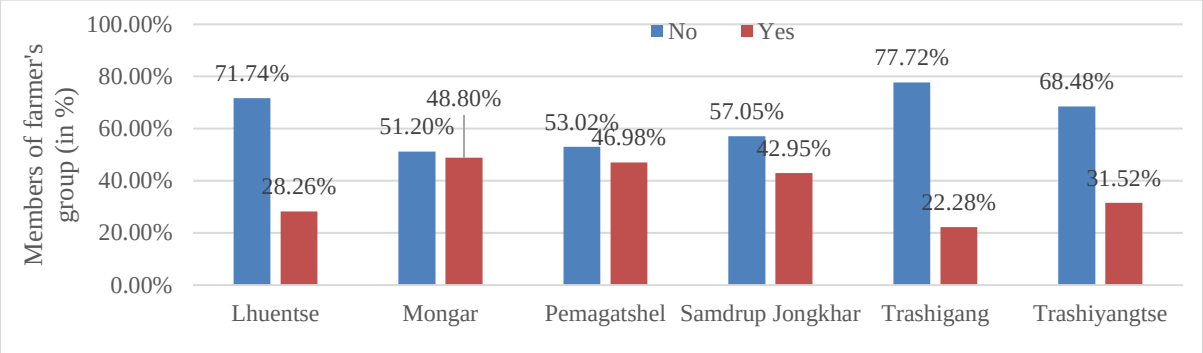


Fig 26: Members of farmer's groups

Among the members who joined the group, majority enrolled during 2017-19, 2020-22 and 2014-16 with 100, 82 and 80 members respectively. The lowest number of new members was recorded during 2011-13, with only 9 members. Among the Dzongkhags, highest members are from Mongar with 125 followed by Pemagatshel with 69 and Samdrup Jongkhar with 64.

Table 42: Year of joining group

Dzongkhags	Before 2010	2011-13	2014-16	2017-19	2020-22	2023-25	**Total**
Lhuentse	0	0	14	7	3	2	**26**
Mongar	5	4	31	45	29	11	**125**
Pemagatshel	2	1	6	24	19	17	**69**
S/Jongkhar	18	3	10	12	15	6	**64**
Trashigang	9	1	11	3	11	6	**41**
Trashiyangtse	1	0	8	9	5	6	**29**
Total	**35**	**9**	**80**	**100**	**82**	**48**	**354**

As per the responsibilities of the members of the group, Mongar has the highest number of members taking the role of chairpersons as represented by 2.98% along with highest number of members of 30.36%. Even in terms of secretaries of the groups, Mongar has about 0.89% followed by Pemagatshel with 0.60%. Overall, majority of individuals about 93.75% serve as members in farmers' groups and a small proportion of 4.76% acting as chairpersons and 1.49% as secretaries.

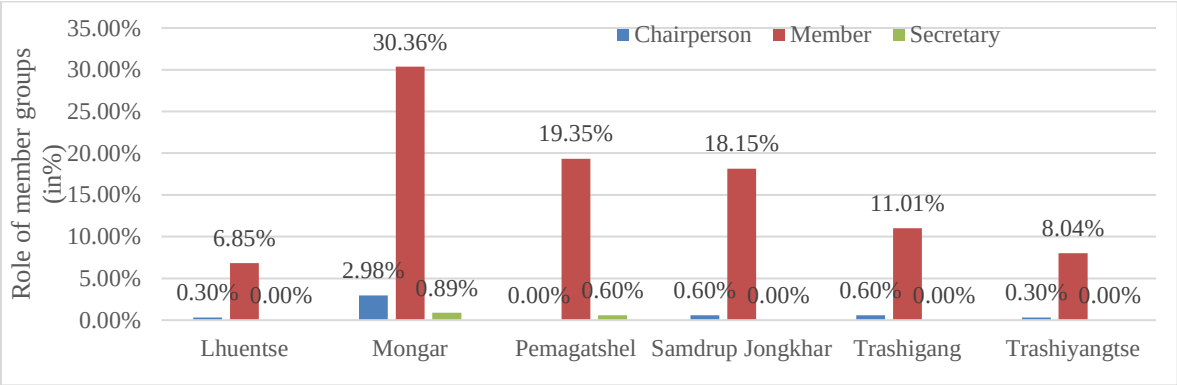


Fig 27: Roles of members in a group

12.2 Group types and functionality

In total, about 393 individuals are engaged in various group activities consisting of 176 in dairy groups, 143 in vegetable groups, and 74 participating in both. Mongar accounts for the highest number of individuals engaged in various groups, with 38 involved in both dairy and vegetable activities, 58 in vegetable groups, and 56 in dairy groups. Pemagatshel and Samdrup Jongkhar have higher participation in dairy groups, with 43 and 42 respectively, while vegetable group membership remains comparatively lower in these Dzongkhags. In contrast, Trashiyangtse shows a stronger participation in vegetable farming, with 27 individuals and minimal participation in dairy groups (3). Lhuentse shows modest but balanced participation, while Trashigang records lower involvement with 2 in both the groups, 20 in vegetable, and 22 in dairy.

While comparing with the baseline data, it was found that the membership for dairy group have increased from 11.2% to 19.21% while it is not in the case of vegetable group. This can be due to the fact that during the household survey, some of the group members may not have been the sampled households.

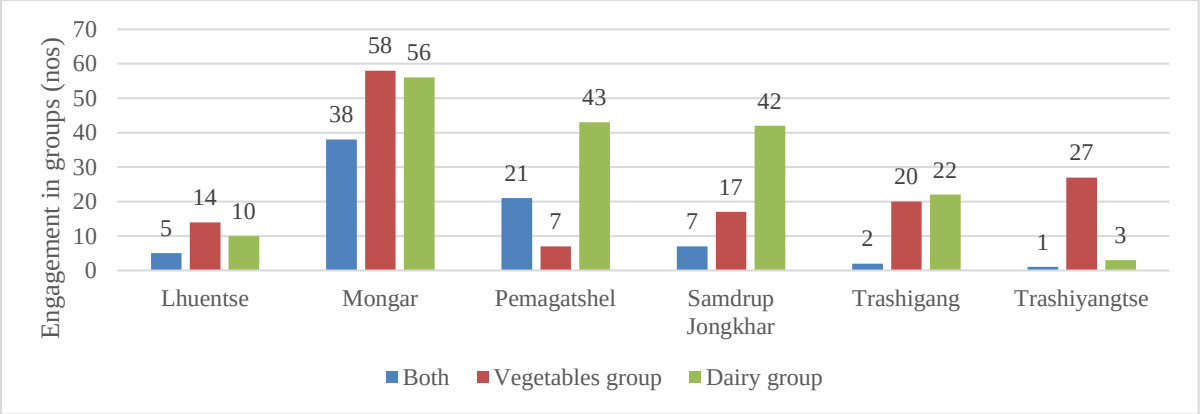


Fig.28: Engagement in farmers groups

Table 43: Membership in groups

	Baseline (in %)	Endline (in%)
Vegetable group	16.4	15.61
Dairy group	11.2	19.21

As per the actual functionality of the groups, only 31.66% are currently functional while 62.34% are not and 6% are non-responsive to this question. Among the dzongkhags, Mongar and Pemagatshel reported the highest number of functional groups by 42.4% and 41.61% respectively, indicating relatively better group organization and sustainability. On the other hand, Trashigang and Trashiyangtse shows the lowest functionality of the groups with over 71% reported as non-functional. Lhuentse also presents a low level of functionality, with only 10.87% of the groups currently remaining active. These findings suggest significant challenges in maintaining active functionality of the group and highlighting the need for support to strengthen group dynamics and sustainability in these dzongkhags.

In terms of functionality of the farmer's groups, Lhuentse is experiencing problems within the groups since 17.39% are not functioning properly against those 10.87% of the groups functioning. However, most of the groups are functional as indicated by Mongar with 42.4%, Pemagatshel with 41.61% and Samdrup Jongkhar with 36.91%.

The non-functionality of many farmers' groups across the dzongkhags can be attributed to a range of structural, environmental, and organizational challenges. A key reason cited is poor group management and lack of coordination, often compounded by insufficient cooperation and misunderstandings (mainly on financial management and trust) among group members. Several groups also reported limited or no access to markets, with concerns ranging from lack of traders and marketing channels to increased competition from new vegetable markets and reduced customer demand. Other factors such as water shortage, landslides, and hailstorms damaging greenhouses also affects group activities.

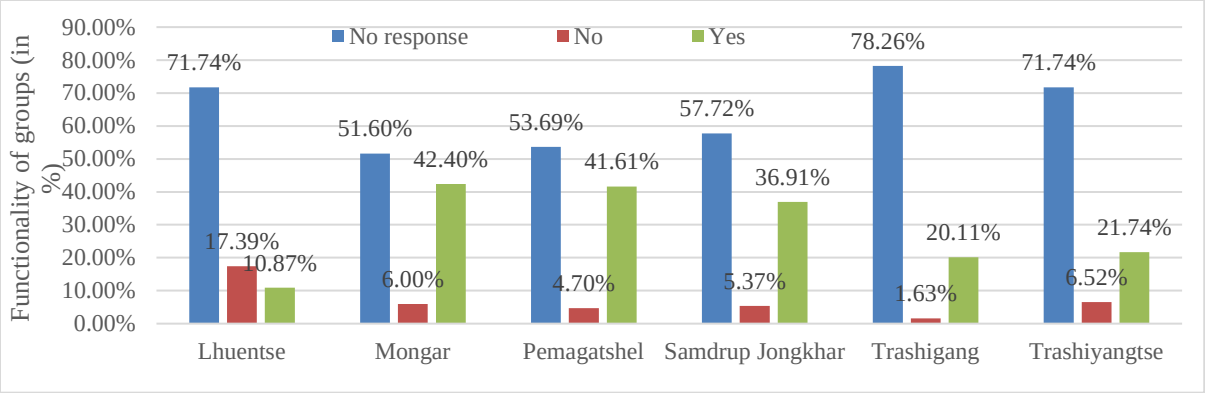


Fig 29: Functionality of groups

In livestock-based groups, problems included irregular milk supply, death or disease among cattle, and difficulty in adapting to improved cattle breeds to the local conditions. Some groups faced challenges due to inadequate irrigation facilities, long distances to markets, or lack of fodder seedlings and production inputs. Low production volumes, labour shortages, and member dropouts due to health or other personal reasons also contributed to group inactivity. In some cases, groups dissolved due to complete lack of cattle or limited activities undertaken by the members.

12.3 Benefits of joining groups

On the other hand, joining farmers' groups provided a range of benefits such as improvement in financial position, production enhancement, and market access. Overall, 287 individuals reported financial benefits, 276 reported improvements in production, and 271 noted marketing-related gains. Among the Dzongkhags, Mongar recorded the highest number of beneficiaries in all three sectors, with 106 individuals benefiting financially, 95 in production, and 81 improved to market access. Pemagatshel showed a balanced impact, with 62 individuals reporting benefits equally across all three dimensions. Samdrup Jongkhar also demonstrated positive outcomes, especially in marketing (57) and finance (56).

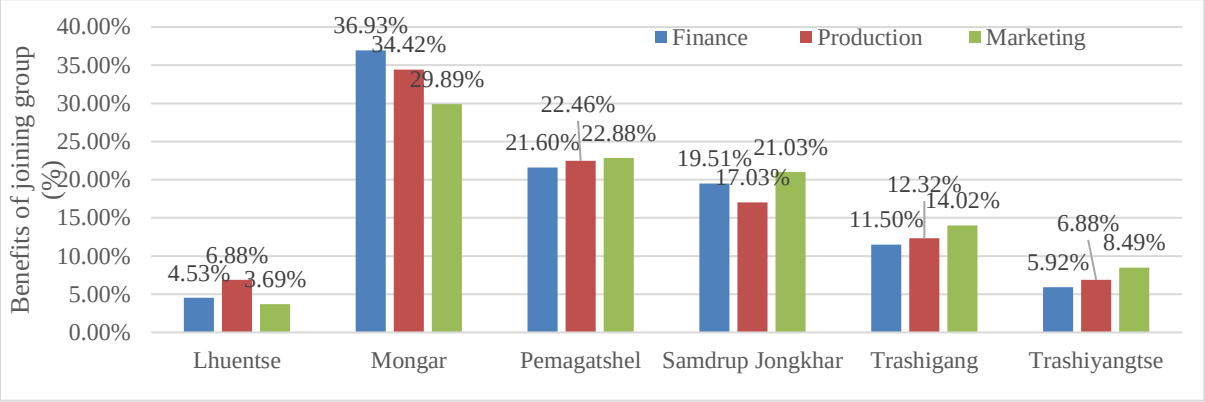


Fig 30: Benefits of joining group

Trashigang and Trashiyangtse recorded relatively lower but still notable improvements, particularly in marketing, where 38 and 23 were benefitted respectively. Lhuentse had the lowest

number of respondents on groups reporting benefits, with 13 citing financial gains, 19 production improvements, and 10 marketing advantages.

12.4 Agricultural enterprise

It was indicated that 34.28% of the respondents consider themselves as agricultural entrepreneurs, while 65.72% do not. This suggests that a majority of the farmers are still not associated their agricultural activities with entrepreneurial identity. Among the Dzongkhags, 68.80% in Mongar consider themselves as agricultural entrepreneurs followed by 44.57% in Lhuentse and 36.96% in Trashiyangtse. Least was in Samdrup Jongkhar with only 5.37% followed by Pemagatshel with 10.74%.

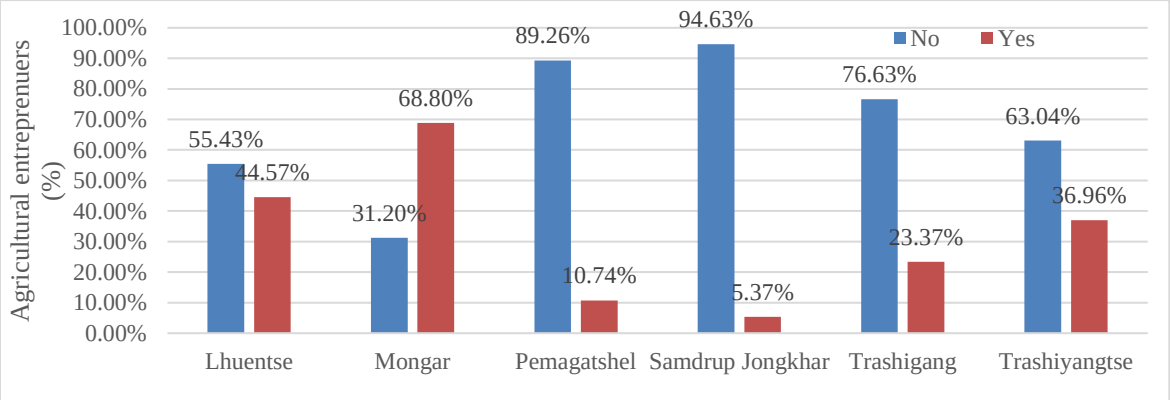


Fig 31: Consider as agricultural entrepreneurs

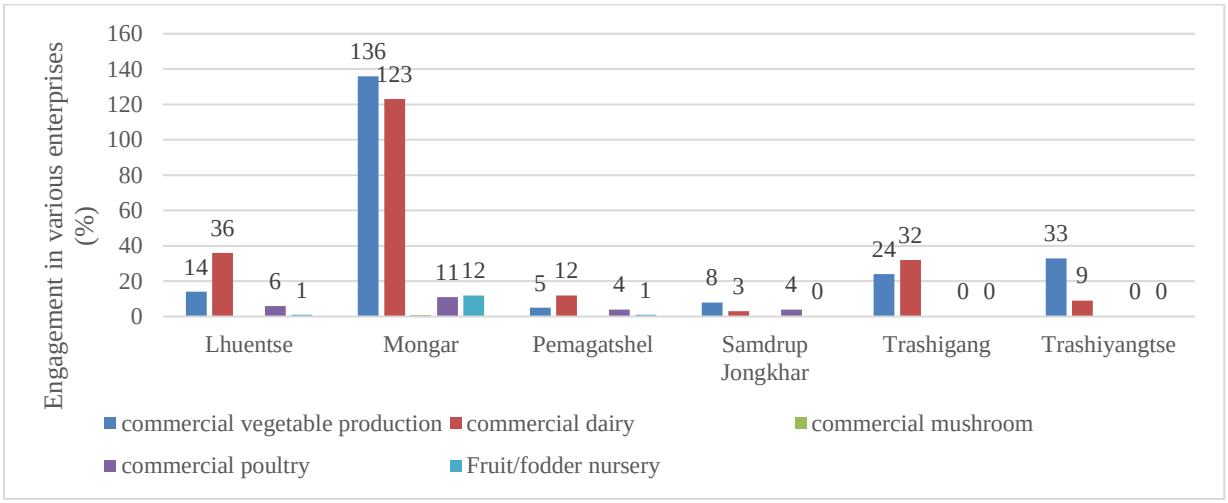


Fig.32: Engagement in types of enterprises

Most of the farmers are primarily engaged in commercial vegetable production (220) and commercial dairy farming (215) across all dzongkhags, indicating importance of these key activities for income-generation. Among the Dzongkhags, Mongar leads in both these areas, with 136 individuals involved in commercial vegetable production and 123 in commercial dairy, indicating a strong orientation toward commercial farming in the dzongkhag. Other enterprises such as commercial poultry farming (25) and fruit or fodder nurseries (14) have moderate

engagement while commercial mushroom cultivation has only 1 individual involved from Mongar. Trashiyangtse has a notable presence in vegetable production (33), but minimum participation in other enterprises. Trashigang also shows a relatively stronger presence in both vegetable and dairy enterprises. In contrast, dzongkhags like Samdrup Jongkhar and Pemagatshel reported fewer individuals engaged across all enterprises indicating limited commercialization in those areas.

13. Producer organizations

In terms of producer organisations just over half of the respondents 51.20 % reported being members of a producer organization, while 48.80 % are not affiliated. Among the dzongkhags, Mongar and Lhuentse show the highest levels of membership, with 80.40 %and 75.00% respectively as members. Pemagatshel also has a relatively stronger membership of 65.77 %. In contrast, Trashigang and Trashiyangtse reported the lowest memberships with only 12.50 % and 31.52 % respectively affiliated with producer organizations. Similarly, Samdrup Jongkhar shows limited engagement, with just 32.89 % of individuals reporting membership.

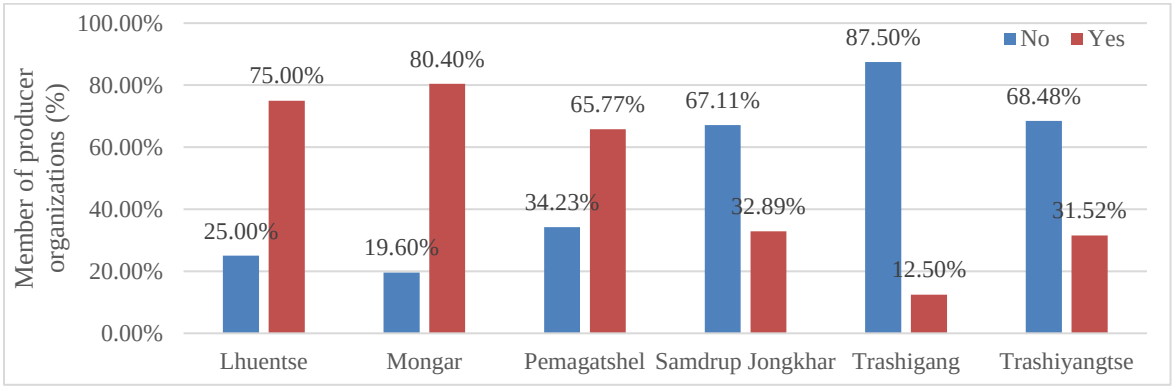


Fig.33: Member of producer organisations

Regarding whether the group members have received any support from the project, Lhuentse and Mongar reported the highest level of support at 72.83% and 75.20% respectively, while Trashigang recorded the lowest with only 12.5% of members receiving support.

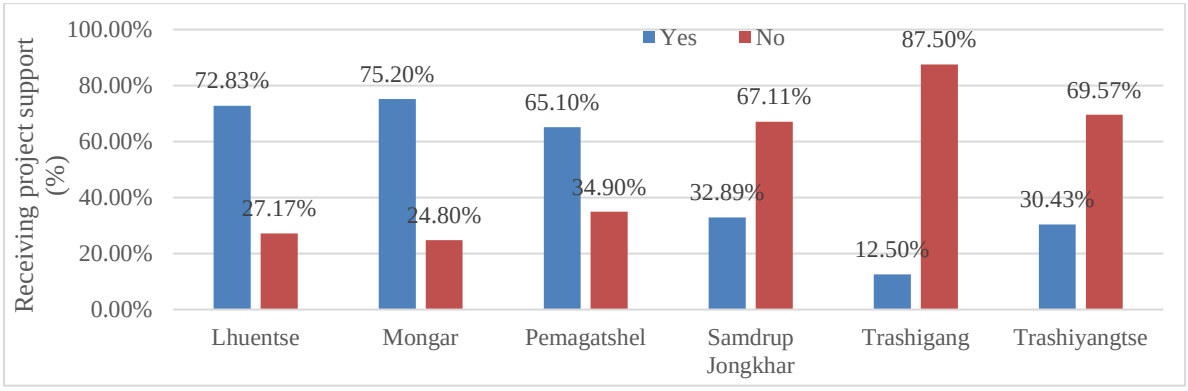


Fig 34: Project support received

Even the type of support received from the project vary among the Dzongkhags. Some of the most common support received by the Dzongkhags are green house, cattle shed, vegetable seeds,

construction materials for construction of dairy shed. The other areas common in most of the Dzongkhags are supply of improved cattle, pasture development, milk bucket, irrigation, water reservoir etc.

Table 44: Type of support received

	Lhuentse	Mongar	P/gatshel	S/Jongkhar	T/gang	T/yangtse
Biogas	Yes	Yes	Yes	Yes		
Green house	Yes	Yes	Yes	Yes	Yes	Yes
Land development	Yes	Yes				
Cattle shed	Yes	Yes	Yes	Yes	Yes	Yes
Improved cattle	Yes	Yes	Yes	Yes	Yes	
Pasture	Yes	Yes		Yes	Yes	
Sprinklers	Yes	Yes				
Seedlings	Yes	Yes			Yes	Yes
Irrigation	Yes	Yes		Yes		
Electric fence	Yes	Yes				
Fodder grass and seeds	Yes	Yes		Yes		
Milk bucket	Yes	Yes			Yes	Yes
Vegetable seeds	Yes	Yes		Yes	Yes	Yes
Cereal seeds	Yes	Yes			Yes	
Poultry farm	Yes	Yes	Yes			
Pipe	Yes	Yes				
Dairy materials	Yes	Yes	Yes	Yes	Yes	Yes
Rice huller	Yes					
Flour mill	Yes		Yes			
Maize sheller	Yes			Yes		
Water reservoir	Yes	Yes		Yes		
Chuff cutter		Yes	Yes	Yes		
Power tillers		Yes				
Fruit seeds		Yes				
Fodder conservation		Yes				
Chain link			Yes			

With the support from the project, various infrastructure has been established within the communities for access to various facilities. Among various input supplies and facilities, majority of the members have easy access to manure and fertilizers, local variety maize seeds, sprinklers, local variety paddy seeds, improved variety paddy seeds, supply of improved cattle, spades, power tillers, chauff cutter and milk processing units. Least accesses are the post-harvest equipment, post-harvest processing, improved packaging materials, paddy transplanter, paddy thresher, paddy harvester etc.

Table 45: Ready access to various inputs (households)

	Lhuentse	Mongar	P/gatshel	S/Jongkhar	T/gang	T/yangtse	Total
Local variety paddy seeds	8	20	0	14	65	55	162
Improved variety paddy seeds	13	43	1	4	23	32	116
Local variety maize seeds	34	89	40	21	84	44	312
Sprinkler	24	124	31	23	30	16	248
Sprayers	1	4	6	0	4	5	20
Dairy concentrate feed	17	35	5	3	14	3	77
Poultry concentrate feed	8	10	1	2	0	1	22
Improved cattle	18	76	71	21	11	1	198
Pullets (Poultry birds)	0	5	4	0	4	0	13
Manure	56	149	94	23	144	70	536
Fertilizer	26	93	48	7	133	74	381
Insecticides/pesticides	1	2	0	0	38	13	54
Spades	10	23	41	15	57	42	188
Local plough	4	20	14	10	27	3	78
Improved plough	1	7	5	14	2	3	32
Power tiller	25	69	7	16	19	16	152
Improved packaging materials	0	3	0	0	0	1	4
Paddy transplanter	0	0	0	0	0	1	1
Paddy harvester	2	2	0	0	0	0	4
Paddy thresher	1	0	0	1	0	1	3
Maize sheller	2	13	17	3	14	3	52
Improved milk churner	0	5	10	2	3	1	21
Access to credits	0	0	0	0	3	1	4
Post harvest/agro processing units	4	1	0	0	0	0	5
Milk processing units	1	18	60	25	4	1	109
Collection and storage centers	0	13	7	10	17	1	48
Marketing sheds	1	19	6	5	3	0	34
Linkage to schools	7	33	3	0	3	2	48
Traders across border	0	5	0	2	1	0	8
Chuff cutter	1	32	54	14	8	4	113
Farmer's training	13	33	1	6	5	18	76
Post harvest equipment	3	1	0	1	0	0	5

14. Trainings

In terms of training activities conducted by CARLEP, overall, 44% of respondents or their family members reported having participated in such training, while 56% indicated they had not. Mongar and Lhuentse recorded the highest participation rates, with 69.6% and 64.1% respectively, showing strong engagement in CARLEP's training programs. In contrast, Pemagatshel and

Samdrup Jongkhar had the lowest involvement, with only about 20.8% of respondents reporting participation. Trashigang and Trashiyangtse showed moderate levels of engagement, with participation rates of 38.0% and 41.3% respectively.

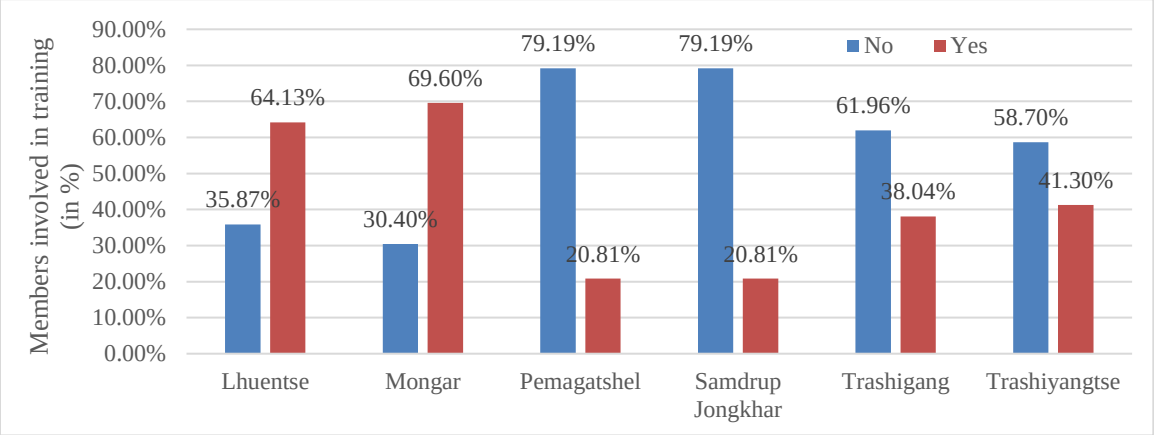


Fig 35: Members involved in training

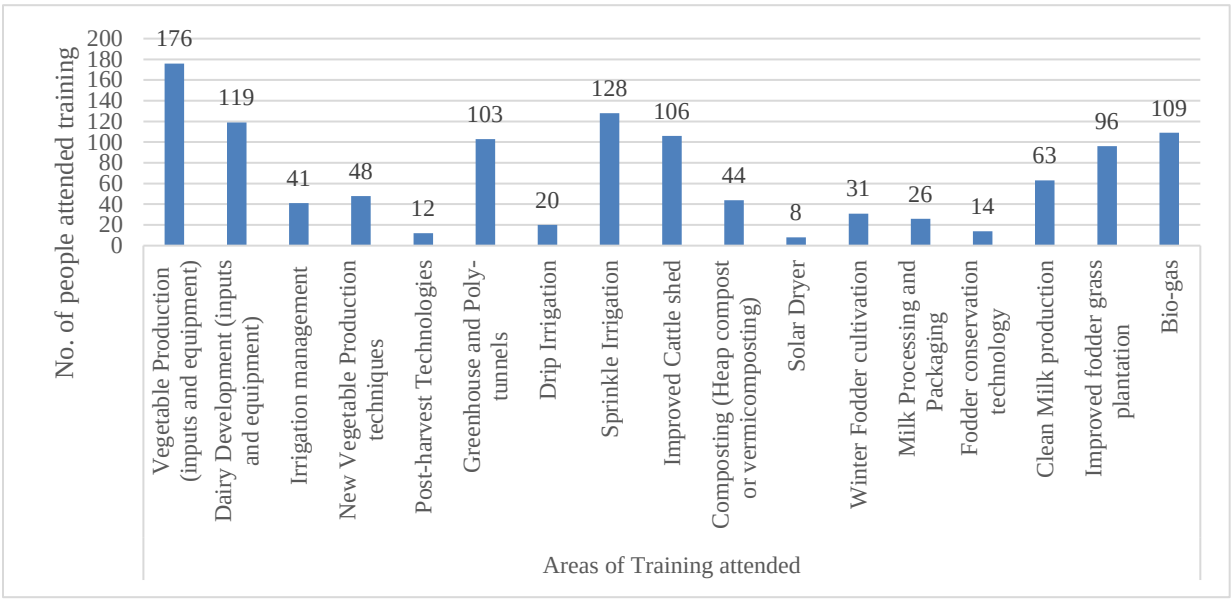


Fig.36: Areas of trainings received.

The training activities attended by respondents and their families covered a wide range of agricultural and livestock development areas. The most commonly attended training was in Vegetable Production, with 176 participants gaining skills related to inputs and equipment. This was followed by Sprinkle Irrigation (128 participants) and Dairy Development (119 participants), indicating a strong focus on both crop and livestock productivity. Other significant training areas included Bio-gas (109 participants), Improved Cattle Shed construction (106 participants), and Greenhouse and Poly-tunnels (103 participants), reflecting interest in improving farm infrastructure and sustainable practices. Trainings on Clean Milk Production and Improved Fodder Grass Plantation also attracted substantial participation, with 63 and 96 attendees respectively. Less attended but still important were specialized topics like Post-harvest Technologies (12

participants), Solar Dryer use (8 participants), and Fodder Conservation Technology (14 participants).

15. Sources of energy

15.1 Bio-gas

As per the respondents, only 21.83% have a biogas plant while 78.17% do not. Among the dzongkhags, Samdrup Jongkhar reports the highest rate of biogas adoption at 32.89%, followed by Mongar at 29.60%. These figures suggest relatively better uptake of renewable energy technologies in these areas. On the other hand, Trashiyangtse has the lowest adoption rate, with only 4.35% of respondents owning a biogas plant. Trashigang, Pemagatshel, and Lhuentse also show limited adoption with the households owning from 16% to 18%.

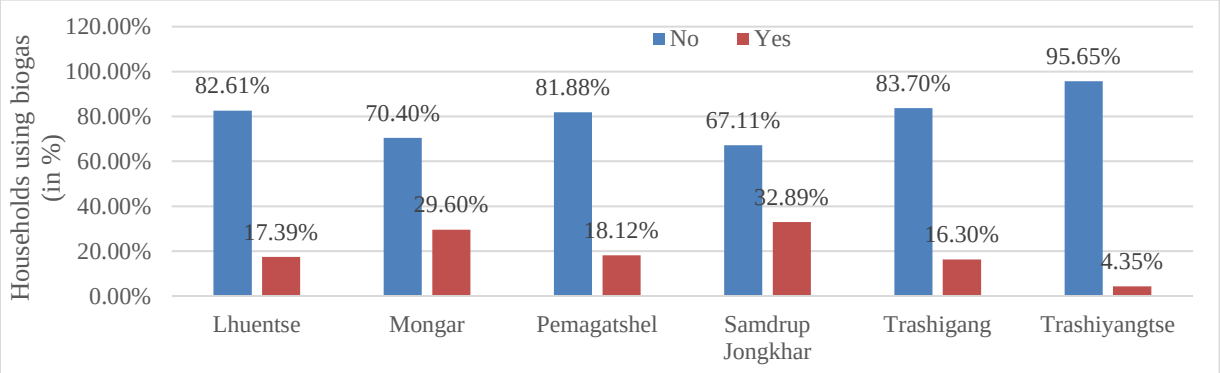


Fig.37: Households using bio-gas.

Among the functional users, about 20.5% of them use in between 30 minutes to 1 hour on daily basis. Among the Dzongkhags, Lhuentse and Trashiyangtse shows higher percentages of users as responded by 56.25% and 25% respectively. Utilization of biogas varies among the respondents, 3% using less than or equal to 30 minutes and 13% using 1 to 2 hours. Utilization of biogas for longer durations are less frequent such as 4% using 2 to 3 hours and 2% using 3 to 4 hours. A small proportion of 5% use biogas for cooking for duration of more than 6 hours daily such as Pemagatshel and Samdrup Jongkhar.

Table 46: Percentage utilization of biogas

	1-2 hrs	2-3 hrs	3-4 hrs	0.5-1 hr	4-5 hrs	5-6 hrs	≤0.5hrs	>6 hrs
Lhuentse	0.00	0.00	0.00	56.25	0.00	0.00	0.00	0.00
Mongar	8.11	1.35	1.35	24.32	0.00	0.00	6.76	0.00
P/gatshel	3.70	7.41	0.00	7.41	0.00	0.00	0.00	18.52
S/Jongkhar	14.29	8.16	2.04	8.16	2.04	2.04	2.04	10.20
T/gang	40.00	3.33	6.67	23.33	0.00	0.00	0.00	0.00
T/yangtse	0.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00
Average	**11.02**	**3.38**	**1.68**	**24.08**	**0.34**	**0.34**	**1.47**	**4.79**

Most of the biogas plants are non-functional as reported by 51.5% mainly due to lack of skill for repair and maintenance as well as limited input of dung for operation. Highest non-functionality of bio-gas was reported from Trashiyangtse with 75% followed by Pemagatshel with 62.96% and the lowest was from Trashigang.

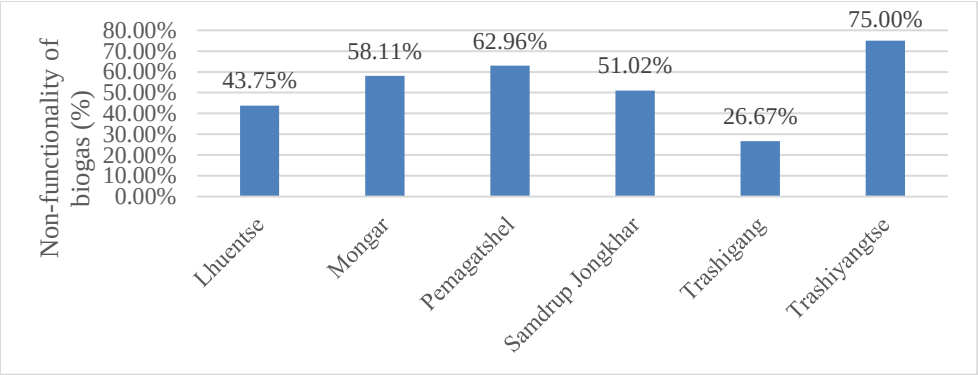


Fig.38: Non-functionality of bio-gas

Among the respondents, majority have indicated problems with the biogas as indicated by most of the Dzongkhags of Lhuentse, Mongar, Trashiyangtse and Trashigang ranging from 63.33% to 87.50%. However, Pemagatshel reported lowest of 29.63% having problems with the biogas, while Samdrup Jongkhar has almost equal percentage of both having problem by 48.98% and not having problem by 51.02%.

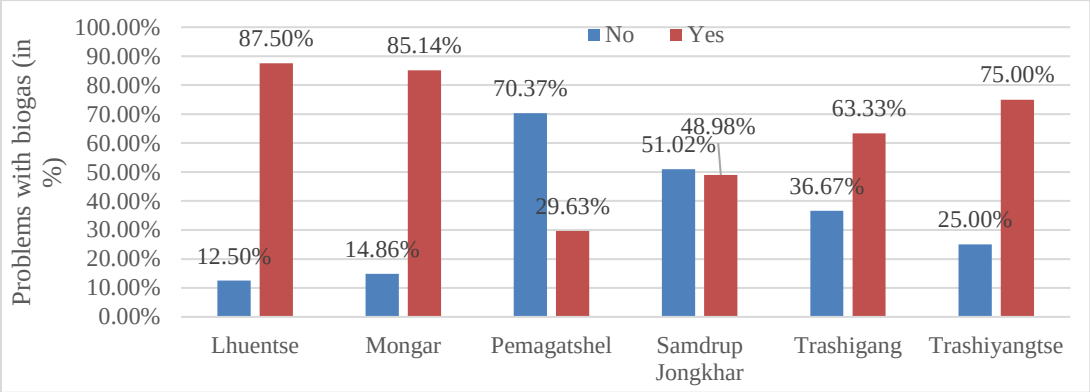


Fig 39: Problems with biogas

Overall, most problems are with the minimum gas production from biogas due to insufficient dung, gas stove problem itself and poor equipment design along with lack of skilled operator. The other issues are gas leakage, labour intensive and located far from the kitchen.

Table 47: Problems with biogas (in percent)

Dzongkhags	**Far from kitchen**	**Minimum gas production**	**Stove problem**	**Gas leakage**	**Labour intensive**	**Insufficient dung input**	**Poor equipment design**	**Lack of skilled operator**
Lhuentse	1.08	6.45	4.30	0.00	3.23	5.38	1.08	2.15
Mongar	2.00	8.80	7.60	1.20	1.20	7.20	3.60	5.20
P/gatshel	0.00	2.01	1.34	0.00	0.00	2.68	1.34	0.67

S/Jongkhar	1.99	3.31	9.27	3.97	0.00	1.99	3.97	1.99
T/gang	0.00	2.72	3.26	2.72	0.54	4.35	2.72	0.54
T/yangtse	0.00	0.00	3.26	1.09	0.00	2.17	2.17	1.09
Average	0.85	3.88	4.84	1.50	0.83	3.96	2.48	1.94

15.2 Other sources of energy

Prior to biogas, the initial sources of fuel used by households were electricity by 26.36% to 40% with Trashiyangtse having the highest reliance on electricity at 40%. Kerosene is used by 6% in Trashigang to 18.18% in Pemagatshel. LPG was a common fuel source, particularly in Trashigang (37.31%) and Pemagatshel (35.06%), while Lhuentse and Mongar also showed significant use by 25% and 28.68% respectively. Firewood remained a key source of energy for many, especially in Mongar (37.21%), Lhuentse (30%), and Trashiyangtse (30%) and the lowest was Pemagatshel with 11.69%.

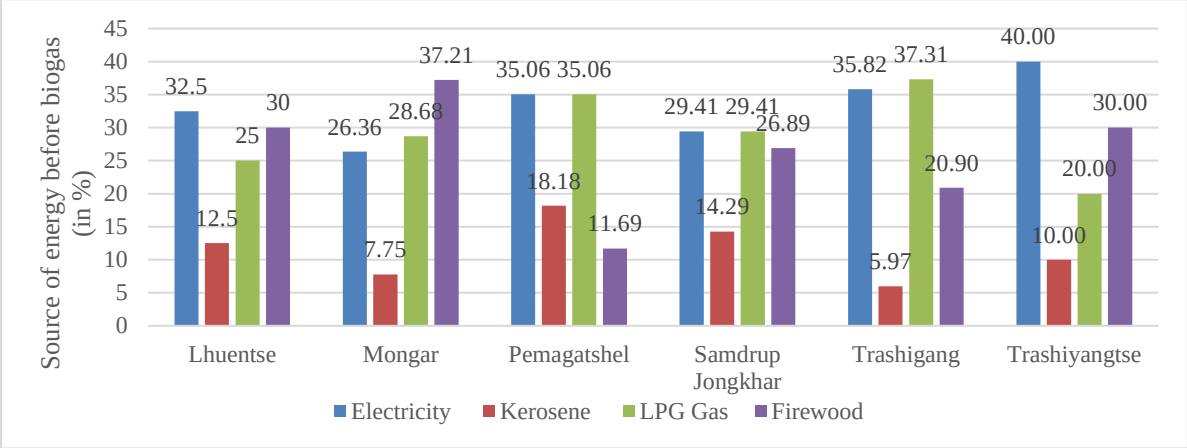


Fig.40: Source of energy before bio-gas

When asked about the trend in utilization of other sources of energy, only about 20% of the respondents have responded to this question. Among those responded, most of the respondents from Pemagatshel, Samdrup Jongkhar, Trashigang and Trashiyangtse feel that the use of other sources of energy remains the same even after the utilization of biogas. However, respondents in Lhuentse feel that biogas has reduced their reliance on other sources of energy.

Table 48: Trend of other energy source utilization (in percent)

Dzongkhag	Decrease	Increased	Same	No response
Lhuentse	10.75	1.08	5.38	82.80
Mongar	9.20	12.40	8.00	70.40
Pemagatshel	3.36	4.03	10.74	81.88
Samdrup Jongkhar	5.43	9.27	17.88	66.23
Trashigang	5.43	0.00	10.87	83.70
Trashiyangtse	0.00	0.00	4.35	95.65

15.3 Impact of biogas

After adopting biogas, households across the dzongkhags reported a noticeable reduction in the use of several traditional fuels. Firewood saw the largest average reduction, with 34.92% less usage, indicating a significant shift away from biomass fuel. LPG usage also declined substantially by 28.04%, reflecting the role of biogas in substituting commercial gas. Electricity consumption reduced by 20.37%, and kerosene use dropped by 16.67%, showing some impact on these energy sources as well.

Table 49: Reduction in use of fuels after biogas (in percent)

Dzongkhags	Electricity	Kerosene	LPG	Fire wood
Lhuentse	20.00	17.14	22.86	40.00
Mongar	16.79	13.74	26.72	42.75
Pemagatshel	25.00	25.00	25.00	25.00
Samdrup Jongkhar	18.18	22.22	28.28	31.31
Trashigang	27.87	6.56	36.07	29.51
Trashiyangtse	25.00	25.00	25.00	25.00
Average	22.14	18.28	27.32	32.26

Overall, majority of the respondents from Lhuentse, Mongar, Trashigang and Samdrup Jongkhar feels that there is reduction in the uses of fuel from other sources after the introduction of biogas ranging from 69.39% in Samdrup Jongkhar to 89.19% in Mongar. Lowest reduction was recorded in Trashiyangtse as represented by 25%.

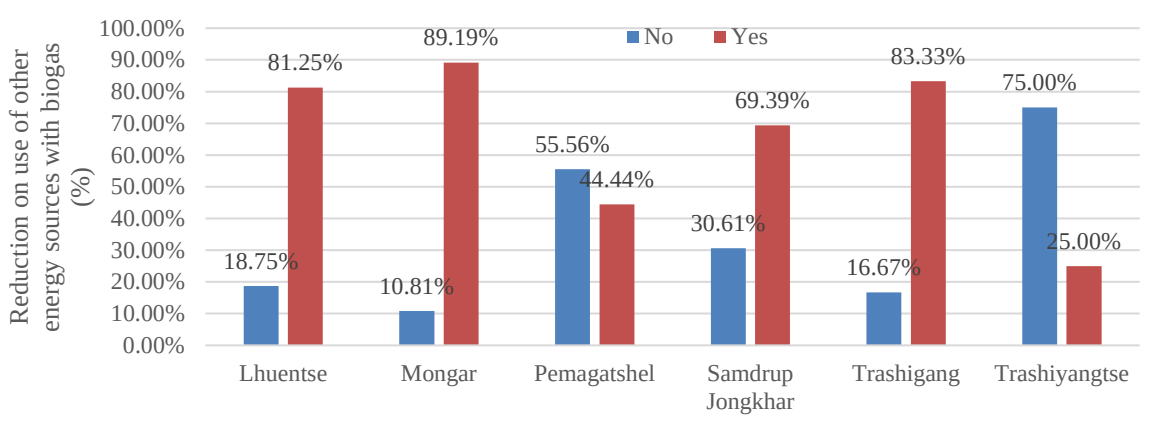


Fig 41: Reduction in use of other sources of fuel with biogas

16. Drudgery reduction interventions

Drudgery reduction interventions have reached varying levels of adoption across the six eastern dzongkhags. Overall, biogas was the most widely adopted technology, with approximately 15% of the 916 surveyed households benefiting from it. Mongar recorded the highest uptake of biogas (22%), followed by Samdrup Jongkhar (18.12%) and Lhuentse (14.13%). These figures suggest that biogas has played a key role in reducing the workload related to cooking and fuel collection.

Chaff cutters, which ease the process of fodder preparation, were adopted by nearly 10% of households. Pemagatshel stood out with the highest adoption rate at 32.89%, reflecting a strong emphasis on mechanized fodder processing in the dzongkhag. In contrast, several dzongkhags such as Lhuentse and Trashiyangtse had not reported use of chaff cutters.

Table 50: Drudgery reduction interventions (count and percent)

	Biogas	Chaff cutter	Smart/efficient irrigation	**Total HH**
Lhuentse	13	0	7	92
In percent	14.13	0.00	7.61	
Mongar	55	27	45	250
In percent	0.22	0.108	0.18	
Pemagatshel	18	49	2	149
In percent	12.08	32.89	1.34	
S/Jongkhar	27	7	1	149
In percent	18.12	4.70	0.67	
Trashigang	21	6	0	184
In percent	11.41	3.26	0.00	
Trashiyangtse	3	0	1	92
In percent	3.26	0.00	1.09	
Average	**13.58**	**8.61**	**4.79**	

Smart or efficient irrigation systems were the least adopted intervention, reaching just 6% of households. Among the Dzongkhags, Mongar is the highest in adoption of improved irrigation by 18% of its households. The resulting time saved due to drudgery-reduction interventions indicates that the majority of beneficiaries across the dzongkhags experienced a reduction of 0–1 hour per day in tasks such as collecting water, fuel, and fodder. Overall, 64.68% of respondents reported saving 0–1 hour, followed by 24.88% who saved 1–2 hours, and 5.47% reporting savings of 2–3 hours. A small proportion, 4.98%, experienced reductions of more than 4 hours.

Table 51: Time spent for collecting fuel/water

Dzongkhags	**1 to 2 hrs**	**2 to 3 hrs**	**3 to 4 hrs**	**30 min to 1 hr**	**4 to 5 hrs**	**5 to 6 hrs**	**≤30 min**	**>6 hrs**	**Non-functional**	**Total**
Lhuentse	0.00	0.00	0.00	56.25	0.00	0.00	0.00	0.00	43.75	100.00
Mongar	8.11	1.35	1.35	24.32	0.00	0.00	6.76	0.00	58.11	100.00
Pemagatshel	3.70	7.41	0.00	7.41	0.00	0.00	0.00	18.52	62.96	100.00
S/Jongkhar	14.29	8.16	2.04	8.16	2.04	2.04	2.04	10.20	51.02	100.00
Trashigang	40.00	3.33	6.67	23.33	0.00	0.00	0.00	0.00	26.67	100.00
T/Yangtse	0.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00	75.00	100.00
Average	**13.00**	**4.00**	**2.00**	**20.50**	**0.50**	**0.50**	**3.00**	**5.00**	**51.50**	**100.00**

17. Utilization of various project interventions

17.1 Benefits of green houses

The use of greenhouses has brought diverse benefits across the region. Among the various advantages, Trashigang shows the highest for ease of farming by 70.54%. Samdrup Jongkhar and Pemagatshel also reported high levels of ease by 46.04% and 48.38% respectively, with Samdrup Jongkhar leading in perceived convenience by 33.17%. Lhuentse and Trashiyangtse share relatively balanced benefits across all categories, with Trashiyangtse slightly higher in enhanced production (14.58%) and year-round cultivation (13.54%). Mongar shows notable convenience (24.50%) and ease of farming (44.80%) but reports lower percentages in other benefits.

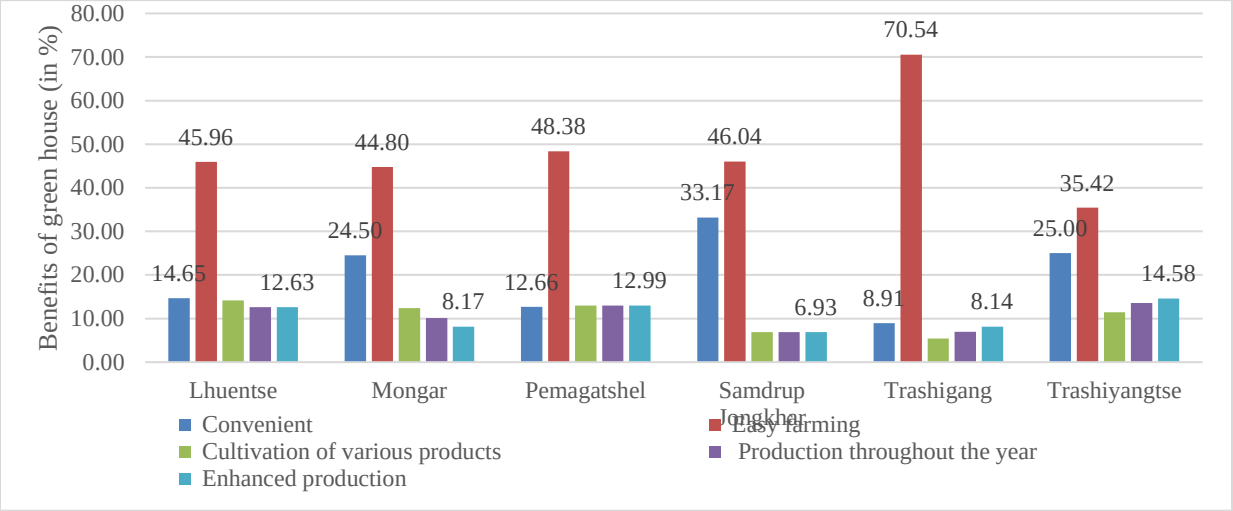


Fig.42: Benefits of green houses

17.2 Benefits of dry land irrigation

Among the various advantages of using dry land irrigation, Mongar shows the highest for self-sufficiency by 27.58%, cultivation of various crops and vegetables by 55.20%, utilization of barren land by 24.01% and enhancement of production by 23.70%. Pemagatshel also reported high levels for utilization of barren land by 22.64% and enhancement of production by 23.70%. This is followed by Samdrup Jongkhar in utilization of barren land by 21.88% and Trashigang for self-sufficiency by 20.40%. Among the Dzongkhags, Trashiyangtse shows lower score on various benefits of dry land irrigation from 9.64% in self-sufficiency to 14.03% in cultivation of various crops and vegetables.

Table 52: Benefits of dry land irrigation

Dzongkhags	Self sufficiency	Cultivation of various crops/ vegetables	Utilization of barren land	Enhanced production
Lhuentse	9.42%	18.10%	8.05%	8.15%
Mongar	27.58%	55.20%	24.01%	23.70%

Pemagatshel	16.70%	0.00%	22.64%	22.07%
Samdrup Jongkhar	16.26%	1.81%	21.88%	19.26%
Trashigang	20.40%	10.86%	13.53%	16.59%
Trashiyangtse	9.64%	14.03%	9.88%	10.22%

17.3 Benefits of wet land irrigation

Similar to benefits of dry land irrigation, there are various advantages of using wet land irrigation. Among the Dzongkhags, Mongar shows the highest for self-sufficiency by 27.51%, cultivation of various crops and vegetables by 34.36%, utilization of barren land by 41.29% and enhancement of production by 15.87%. Among the other Dzongkhags, Pemagatshel reported high levels for enhancement of production by 33.79%, Samdrup Jongkhar for utilization of barren land by 30.97%, Trashigang for enhancement of production by 24.26% and self-sufficiency by 20.33%. In the case of Lhuentse, highest is for cultivation of various crops or vegetables by 20.25%. Overall, Trashiyangtse shows lower score on various benefits of wet land irrigation from 8.39% in enhancement of production to 19.63% for cultivation of various crops and vegetables.

Table 53: Benefits of wet land irrigation (in percent)

Dzongkhags	Self sufficiency	Cultivation of various crops/ vegetables	Enhanced land utilization	Enhanced production
Lhuentse	9.8	20.25	5.59	16.33
Mongar	27.51	34.36	41.29	15.87
Pemagatshel	16.46	1.84	0.65	33.79
Samdrup Jongkhar	16.02	12.27	30.97	1.36
Trashigang	20.33	11.66	6.45	24.26
Trashiyangtse	9.83	19.63	15.05	8.39

17.4 Benefits of land development

Similar to benefits of dry land irrigation (0.25 to 2 acres were brought under irrigation in each of the target Dzongkhags), there are various advantages of using wet land irrigation. Among the Dzongkhags, Trashigang and Trashiyangtse shows the highest for self-sufficiency by 39.70% and 21.49%, enhancement of land utilization by 35.54% and 31.93%, enhancement of production by 36.72% and 31.07%, and cultivation of various crops or vegetables by 27.15% and 24.89%. It is followed by Mongar for self-sufficiency by 22.39%, cultivation of various crops and vegetables by 25.34% and enhancement of production by 15.87%. The other Dzongkhags such as Lhuentse, Pemagatshel and Samdrup Jongkhar reported lowest in all levels of benefits of land development.

Table 54: Benefits of land development (in percent)

Dzongkhags	Self sufficiency	Cultivation of various crops/ vegetables	Enhanced land utilization	Enhanced production
Lhuentse	9.55	11.76	9.04	9.04
Mongar	22.39	25.34	9.04	8.47

Pemagatshel	5.97	9.05	12.05	11.30
Samdrup Jongkhar	0.90	1.81	2.41	3.39
Trashigang	39.70	27.15	35.54	36.72
Trashiyangtse	21.49	24.89	31.93	31.07

17.5 Utilization of various facilities

Project has provided various facilities to enhance production as well as to market the products for both vegetables and dairy such as collection store, milk collection center, milk processing and milk collection shed. In order to enhance production of vegetables, both dry land and wet land irrigation facilities were also provided. Among the Dzongkhags, Trashigang use majority of the facilities such as collection store by 35.29%, irrigation channel by 35.96%, milk collection shed by 35.35% and milk processing center by 34.83%. This is followed by Pemagatshel for utilization of milk collection shed by 32.79%, milk processing center by 34.83%, milk collection center by 28.40% and irrigation channel by 22.91%. In the case of Monger, the highest was for dry land irrigation by 30.92% and milk collection center by 30.86%. Trashiyangtse has moderate utilization of collection store by 27.06% as well as Samdrup Jongkhar for milk collection center by 24.69%. However, Lhuentse is lowest in the utilization of all these facilities.

Table 55: utilization of various facilities (in percent)

Dzongkhags	Collection store	Dry land irrigation	Irrigation channel	Milk collection shed	Milk collection center	Milk processing center
Lhuentse	0.00	11.65	14.04	7.44	3.70	7.82
Mongar	7.06	30.92	19.21	16.28	30.86	14.45
Pemagatshel	16.47	12.32	22.91	32.79	28.40	34.83
Samdrup Jongkhar	14.12	16.20	2.96	5.81	24.69	6.64
Trashigang	35.29	19.68	35.96	35.35	8.64	34.83
Trashiyangtse	27.06	9.24	4.93	2.33	3.70	1.42

18. Nutritional assessment

18.1 Household food security

Overall, 52.72% of households produced cereals for their own consumption in the past year, indicating a moderate level of cereal food self-sufficiency. Mongar and Lhuentse had the highest proportions of households engaged in cereal production with 86.80% and 78.26% respectively. In contrast, Pemagatshel (14.09%) and Samdrup Jongkhar (6.71%) showed very low engagement. In terms of vegetable production, the participation rate was significantly higher across all regions, with an overall rate of 89.48% of households producing vegetables for family consumption. Lhuentse and Mongar are the major producers of vegetables for self-consumption with 97.83% and 98.40% respectively. However, Samdrup Jongkhar is lowest producer of vegetables for self-consumption among the Dzongkhags with 75.17%.

Table 56: Production for self-consumption

	Cereals		Vegetables		Dairy products	
Dzongkhags	No	Yes	No	Yes	No	Yes
Lhuentse	21.74%	78.26%	2.17%	97.83%	6.52%	93.48%
Mongar	13.20%	86.80%	1.60%	98.40%	4.40%	95.60%
Pemagatshel	85.91%	14.09%	12.75%	87.25%	43.62%	56.38%
S/Jongkhar	93.29%	6.71%	24.83%	75.17%	44.30%	55.70%
Trashigang	34.78%	65.22%	13.04%	86.96%	39.67%	60.33%
Trashiyangtse	34.78%	65.22%	8.70%	91.30%	40.22%	59.78%
Average	**47.28%**	**52.72%**	**10.52%**	**89.48%**	**29.79%**	**70.21%**

Dairy product production also shows widespread engagement, though with more variability across the Dzongkhags. Overall, 71.83% of households produced dairy products for self-consumption. The highest dairy producers for self-consumption are Mongar and Lhuentse with 95.60% and 93.48% respectively. Conversely, Pemagatshel and Samdrup Jongkhar produces dairy for self-consumption by just over 55% of the households, which is lowest among the Dzongkhags, still reflects a significant portion of the population.

In terms of food security, on average, households reported that their cereal stock lasted for 9.72 months. Households in Mongar last cereals about 11.90 months, in Lhuentse about 11.68 months, Trashiyangtse about 11.62 months, and Trashigang about 10.98 months, indicating cereals lasting almost a year-round from their own production. In contrast, Pemagatshel (5.79 months) and Samdrup Jongkhar (6.04 months) had cereals lasting about half a year, suggesting greater dependence on market purchases or other sources to meet cereal needs for nearly half the year.

For vegetables, Mongar again recorded the highest self-sufficiency (11.89 months), followed by Lhuentse (11.93 months), Trashigang (11.67 months), and Trashiyangtse (10.24 months). Pemagatshel (10.08 months) and Samdrup Jongkhar (7.05 months) are low compared to other Dzongkhags with an average of vegetables lasting about 10.60 months. Dairy product self-sufficiency is consistently high across most dzongkhags, with Trashigang having the highest of about 11.98 months followed by Mongar (11.82 months), Lhuentse (11.72 months), Trashiyangtse (11.76 months), Pemagatshel (10.83 months), and Samdrup Jongkhar (10.26 months), with the overall average of 11.42 months.

Table 57: Average duration of food lasted (in months)

Dzongkhags	**Staple cereals**	**Vegetables**	**Dairy products**
Lhuentse	11.68	11.93	11.71
Mongar	11.90	11.88	11.82
Pemagatshel	5.79	10.08	10.82
S/Jongkhar	6.04	7.04	10.26
Trashigang	10.98	11.67	11.97
Trashiyangtse	11.62	10.23	11.76
Average	**9.67**	**10.47**	**11.39**

Over the past 12 months, the vast majority of households across the six dzongkhags reported no difficulty in having three meals a day. On average, 98.8% of households did not face any food insecurity while only 1.2% experienced some difficulty. Notably, Lhuentse and Pemagatshel reported 100% food security, followed by Trashigang (99.46%) and Mongar (99.20%). Samdrup Jongkhar and Trashiyangtse had slightly higher instances of food difficulty, with 3.36% and 3.26% respectively reporting challenges in maintaining three meals a day.

Based on the duration of food shortages, Lhuentse and Pemagatshel reported no food shortages throughout the year. Mongar experienced shortages mainly in the months of June, July, September, and November, with one event in each month. Samdrup Jongkhar faced food shortages in multiple months, from February through July, peaking in May with three instances, and one occurrence in December. Trashigang reported shortages in February and April. Trashiyangtse experienced food shortages mainly in November and December, with two and three occurrences respectively. Overall, the highest number of food shortage events was recorded in December with four instances, followed by May and November with three instances in each, indicating that food shortages tend to be more frequent towards the end of the year and in the pre-monsoon months.

The food self-sufficiency improvements compared to the previous year shows that most households experienced some improvement as reported by 65.94%. Lhuentse, Mongar, Pemagatshel, and Samdrup Jongkhar had high proportions of households noting improvement, ranging from about 86% to 94%. In contrast, Trashigang and Trashiyangtse reported fewer improvements, with 9.24% and 17.39% respectively, while the majority of these dzongkhags reported that their food self-sufficiency remained the same as reported by 90.76% and 78.26% respectively. A very small percentage of just 0.55%, reported worsening conditions, mainly in Pemagatshel and Trashiyangtse.

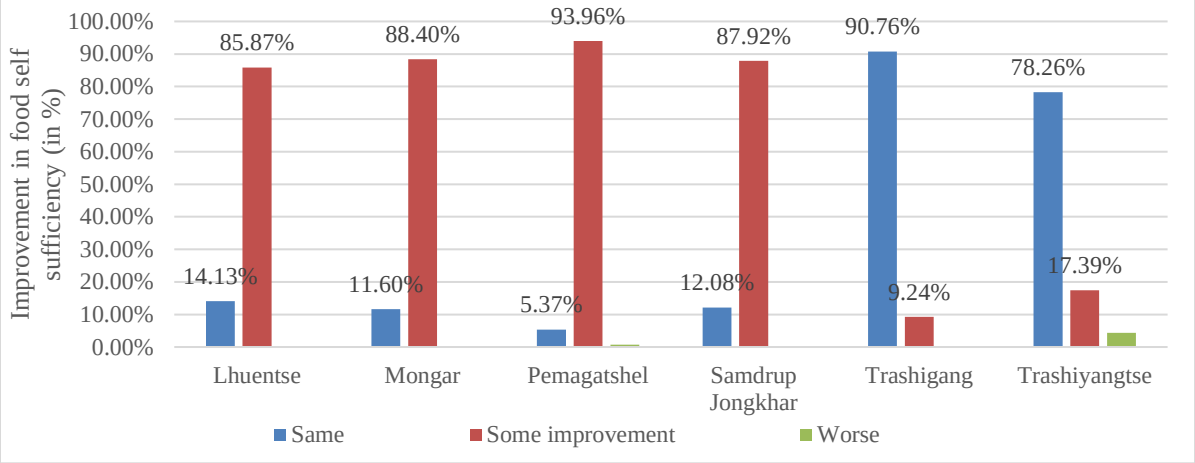


Fig.28: Improvements in food sufficiency compared to previous year

The food self-sufficiency by type and duration reveals notable differences in household production patterns. A majority of households reported being self-sufficient in maize and vegetables for throughout the year as indicated by 58.08% and 55.24% respectively. Similarly, 45.31% of households could meet their milk requirements all year-round, followed by 43.01% for potatoes, 39.96% for butter, and 38.86% for cheese. In contrast, rice had a lower year-round sufficiency at 27.18%, with a significant 61.24% of households not producing rice at all, highlighting a high

reliance on market purchase or external sources. Cheese and butter also had high non-production rates at 41.05% and 40.07% respectively.

Notably, a small percentage of households reported irregular availability of all types of food ranging from 3.82% for vegetables to 6.11% for cheese. Seasonal insufficiencies were most prominent for potatoes and vegetables with 18.34% and 12.66% of the households reported respectively with the production for less than three months.

A comparison between endline and baseline information for food items lasting from own farm production is reflected in table 43. It is evident that most of the food items have improved for lasting whole year compared to baseline as can be seen in potato 43.01% HHs from endline to that of 25.2% HHs from baseline, vegetables 55.24% HHs during endline from 38.8% HHs during baseline. However, there are slight differences in the case of rice with 27.18%HHs during endline to that of 29%HHs during baseline. This can be due to the fact that most farmers are into commercial activity with more focus into faster returns such as vegetables and dairy products in the market.

Table 58: Percentage of food types lasting in a year (endline and baseline comparison)

Food lasting duration	**Food types**													
	Rice		**Maize**		**Potato**		**Cheese**		**Milk**		**Vegetables**		**Butter**	
	Base	End	Base	End	Base	End	Base	End	Base	End	Base	End	Base	End
Irregular	0.0	4.59	0.9	4.48	3.3	5.35	9.8	6.11	9.8	6.00	9.8	3.82	9.8	5.90
More than a year	1.9	0.33	3.7	0.22	2.8	0.44	1.9	0.00	1.9	0.00	4.7	0.00	1.9	0.00
No production	41.6	61.24	14.5	14.85	39.3	19.76	43.9	41.05	43.9	29.69	1.9	7.86	43.9	40.07
Less than 3 months	6.5	1.20	7.0	11.90	49.8	18.34	0.5	5.57	0.5	5.46	10.3	12.66	0.5	5.24
Upto 3 months	2.3	1.53	5.1	3.49	4.7	6.44	1.9	1.20	1.9	0.76	9.8	11.57	1.9	1.53
Upto 6 months	6.1	2.62	5.1	4.26	7.0	5.90	4.7	4.04	4.7	6.99	14.0	6.77	4.7	4.15
Upto 9 months	12.6	1.31	6.5	2.73	7.9	0.76	12.6	3.17	12.6	5.79	10.7	2.07	12.6	3.17
Whole year	29.0	27.18	57.0	58.08	25.2	43.01	24.8	38.86	24.8	45.31	38.8	55.24	24.8	39.96

18.2 Nutritional Status

The nutritional status of children reflects their overall health where inadequate nutrition impacts their health, cognition, and subsequently their educational achievement. As per the WHO 2006, there are nutritional status indicators such as stunting, wasting and underweight for children less than five years of age. All of these indicators are derived based on the reference population where a child's growth attainment is categorized using standard deviations (SDs) from the mean for a child of a given type. Moderate under nutrition is defined as between -3 and -2 SDs from the mean while severe under nutrition is defined as less than -3 SDs from the mean. Stunting, also known as

chronic malnutrition is defined using height-for-age or the height of the child given the child's age. Wasting, also known as acute malnutrition is defined using weight-for-height or the weight of the child given the child's height.

For this study, the weights and heights of all children under-five years of age were collected during the field survey based on the record maintained as per the health book. As per cut-offs recommended by the WHO, data were excluded if a child's Height for age z-score was below –6 or above +6, Weight for age z-score was below –6 or above +5, Weight for height Z-score was below –5 or above +5, because these extreme values were most likely a result of errors in measurement or data entry.

In terms of participation in project-supported nutritional enhancement activities, Lhuentse and Mongar reported the highest engagement with 76.09% and 73.20% of the households with at least one member participating in such initiatives. Conversely, very low participation was observed in Pemagatshel (17.45%) and Samdrup Jongkhar (18.12%). In Trashigang and Trashiyangtse, participation stood at 36.96% and 39.13% respectively. Overall, 44.76% of households across all dzongkhags participated in nutrition-focused project activities while 55.24% did not.

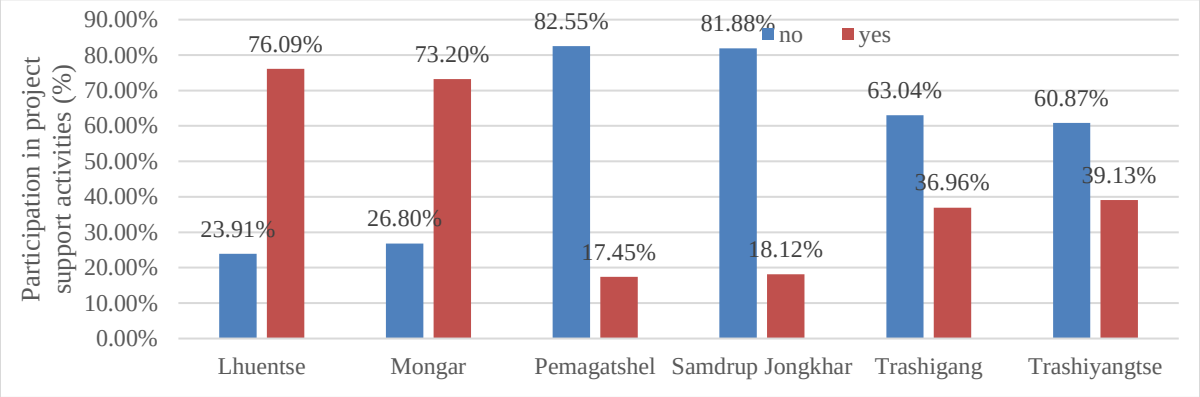


Fig.44: Participation in project supported activities to improve nutrition

The nutritional status of children aged 0–5 years based on the three anthropometric indices: height for age, weight for age and weight for height between endline and baseline indicates generally good health and growth status. Only 3.4% of the children are stunted (height-for-age below -2 SD) compared to 31.37% during baseline. There are none being severely stunted (below -3 SD) as compared to baseline, and the mean height-for-age z-score is 0.0, suggesting normal linear growth. In terms of weight-for-age, 6.7% of children are underweight as compared to 8.57% during baseline assessment, then none are falling below the severe threshold of -3 SD as compared to 1.27% during baseline. There is a slightly negative mean z-score, indicating minor deviation from the standard. However, no cases of wasting (weight-for-height below -2 SD) were observed as compared to 3.27% during baseline, and the mean z-score for this indicator is also within the normal range. Overall, the data reflects a low prevalence of malnutrition and a positive trend in child nutritional status among the 89 children being assessed during this endline.

Table 59: Percentage of children under age 5 by nutritional status

Indicator	% below -2 SD		% below -3 SD		Mean Z-Score (SD)		No. of children 0–5 years	
	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline
Height-for-age (HAZ)	31.37	3.4	13.37	0.0	-1.22	0.0	306	89
Weight-for-age (WAZ)	8.57	6.7	1.27	0.0	-0.49	-0.0	315	89
Weight-for-height (WHZ)	3.27	0.0	0.98	0.0	0.26	-0.0	305	89

18.3 Women's Dietary Diversity Score

The Women's Dietary Diversity Score (WDDS) is an important indicator used to assess the nutritional quality of women's diets, based on their consumption of diverse food groups within a 24-hour recall period. Basically, there are two scores they are household dietary diversity score (HDDS) proposed by FANTA (Swindale and Bilinsky, 2006) and women dietary diversity score (WDDS). The HDDS and WDDS are calculated based upon different numbers of food groups because the scores are used for different purposes. The WDDS is calculated using ten standardized food groups as recommended by the FAO, which include: (1) grains, white roots and tubers, and plantains; (2) pulses (beans, peas, and lentils); (3) nuts and seeds; (4) dairy; (5) meat, poultry, and fish; (6) eggs; (7) dark green leafy vegetables; (8) other vitamin A-rich fruits and vegetables; (9) other vegetables; and (10) other fruits. A higher WDDS indicates better dietary diversity and is often associated with improved micronutrient adequacy among women of reproductive age.

The overall average WDDS for women across the surveyed areas was 5.94 as compared to 4.3 during baseline, highlighting better dietary diversity. However, when compared among the districts, there are variations such as Pemagatshel being the highest WDDS of 7.91, indicating a significantly diverse intake, followed by Samdrup Jongkhar at 7.18. Lhuentse (5.76), Mongar (5.61), Trashigang (5.25), and Trashiyangtse (4.63) reported the lowest. Comparatively, WDDS has improved among the districts as compared to baseline data except the case of Trashiyangtse.

Table 60: Mean WDDS Score

Dzongkhag	Endline WDDS	Baseline WDDS
Lhuentse	5.76	4.57
Mongar	5.61	3.99
Pemagatshel	7.91	3.02
Samdrup Jongkhar	7.18	3.07
Trashigang	5.25	5.71
Trashiyangtse	4.63	5.06
Average	**5.94**	**4.3**

Overall, the table below reveals significant variation in the consumption of food groups among women across the sampled six dzongkhags. The highest average consumption is observed in

Pemagatshel, where over 85% of women consume most of the food groups, including 100% for vitamin A-rich fruits, vegetables and roots, and above 90% for other vegetables, milk, beans, and meat products. Samdrup Jongkhar also reported high averages, especially for beans (88.89%), other fruits (59.72%), and vitamin A-rich items (95.83%). Lhuentse and Mongar falls in the mid-range with consistent consumption of meat, milk, and other vegetables, though intake of nuts and vitamin A-rich produce is lower. Trashigang and Trashiyangtse have the lowest overall averages, particularly for other fruits (17.65% and 15.63% respectively), beans (50.98% and 29.69%), and milk (61.76% and 46.88%). Across all dzongkhags, meat and fish are among the most consistently consumed groups, while nuts or seeds are the least consumed, often below 15%.

The general trend is quite similar between endline and baseline studies. The higher consumption of individual food groups by at least 50% of households include meat and fish products, dark green leafy vegetables, milk and milk products, beans and peas, other vegetables, vitamin A rich fruits and vegetables during the endline study. The least consumed food groups include nuts and seeds, other fruits including food made from food grains and white roots as of endline survey. However, during the baseline assessment, the most consumed of at least 50% are food made from grains or white roots, milk and milk products, other vegetables, vitamin A rich fruits and vegetables. On the other hand the least consumed of less than 50% during the baseline are nuts and seeds, peas and beans, meat and fish products, dark green leafy vegetables and eggs.

Table 61: Percentage of Women consuming each food groups by Dzongkhag

		Lhuentse	**Mongar**	**P/gatshel**	**S/Jongkhar**	**T/gang**	**T/yangtse**
Other fruits	Endline	42.86	38.07	48.53	59.72	17.65	15.63
	Baseline	0	0	0	0	0	0
Nuts or seeds	Endline	3.17	2.27	11.76	16.67	10.78	12.50
	Baseline	18.46	15.73	19.77	17.24	18.80	28.30
Beans or peas	Endline	57.14	54.55	92.65	88.89	50.98	29.69
	Baseline	1.54	2.25	4.65	4.60	4.51	9.43
Food made from grains and any white roots or tuber or plantains	Endline	36.51	32.95	86.76	81.94	34.31	31.25
	Baseline	98.46	84.27	55.81	52.87	100.0	100.0
Meat, poultry and fish products	Endline	100.00	81.25	98.53	80.56	98.04	70.31
	Baseline	36.92	46.07	27.91	36.68	72.93	54.72
Vitamin A rich Dark green leafy vegetables	Endline	71.43	71.02	89.71	88.89	65.69	78.13
	Baseline	49.23	38.20	27.91	36.78	65.41	73.58
Eggs	Endline	36.51	44.89	73.53	29.17	41.18	50.00
	Baseline	38.46	22.47	31.40	22.90	59.40	37.74
Milk or milk products	Endline	76.19	75.00	91.18	87.50	61.76	46.88
	Baseline	72.31	74.16	50.0	49.43	93.23	79.25
Other vegetables	Endline	90.48	89.20	98.53	88.89	98.04	98.44
	Baseline	76.92	62.92	47.67	48.28	81.95	66.04
	Endline	61.90	71.16	100.00	95.83	46.08	29.69

Vitamin A rich fruits, vegetables and roots	Baseline	64.62	52.81	37.93	56.60	55.17	74.44

19. Overall recommendations

Access to irrigation

Presently only about 70.74% have access to proper irrigation system and there are still about 29% to be covered with the irrigation system to boost agriculture production. Even in terms of various types of irrigation system that has been implemented by the project, the coverage differs from place to place such as surface or open irrigation system, drip irrigation, storage system, pipe irrigation system, sprinklers etc. However, all these types of irrigation system are being used by only about 22% to 27%. As the irrigation system in the country is undergoing significant changes to enhance climate resilience and improve water management- particularly for smallholder farmers through retrofitting of existing systems with climate-resilient technologies such as pressurized piped systems and solar-powered lift irrigation. It is important to coordinate with various ongoing projects to further expand irrigation coverage, ensure a more reliable water supply, increase agricultural productivity, and support sustainable livelihoods in the face of climate change.

Land for cultivation:

Majority of land holdings are small where most agricultural activities are concentrated in land below 2 acres. For instance, 57.22% of total dry land cultivated and 86.68% of total wet land cultivated fall within the range of 0–2 acre. Upland rice and cardamom cultivation are particularly concentrated in very small land holdings of 0.25 acres to about 78.93% and 81.22% households respectively. As per the 13th Five-Year Plan, the emphasis is on transforming the agrifood sector for economic growth and sustainable development by enhancing productivity, diversifying markets and products, and fostering inclusive economic growth. Thus, there is a need for optimum utilization of agricultural land as well as to allocate some of the un-utilized government land for agriculture development. In this case, there is a need to coordinate with various responsible agencies to further bring about a change in the land utilization for agriculture with proper plans for agriculture productivity enhancement in future projects.

Livestock production:

It was found that only about 20% to 30% of the respondents own various types of livestock such as local cattle owed by only 40%, improved cattle by about 34%. The priority of the government on livestock sector is to enhance food security, improve rural livelihoods and sustainable natural resource management. This objective will be possible only through improving livestock production, enhancing feed quality, expanding breeding programs, and promoting efficient farming practices. While CARLEP has made notable progress in improving dairy production through the enhancement of the dairy value chain, survey findings indicate that further efforts are needed to address remaining gaps and strengthen the sector. Accordingly, there is a need to further enhance milk production, improve milk quality and diversify dairy products to strengthen market opportunities and meet evolving consumer demands.

Agriculture production:

As compared to baseline information of the project, production of vegetables, fruits and cereals have shown significant improvement such as rice from 15,026kgs in 2015 to 501,388 kgs in 2024, maize production from 45,566kgs in 2015 to 517,064kgs in 2024. Similarly, potato production has increased from 16,067kgs in 2015 to 458,737kgs in 2024. However, in line with the priority of the government to transform the country's agri-food systems from deficit to surplus through improved agricultural practices, promotion of organic farming and increased exports. It is important to further strengthen agricultural practices, develop infrastructure for agriculture production, and introduce high end agriculture products for export.

Access to market:

The distribution of agriculture and dairy products varies across the eastern dzongkhags, where most producers prefer to sell within the community, to Dzongkhag markets, schools and institutions, or directly to the traders. However, only small section is sold outside the country that too only by few Dzongkhags. Majority of the households sell milk to KIL (Chenery) with the guaranteed continuous demand from the KIL. Thus, in order to improve and expand market for agriculture and dairy products, there is a need to introduce various post-harvest processing units for value addition and diversification of products. It is also important to plan for supply of vegetables and dairy products to nearby cities like the Gelephu Mindfulness City and Smart City coming up in Guwahati in India.

Since KIL is the major player in the diary value chain in eastern Bhutan, it is important for KIL to plough back some incentives to the farmers for long term sustainability of the value chain. The option will be to increase milk flow to the plant by KIL’s investment to cow leasing program. At least 30-40% of the net profit from the business operation should be reinvested into procurement of Dairy Cows and Leasing Dairy Cows to farmers through special cost sharing mechanism and recover cost through monthly installment basis from the milk. This new approach of investment will ease farmer’s limited access to credit from the financial institutions.

Adopt, adapt and scale up of technologies:

The project has brought about lot of changes in the adoption of various climate resilience technologies including innovative technologies for both agriculture and dairy value chain. However, there is a need to scale up those technologies to larger beneficiaries and actors in the agriculture and dairy value chain. Climate change is impacting all works of life mainly to agriculture and farming where the government is trying to promote climate-resilient agricultural practices to mitigate the impacts of climate change due to rising temperatures, erratic rainfall, and increased frequency of extreme weather events. These efforts include enhancing water management, promoting drought-tolerant crops, improving land management, and diversifying the crops. Accordingly, various climate resilient interventions need to be scale up by collaborating with various programmes or upcoming projects to further enhance agriculture and livestock sectors.

Sustainability of project interventions:

Project has undertaken to establish various value chain infrastructure or facilities in the communities such as market sheds, market outlets, milk collection centers, milk processing units etc. However, there is no clarity on operation and management of these facilities. Accordingly,

there is a need to draw clear responsibility and ownership of these facilities with proper handing or taking over notes between the parties as well as to work out proper operation and management of these facilities for long term sustainability of the infrastructure.

Even the equipment or mechanization supplies provided to the farmers or groups, farmers or beneficiaries are not aware of critical spare parts including repair and maintenance. Accordingly, there is a need to impart training on repair and maintenance of those equipment and mechanization tools.

On the other hand, even those who have undergone various trainings in agriculture, vegetable production, land management or dairy production require periodic refresher courses to remain relevant and keep pace with the evolving technologies and management practices.

20. Conclusion

The aim of the end line survey was to provide information needed to benchmark the performance of the Commercial Agriculture Livelihood Enhancement Programme (CARLEP) interventions in the six eastern districts of Lhuentse, Mongar, Trashiyangtse, Trashigang, Pemagatshel and Samdrup Jongkhar.

During the implementation of the project, lot of interventions were undertaken at different stages of farming for both agriculture and dairy to increase the participation and ownership from the grassroots communities to move from subsistence to commercial agriculture. In order to achieve this, the project used participatory process to promote stakeholder involvement and buy-in to empower them with project activities. The mobilization and awareness meetings were held on regular basis between project staff, local leaders from the district level up to the village level, farmers' organization and other stakeholders involved in agricultural development. Farmers' mobilization is a continuous activity that empowers farmers to feel part of the project interventions within the project areas.

In order to increase crop and dairy production, various project activities were implemented to facilitate smooth transitioning of farmers to commercial level along with market linkages. Concerning crops or livestock productivity increase, productivity of various vegetables, fruits and cereals yield has been increased. These commendable project results should be attributed to various factors such as efficient use of agricultural inputs, capacity building (which allowed the farmers to adopt innovations); mobilization and sensitization (which allowed the farmers to change their mind set); establishment of farmers' structures (collection centers, market sheds, processing units, sales counters etc.) which allowed the value chain facilitation.

Overall, project was able to increase production of crops and livestock products, development of vegetable and dairy value chains, and ecosystem restoration. Additionally, CARLEP supported farmers in coping with climate change impacts and has seen positive changes in household assets and a reduction in child malnutrition. Not leaving at this point, the project's activities should be further scaled up to larger stakeholders with proper business plans and investment priorities.

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22. Annexure

12.1 Additional data analysis

Table 1: Count of family size

Dzongkhag	Size of Households					
	1 person	2 persons	3-4 persons	5-6 persons	Above 6 persons	Total
Lhuentse	2	29	39	15	4	89
Mongar	21	84	92	45	8	250
Pemagatshel	1	72	56	15	5	149
Samdrup Jongkhar	7	39	53	39	11	149
Trashigang	13	58	89	21	3	184
Trashiyangtse	7	25	38	20	2	92
Total	**51**	**307**	**367**	**155**	**33**	**913**

Table 2: Count of persons actually present for agriculture

Dzongkhag	Persons actually present for agriculture (HHs)					
	1 person	2 persons	3-4 persons	5-6 persons	Above 6 persons	Total
Lhuentse	17	42	31	1	1	92
Mongar	46	134	61	9	0	250
Pemagatshel	14	105	29	1	0	149
Samdrup Jongkhar	35	72	34	6	2	149
Trashigang	35	124	20	5	0	184
Trashiyangtse	31	49	12	0	0	92
Total	**178**	**526**	**187**	**22**	**3**	**916**

Table 3: Count of different types of land usage in acres

Land owned (acres)	<0.25	0.25-0.5	0.51-1	1.1-2	2.1-4	4.1-6	6.1-10	>10	None
Total area of dry land owned	12	76	162	270	203	99	58	32	4
Total area of dry land cultivated	72	158	194	222	156	59	24	7	24
Total area of wet land owned	61	125	135	113	54	8	4	3	411
Total area of wet land cultivated	82	92	98	74	43	2	2	1	523
Upland rice cultivated	35	43	40	40	28	3	1	2	723
Total orchard	156	46	41	31	15	5	2	1	621
Maize cultivated	156	190	210	128	38	3	0	1	190
Potato cultivated	432	159	90	31	7	1	0	0	196
Kitchen garden vegetables	616	127	52	35	4	0	0	0	82
Commercial vegetable cultivated	194	116	65	25	9	1	1	0	505
Total citrus owned	250	37	11	8	8	2	0	0	600
Total mango owned	232	22	12	2	6	1	0	1	640

Total productive mango area	175	18	8	1	4	1	0	2	707
Total avocado owed	264	25	8	1	4	1	0	0	613
Total productive avocado owned	141	16	5	2	7	1	0	0	744
Total cardamom owned	76	32	17	14	13	1	0	1	762
Total productive cardamom area	69	39	28	15	18	3	0	0	774
Improved pasture	217	100	52	37	13	2	3	0	492

Table 4. Numbers of livestock owned by HHs

Number of animals	1	2	3	4	5	6	7	8	9	>10	None
1. Local cattle											
a) Milking	169	116	38	17	8	6	1	1	1	4	556
b) Dry	126	89	26	11	10	13	5	2	1	13	620
c) Pregnant	76	27	3	2	0	3	0	1	1	0	802
d) Heifers	19	13	4	1	1	4	2	0	0	1	871
e) Calf											
i. Male	178	60	13	7	1	3	4	0	1	0	649
ii. Female	142	67	13	4	4	1	1	0	1	0	683
Total local cattle	**710**	**372**	**97**	**42**	**24**	**30**	**13**	**4**	**5**	**18**	
2. Improved cattle											
a) Milking	160	85	29	11	5	4	0	0	0	2	620
b) Dry	58	29	13	1	2	2	0	1	0	2	808
c) Pregnant	104	33	10	1	1	1	0	0	0	1	765
d) Heifers	31	16	5	1	2	1	0	0	0	0	860
e) Calf											
i. Male	113	25	3	4	0	1	2	0	1	0	766
ii. Female	98	45	9	2	4	5	0	0	0	0	753
Total improved cattle	**564**	**233**	**69**	**20**	**14**	**14**	**2**	**1**	**1**	**5**	
3. Yak	1	0	1	0	3	5	0	0	0	0	906
4. Pig	1	2	0	0	0	5	0	0	0	0	908
5. Sheep/Goat	1	5	4	2	1	5	1	3	0	0	894
6. Poultry	13	10	6	10	12	9	5	5	1	30	815
7. Fish	5	1	0	0	1	3	0	0	1	0	905

Table 5: Ownership of assets by gender

Ownership of assets by gender (percentage)						
Gender	**Land**	**Electronics**	**Assets**	**Farm Machineries and equipment**	**Finance**	**Livestock**
Women	41.59	16.38	17.25	15.39	16.70	14.63
Men	42.14	32.64	30.90	29.26	23.91	12.45
Both	16.27	50.98	51.86	55.35	59.39	72.93

Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 6: Type of house owned (in percentage)

Type of house owned	Lhuntse	Mongar	P/gatshel	S/jongkhar	T/gang	T/yangtse	**Average**
Wooden wall with CGI roof	0	1.2	8.05	1.34	2.72	5.43	**2.95**
Mud and stone wall with CGI roof	77.17	81.2	7.38	4.7	56.52	39.13	**47.16**
Concrete (stone or brick wall) with shingle roof	3.26	2	28.19	61.07	27.17	18.48	**22.71**
Concrete (stone or brick wall) with CGI roof	11.96	12.8	2.01	5.37	10.87	31.52	**11.24**
Mud and stone wall with shingle roof	7.61	2.8	34.23	11.41	2.72	4.35	**9.93**
Thatched/bamboo wall with CGI roof	0	0	1.34	3.36	0	1.09	**0.87**
Wooden wall with shingle roof	0	0	18.79	12.75	0	0	**5.13**

Table 7: Type of asset owned

Assets owned	**Percentage**
Electronics	89.08
Vehicle	27.40
Power Chain	32.31
Maize Sheller	8.52
Paddy thresher	1.09
Paddy harvester	0.00
Paddy transplanter	0.22
Improved plough	1.86
Chips making machine	0.11
Flour mill	21.72
Flake making machine	3.06
Rice huller	12.45
Sprayers	3.28
Sprinklers	28.82
Power tiller	26.97
Refrigerator	75.00
Chaff cutter	20.52
Oil expeller	0.22
Grass cutter	21.72
Water boiler	90.39

Rice/curry cooker	99.24
TV	77.84

Table 8: Type, area of land owned and cultivated

Land Owned & cultivated	AREA (acres)									
	0	**<0.25**	**0.25-0.5**	**0.51-1**	**1.1-2**	**2.1-4**	**4.1-6**	**6.1-10**	**>10**	**Grand Total**
Dry land owned	0.44%	1.31%	8.30%	17.69%	29.48%	22.16%	10.81%	6.33%	3.49%	100.00%
Total dry land cultivated	2.62%	7.86%	17.25%	21.18%	24.24%	17.03%	6.44%	2.62%	0.76%	100.00%
Total area of wet land owned	44.87%	6.66%	13.65%	14.74%	12.34%	6.00%	0.98%	0.44%	0.33%	100.00%
Total area of wet land cultivated	56.99%	8.95%	10.04%	10.70%	8.08%	4.69%	0.22%	0.22%	0.11%	100.00%
Upland rice cultivated	78.93%	3.82%	4.69%	4.37%	4.37%	3.17%	0.33%	0.11%	0.22%	100.00%
Total productive cardamom area	81.22%	7.53%	4.26%	3.06%	1.64%	1.97%	0.33%	0.00%	0.00%	100.00%
Total orchard in Acres	67.79%	16.92%	4.91%	4.48%	3.38%	1.64%	0.55%	0.22%	0.11%	100.00%
Maize cultivated	20.74%	17.03%	20.74%	22.93%	13.97%	4.15%	0.33%	0.00%	0.11%	100.00%
Potato cultivated	21.40%	47.16%	17.36%	9.83%	3.38%	0.76%	0.11%	0.00%	0.00%	100.00%
Kitchen garden vegetables	8.95%	67.25%	13.86%	5.68%	3.82%	0.44%	0.00%	0.00%	0.00%	100.00%
Commercial vegetable cultivated	55.13%	21.18%	12.66%	7.10%	2.73%	0.98%	0.11%	0.11%	0.00%	100.00%
Total citrus owned	65.50%	27.29%	4.04%	1.20%	0.87%	0.87%	0.22%	0.00%	0.00%	100.00%
Total mango owned	69.87%	25.33%	2.40%	1.31%	0.22%	0.66%	0.11%	0.00%	0.11%	100.00%
Total productive mango area	77.18%	19.10%	1.97%	0.87%	0.11%	0.44%	0.11%	0.00%	0.22%	100.00%

Total avocado owned	66.92%	28.82%	2.73%	0.87%	0.11%	0.44%	0.11%	0.00%	0.00%	100.00%
Total cardamom owned	83.19%	8.30%	3.49%	1.86%	1.53%	1.42%	0.11%	0.00%	0.11%	100.00%
Improved pasture	53.71%	23.69%	10.92%	5.68%	4.04%	1.42%	0.22%	0.33%	0.00%	100.00%
Total productive avocado owned	81.22%	15.39%	1.75%	0.55%	0.22%	0.76%	0.11%	0.00%	0.00%	100.00%

Table 9. Type of livestock owned.

Livestock	**Count of livestock (in percent)**										
	None	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**>10**
Local cattle Milking	60.70	18.45	12.66	4.15	1.86	0.87	0.66	0.11	0.00	0.11	0.44
Local cattle Dry	67.69	13.76	9.72	2.84	1.20	1.09	1.42	0.55	0.22	0.11	1.42
Local cattle Pregnant	79.91	8.30	6.11	0.98	0.87	0.00	1.97	0.00	0.87	0.98	0.00
Local cattle heifers	95.09	2.07	1.42	0.44	0.11	0.11	0.44	0.22	0.00	0.00	0.11
Local cattle calf (male)	53.60	19.43	13.10	4.26	3.06	0.55	1.97	3.06	0.00	0.98	0.00
Local cattle calf (Female)	59.28	15.50	14.63	4.26	1.75	2.18	0.66	0.76	0.00	0.98	0.00
Improved cattle milking	67.69	17.47	9.28	3.17	1.20	0.55	0.44	0.00	0.00	0.00	0.22
Improved cattle Dry	88.21	6.33	3.17	1.42	0.11	0.22	0.22	0.00	0.00	0.11	0.22
Improved cattle pregnant	83.52	11.35	3.60	1.09	0.11	0.11	0.11	0.00	0.00	0.00	0.11
Improved cattle heifers	88.97	3.38	3.49	1.64	0.44	0.00	1.31	0.76	0.00	0.00	0.00
Improved cattle calf (male)	75.98	12.34	5.46	1.31	1.75	0.66	1.53	0.00	0.00	0.98	0.00
Improved cattle calf (female)	70.20	10.70	9.83	2.95	0.87	2.18	3.28	0.00	0.00	0.00	0.00
Fish	95.74	0.55	0.22	0.00	0.00	0.55	1.97	0.00	0.00	0.98	0.00
Yak	94.65	0.11	0.00	0.33	0.00	1.64	3.28	0.00	0.00	0.00	0.00
Pig	96.18	0.11	0.44	0.00	0.00	0.00	3.28	0.00	0.00	0.00	0.00
Sheep/goat	88.43	0.11	1.09	1.31	0.87	0.55	4.26	0.76	2.62	0.00	0.00
Poultry	88.97	1.42	1.09	0.66	1.09	1.31	0.98	0.55	0.55	0.11	3.28

Table 10: Area, production and amount earned from agriculture and livestock

Vegetables	**Cultivation area (acres)**	**Production (last year 2024) Kg**	**Quantity sold (kg)**	**Amount earned (Nu)**
Onion	30.344	8,113.00	3,819.00	174,575.00
Radish	84.205	72,005.00	20,188.00	390,415.00
Carrot	24.082	18,219.00	11,618.00	595,920.00
Broccoli	63.761	40,527.00	35,040.00	1,389,455.00
Tomato	33.442	4,972.00	1,665.00	81,840.00
Cabbage	89.472	65,833.00	48,715.00	1,197,845.00

Beans	86.694	45,126.00	34,403.00	1,474,035.00
Chilli	165.992	92,463.00	69,099.00	5,048,800.00
Asparagus	1.363	344.00	1,238.00	27,400.00
Peas	8.862	4,868.00	3,112.00	150,126.00
Cauliflower	53.762	32,851.00	21,086.00	952,220.00
Green leaves	86.323	31,117.50	16,652.00	448,430.00
Ginger	62.356	41,437.00	34,146.00	1,268,990.00
Potatoes	181.303	458,737.00	408,628.00	8,882,861.00
Fruits	**Cultivation area (acres)**	**Production (last year 2024) Kg**	**Quantity sold (kg)**	**Amount earned (Nu)**
Kiwi	3.243	748.00	120.00	18,000.00
Passion fruit	4.36	790.00	220.00	12,000.00
Mandarin	32.043	67,928.00	62,059.00	2,477,570.00
Pear	3.263	4,035.00	1,851.00	93,400.00
Mango	50.393	11,683.00	6,940.00	313,400.00
Persimmon	0.62	1,183.00	800.00	35,000.00
Pineapple	15.92	2,175.00	999.00	63,300.00
Avocado	28.653	5,151.00	6,232.00	927,200.00
Strawberry	0.131	11.00	0	0
Cardamom	57.49	5476	5412	3,705,380.00
Areca nut	94.75	83541	716544	3,561,368.00
Cereals	**Cultivation area (acres)**	**Production (last year 2024) Kg**	**Quantity sold (kg)**	**Amount earned (Nu)**
Rice	433.517	501,388.00	97,983.00	1,266,750.00
Maize	836.555	517,064.20	56,416.00	2,939,450.00
Quinoa	4.671	2,118.00	1,013.00	73,000.00
Wheat	12.372	5,727.00	75.00	3,000.00
Buckwheat	4.79	1,320.80	0	0
Mustard	8.42	890.00	175.00	13,000.00

Table 11: Sources of HHs income

Source of income (Nu.)	Lhuentse	Mongar	P/gatshel	S/ Jongkhar	T/gang	T/yangtse	Grand Total
Other source of income	2,332,000.00	750,000.00	6,138,100.00	2,963,000.00	45,000.00	75,000.00	12,303,100.00
Remittance	145,000.00	285,000.00	160,000.00	105,000.00	270,000.00	170,000.00	1,135,000.00
Cereals	30,000.00	1,751,250.00	405,000.00	-	558,000.00	235,000.00	2,979,250.00
Sale of vegetables	1,669,105.00	11,160,780.00	1,720,100.00	2,515,800.00	3,060,900.00	2,520,000.00	22,646,685.00
Salary earned if employed	550,000.00	984,000.00	2,876,000.00	4,380,000.00	240,000.00	715,000.00	9,745,000.00
Poultry-eggs sold	130,700.00	512,010.00	641,400.00	2,205,600.00	-	54,900.00	3,544,610.00
Fruit	47,000.00	3,937,250.00	595,500.00	44,200.00	1,051,300.00	269,000.00	5,944,250.00
Livestock (Meat sold)	-	-	12,600.00	620,000.00	-	-	632,600.00
Cash crop	1,006,650.00	4,562,670.00	3,749,270.00	6,741,715.00	1,405,800.00	1,130,750.00	18,596,855.00
Farm labour/off farm activities wages earned	1,252,500.00	4,082,000.00	2,275,400.00	1,764,400.00	20,000.00	130,000.00	9,524,300.00
Processed products sold	-	1,722,000.00	-	60,000.00	-	70,000.00	1,852,000.00
Enterprise	135,000.00	-	1,740,000.00	1,428,000.00	74,000.00	910,000.00	4,287,000.00
Livestock (Dairy products sold)	1,733,540.00	9,816,424.00	10,049,120.00	5,555,890.00	3,691,000.00	824,750.00	31,670,724.00

Table 12: Benefits of green house (count and percentage)

	Lhuntse		Mongar		P/gatshel		S/jongkhar		T/gang		T/yangtse		Total
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Enhanced production	25	67	33	217	40	109	14	135	21	163	28	64	161
In percentage	27.17%	72.83%	13.20%	86.80%	26.85%	73.15%	9.40%	90.60%	11.41%	88.59%	30.43%	69.57%	19.74%
Production throughout the year	25	67	41	209	40	109	14	135	18	166	26	67	164
In percentage	27.17%	72.83%	16.40%	83.60%	26.85%	73.15%	9.40%	90.60%	9.78%	90.22%	28.26%	72.83%	19.64%
Cultivation of various products	28	64	50	200	40	109	14	135	14	170	22	70	168
In percentage	30.43%	69.57%	20.00%	80.00%	26.85%	73.15%	9.40%	90.60%	7.61%	92.39%	23.91%	76.09%	19.70%
Easy farming	91	1	181	69	149	0	93	56	182	2	68	24	764
In percentage	98.91%	1.09%	72.40%	27.60%	100.00%	0.00%	62.42%	37.58%	98.91%	1.09%	73.91%	26.09%	84.43%
Convenient	29	63	99	151	39	110	67	82	23	161	48	44	305
In percentage	31.52%	68.48%	39.60%	60.40%	26.17%	73.83%	44.97%	55.03%	12.50%	87.50%	52.17%	47.83%	34.49%

Table 13: Benefits of dry land irrigation

	Lhuntse		Mongar		P/gatshel		S/jongkhar		T/gang		T/yangtse		Total
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Enhanced production	55	37	160	90	149	0	130	19	112	72	69	23	675
In percentage	59.78%	40.22%	64.00%	36.00%	100.00%	0.00%	87.25%	12.75%	57.73%	37.11%	75.00%	25.00%	73.96%
Enhanced land utilization	53	39	158	92	149	0	144	5	89	95	65	27	658
In percentage	57.61%	42.39%	63.20%	36.80%	100.00%	0.00%	96.64%	3.36%	45.88%	48.97%	70.65%	29.35%	72.33%
Cultivation of various crops/vegetables	40	52	122	128	0	149	4	145	24	160	31	61	221
In percentage	43.48%	56.52%	48.80%	51.20%	0.00%	100.00%	2.68%	97.32%	12.37%	82.47%	33.70%	66.30%	23.50%

Self sufficiency	84	8	246	4	149	0	145	4	182	2	86	6	892
In percentage	91.30%	8.70%	98.40%	1.60%	100.00%	0.00%	97.32%	2.68%	93.81%	1.03%	93.48%	6.52%	95.72%

Table 14: Benefits of wet land irrigation

	Lhuntse		Mongar		P/gatshel		S/jongkhar		T/gang		T/yangtse		Total
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Enhanced production	72	20	70	180	149	0	6	143	107	77	37	55	441
In percentage	78.26%	21.74%	28.00%	72.00%	100.00%	0.00%	4.03%	95.97%	58.15%	41.85%	40.22%	59.78%	51.44%
Enhanced land utilization	26	66	192	58	3	146	144	5	30	154	70	22	465
In percentage	28.26%	71.74%	76.80%	23.20%	2.01%	97.99%	96.64%	3.36%	16.30%	83.70%	76.09%	23.91%	49.35%
Cultivation of various crops/vegetables	33	59	56	194	3	146	20	129	19	165	32	60	163
In percentage	35.87%	64.13%	22.40%	77.60%	2.01%	97.99%	13.42%	86.58%	10.33%	89.67%	34.78%	65.22%	19.80%
Self sufficiency	89	3	249	1	149	0	145	4	184	0	89	3	905
In percentage	96.74%	3.26%	99.60%	0.40%	100.00%	0.00%	97.32%	2.68%	100.00%	0.00%	96.74%	3.26%	98.40%

Table 15: Benefits of land development

	Lhuntse		Mongar		P/gatshel		S/jongkhar		T/gang		T/yangtse		Total
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Enhanced production	16	76	15	235	20	129	6	143	65	119	55	37	177
In percentage	17.39%	82.61%	6.00%	94.00%	13.42%	86.58%	4.03%	95.97%	35.33%	64.67%	59.78%	40.22%	22.66%
Enhanced land utilization	15	77	15	235	20	129	4	145	59	125	53	39	166
In percentage	16.30%	83.70%	6.00%	94.00%	13.42%	86.58%	2.68%	97.32%	32.07%	67.93%	57.61%	42.39%	21.35%

Cultivation of various crops/vegetables	26	66	56	194	20	129	4	145	60	124	55	37	221
In percentage	28.26%	71.74%	22.40%	77.60%	13.42%	86.58%	2.68%	97.32%	32.61%	67.39%	59.78%	40.22%	26.53%
Self sufficiency	32	61	75	175	20	129	3	146	133	51	72	20	335
In percentage	34.78%	66.30%	30.00%	70.00%	13.42%	86.58%	2.01%	97.99%	72.28%	27.72%	78.26%	21.74%	38.46%

Table 16: Utilization of facilities (count and percentage)

	Lhuntse		Mongar		P/gatshel		S/jongkhar		T/gang		T/yangtse		Total
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Milk processing center	33	60	61	189	147	2	28	121	147	37	6	86	422
In percentage	35.48%	64.52%	24.40%	75.60%	98.66%	1.34%	18.79%	81.21%	79.89%	20.11%	6.52%	93.48%	43.96%
Milk collection center	3	89	25	225	23	126	20	129	7	177	3	89	81
In percentage	3.26%	96.74%	10.00%	90.00%	15.44%	84.56%	13.42%	86.58%	3.80%	96.20%	3.26%	96.74%	8.20%
Milk collection shed	32	60	70	180	141	8	25	124	152	32	10	82	430
In percentage	34.78%	65.22%	28.00%	72.00%	63.80%	3.62%	16.78%	83.22%	82.61%	17.39%	10.87%	89.13%	39.47%
Irrigation channel	57	35	78	172	93	56	12	137	146	38	20	72	406
In percentage	61.29%	37.63%	31.20%	68.80%	62.42%	37.58%	8.05%	91.95%	79.35%	20.65%	21.74%	78.26%	44.01%
Dry land irrigation	87	5	231	19	92	57	121	28	147	37	69	23	747
In percentage	94.57%	5.43%	92.40%	7.60%	61.74%	38.26%	81.21%	18.79%	79.89%	20.11%	75.00%	25.00%	80.80%
Collection store	0	92	6	244	14	135	12	137	30	154	23	69	85
In percentage	0.00%	100.00%	2.40%	97.60%	9.40%	90.60%	8.05%	91.95%	16.30%	83.70%	25.00%	75.00%	10.19%

Table 17: Weight and height of children between 0-5 years.

6-11 mths (Wt. kg)	6-11 mths (Ht.m)	12-23 mths (Wt. kg)	12-23 mths (Ht. m)	24-35 mths (Wt. kg)	24-35 mths (Ht. m)	36-47 mths (Wt. kg)	36-47 mths (Ht.m)	48-59 mths (Wt. kg)	48-59 mths (Ht.m)
Male									

5	0.52	7	0.62	8	0.69	14.5	0.93	12	0.89
5	0.6	9	0.69	10.2	0.75	11.5	0.8	14	0.9
4.3	0.55	9.5	0.78	10.3	0.8	17	0.86	14.6	0.9
5	0.6	8.2	0.64	10	0.77	14	0.82	15	0.76
5	0.45	9	0.65	11	0.65	13.5	0.75	15	0.8
8.5	0.68	11	0.75	10	0.67	12	0.8	12	0.8
				9	0.71	11	0.9	16	0.83
				12	0.72	14	0.9	12	0.98
				10	0.7	11	0.83	14.3	0.9
				10	0.75	12	0.65	12	0.78
				13	0.85	13	0.85	12	0.83
				12	0.7	12	0.7		
				9	0.72	17	0.9		
				9	0.55	15	0.95		
						14	0.95		
						12	1.05		
						15	0.99		
Female									
6	0.75	8.9	0.76	11.5	0.81	13.3	0.63	17	1
5	0.6	8.8	0.8	9.5	0.75	11	0.8	13	0.98
		6	0.5	9	0.8	13	0.94	16	0.8
		10	0.7	9.9	0.75	11.2	0.83	11	0.89
		8.5	0.66	10	0.7	11.8	0.85	11	0.79
				10	0.77	15	0.95	13	0.89
				8	0.8	11	0.86	16.6	1
				11.5	0.73			16.1	0.97
				11	0.87			11	0.83
				12	0.97			11	1

Table 18: Percentage of HHs consuming each food groups.

Dzongkhag	Other fruits	Nuts or seeds	Beans or peas	Food made from grains and any white roots or tuber or plantains.	Meat, poultry and fish products	Vitamin A rich Dark green leafy vegetables)	Eggs (Eggs from poultry or other birds)	Milk or milk products	Other vegetables	Vitamin A rich fruits, vegetables and roots
Man	**113.00**	**29.00**	**254**	**210.00**	**328.00**	**281.00**	**192.00**	**294.00**	**349.00**	**275**
Lhuentse	13.00	2.00	15.00	11.00	29.00	20.00	12.00	21.00	25.00	16
Mongar	23.00	3.00	36.00	37.00	65.00	55.00	42.00	54.00	66.00	53
Pemagatshel	26.00	4.00	78.00	74.00	76.00	73.00	70.00	79.00	81.00	81
S/Jongkhar	41.00	11.00	68.00	58.00	59.00	64.00	27.00	70.00	69.00	71
Trashigang	5.00	7.00	47.00	24.00	79.00	51.00	25.00	51.00	81.00	44
Trashiyangtse	5.00	2.00	10.00	6.00	20.00	18.00	16.00	19.00	27.00	10
Women	**198.00**	**45.00**	**330**	**254.00**	**476.00**	**412.00**	**247.00**	**398.00**	**508.00**	**369**
Lhuentse	27.00	2.00	36.00	23.00	63.00	45.00	23.00	48.00	57.00	39
Mongar	67.00	4.00	96.00	58.00	143.00	125.00	79.00	132.00	157.00	127
Pemagatshel	33.00	8.00	63.00	59.00	67.00	61.00	50.00	62.00	67.00	68
S/Jongkhar	43.00	12.00	64.00	59.00	58.00	64.00	21.00	63.00	64.00	69
Trashigang	18.00	11.00	52.00	35.00	100.00	67.00	42.00	63.00	100.00	47
Trashiyangtse	10.00	8.00	19.00	20.00	45.00	50.00	32.00	30.00	63.00	19
Grand Total	**311.00**	**74.00**	**584**	**464.00**	**804.00**	**693.00**	**439.00**	**692.00**	**857.00**	**644**

Table 19: Percentage of the HHs from indicating food lasts from own farm production

Food	Period of food last	Lhuntse	Mongar	P/gatshel	T/gang	T/yangtse	S/jongkhar
Cereals	<3 months	0.00	0.00	0.00	0.00	0.00	0.00
	Upto 3 months	0.00	0.00	0.00	0.00	0.00	0.00
	Upto 6 months	1.79	0.71	47.65	10.89	2.42	44.10
	Upto 9 months	2.68	1.06	0.00	0.00	2.42	0.00

	Whole year	77.68	86.57	6.14	63.31	69.35	7.64
	More than a year	0.00	0.00	0.00	0.00	0.00	0.00
	Irregular	0.00	0.00	0.00	0.00	0.00	0.00
	Do not produce	17.86	11.66	46.21	25.81	25.81	48.26
Vegetables	<3 months	0.00	0.00	0.00	0.00	0.00	0.00
	Upto 3 months	0.00	0.00	1.20	0.00	0.00	0.00
	Upto 6 months	1.06	1.18	22.29	4.33	21.00	52.69
	Upto 9 months	0.00	1.18	5.42	0.00	0.00	4.30
	Whole year	96.81	96.06	60.84	84.13	71.00	23.12
	More than a year	0.00	0.00	0.00	0.00	0.00	0.00
	Irregular	0.00	0.00	0.00	0.00	0.00	0.00
	Do not produce	2.13	1.57	11.45	11.54	8.00	19.89
Dairy products	<3 months	0.00	0.00	0.00	0.00	0.00	0.00
	Upto 3 months	0.00	0.00	0.00	0.00	0.00	0.00
	Upto 6 months	0.00	1.53	5.14	0.00	2.33	12.09
	Upto 9 months	4.08	1.92	11.68	0.00	0.00	12.09
	Whole year	89.80	92.34	52.80	71.60	68.99	45.12
	More than a year	0.00	0.00	0.00	0.00	0.00	0.00
	Irregular	0.00	0.00	0.00	0.00	0.00	0.00
	Do not produce	6.12	4.21	30.37	28.40	28.68	30.70

Table 20: Percentage of the HHs indicating food lasts from own farm production

Food	Period of food last	Lhuntse		Mongar		P/gatshel		T/gang		T/yangtse		S/jongkhar	
		Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline
Rice	<3 months	4.70%	0.00%	5.60%	0.40%	0.00%	2.01%	0.80%	0.54%	1.90%	5.43%	0.00%	0.67%
	Upto 3 months	10.60%	0.00%	5.60%	0.40%	1.10%	0.67%	2.30%	4.35%	0.00%	4.35%	0.00%	0.00%
	Upto 6 months	22.40%	0.00%	4.60%	0.40%	1.10%	0.00%	2.30%	2.72%	7.50%	13.04%	0.00%	4.03%

	Upto 9 months	9.40%	2.17%	2.80%	0.80%	0.00%	0.67%	14.30%	0.00%	15.10%	4.35%	2.30%	2.01%
	Whole year	18.80%	52.17%	3.70%	28.40%	4.50%	2.68%	30.10%	23.91%	37.70%	20.65%	25.00%	42.28%
	More than a year	2.40%	1.09%	1.90%	0.00%	0.00%	0.00%	9.00%	0.00%	7.50%	2.17%	4.50%	0.00%
	Irregular	0.00%	14.13%	0.00%	8.00%	1.10%	0.00%	0.00%	3.26%	0.00%	1.09%	0.00%	1.34%
	Do not produce	31.80%	30.43%	75.90%	61.60%	92.10%	93.96%	41.40%	65.22%	30.20%	48.91%	68.20%	49.66%
Maize	<3 months	2.40%	0.00%	0.90%	0.40%	1.10%	21.48%	0.00%	9.78%	7.50%	15.22%	3.40%	29.53%
	Upto 3 months	5.90%	0.00%	0.90%	0.00%	0.00%	2.01%	0.80%	9.78%	5.70%	6.52%	2.30%	3.36%
	Upto 6 months	3.50%	0.00%	0.90%	0.00%	1.10%	6.04%	3.80%	1.63%	17.00%	6.52%	2.30%	14.09%
	Upto 9 months	7.10%	4.35%	8.30%	0.80%	5.60%	6.04%	8.30%	0.00%	5.70%	2.17%	5.70%	5.37%
	Whole year	65.90%	79.35%	75.00%	90.80%	68.50%	58.39%	60.20%	46.74%	37.70%	39.13%	70.50%	15.44%
	More than a year	3.50%	0.00%	10.20%	0.00%	18.00%	0.00%	16.50%	54.00%	11.30%	1.09%	6.80%	0.00%
	Irregular	0.00%	5.43%	0.00%	4.40%	0.00%	67.00%	2.30%	11.41%	1.90%	0.00%	1.10%	2.01%
	Do not produce	11.80%	10.87%	3.70%	3.60%	5.60%	5.37%	8.30%	20.11%	13.20%	29.35%	8.00%	20.20%
Potato	<3 months	17.60%	1.09%	60.00%	0.40%	10.10%	36.24%	0.00%	17.93%	5.70%	17.39%	14.80%	42.28%
	Upto 3 months	9.40%	1.09%	3.70%	0.00%	3.40%	12.08%	2.30%	13.59%	3.80%	11.96%	3.40%	2.68%
	Upto 6 months	10.60%	0.00%	6.50%	0.40%	10.10%	15.44%	3.80%	2.72%	17.00%	7.61%	12.50%	12.08%
	Upto 9 months	11.80%	4.35%	9.30%	0.00%	12.40%	0.00%	12.00%	0.00%	17.00%	3.26%	10.20%	0.00%
	Whole year	42.40%	66.30%	66.70%	87.60%	31.50%	6.04%	48.10%	34.24%	37.70%	43.48%	38.60%	1.34%
	More than a year	2.40%	0.00%	5.60%	40.00%	9.00%	0.00%	13.50%	1.09%	9.40%	1.09%	4.50%	0.00%
	Irregular	0.00%	18.48%	0.90%	5.20%	4.50%	0.00%	5.30%	8.15%	0.00%	0.00%	2.30%	2.68%

	Do not produce	5.90%	8.70%	2.80%	6.00%	19.10%	30.20%	15.00%	22.28%	9.40%	15.22%	13.60%	38.93%
Vegetables	<3 months	5.90%	0.00%	7.40%	0.00%	5.60%	21.48%	24.80%	16.30%	17.00%	11.96%	9.10%	28.86%
	Upto 3 months	9.40%	0.00%	7.40%	0.40%	34.80%	2.01%	80.00%	23.37%	15.10%	45.65%	25.00%	11.41%
	Upto 6 months	11.80%	0.00%	1.90%	0.00%	15.70%	10.07%	2.30%	4.35%	11.30%	4.35%	11.40%	23.49%
	Upto 9 months	10.60%	0.00%	13.00%	0.40%	10.10%	7.38%	4.50%	0.00%	7.50%	1.09%	9.10%	4.03%
	Whole year	41.20%	84.78%	63.90%	94.80%	25.80%	48.32%	55.60%	29.89%	47.20%	32.61%	28.40%	22.82%
	More than a year	2.40%	0.00%	1.90%	0.00%	3.40%	0.00%	5.30%	0.00%	1.90%	0.00%	5.70%	0.00%
	Irregular	15.30%	6.52%	3.70%	3.20%	4.50%	0.00%	4.50%	10.33%	0.00%	0.00%	8.00%	1.34%
	Do not produce	3.50%	8.70%	0.90%	1.20%	0.00%	10.74%	2.30%	15.76%	0.00%	4.35%	3.40%	8.05%
Cheese	<3 months	8.20%	0.00%	10.20%	0.80%	20.20%	0.00%	15.00%	17.93%	15.10%	14.13%	1.10%	2.01%
	Upto 3 months	0.00%	0.00%	4.60%	0.40%	1.10%	0.67%	0.80%	1.09%	9.40%	1.09%	6.80%	4.03%
	Upto 6 months	1.20%	0.00%	7.40%	0.40%	18.00%	8.05%	0.80%	0.00%	5.70%	0.00%	9.10%	16.11%
	Upto 9 months	23.50%	0.00%	15.70%	1.20%	13.50%	6.04%	10.50%	0.00%	11.30%	0.00%	5.70%	11.41%
	Whole year	10.60%	68.48%	14.80%	69.20%	18.00%	8.72%	23.30%	29.35%	28.30%	36.96%	17.00%	12.75%
	More than a year	1.20%	0.00%	0.90%	0.00%	3.40%	0.00%	2.30%	0.00%	0.00%	0.00%	4.50%	0.00%
	Irregular	1.20%	19.57%	6.50%	14.00%	13.50%	67.00%	6.00%	54.00%	1.90%	0.00%	11.40%	67.00%
	Do not produce	54.10%	11.96%	39.80%	14.00%	12.40%	75.84%	41.40%	51.09%	28.30%	47.83%	44.30%	53.02%
Milk	<3 months	7.10%	0.00%	10.20%	0.40%	20.20%	0.00%	15.00%	19.02%	15.10%	14.13%	11.50%	0.67%
	Upto 3 months	2.40%	0.00%	4.60%	0.00%	1.10%	0.00%	0.80%	1.09%	9.40%	1.09%	3.60%	2.68%

	Upto 6 months	1.20%	0.00%	7.40%	0.80%	18.00%	18.12%	0.80%	0.00%	5.70%	0.00%	6.70%	23.49%
	Upto 9 months	24.70%	0.00%	15.70%	0.80%	12.40%	16.78%	10.50%	0.00%	11.30%	0.00%	13.30%	17.45%
	Whole year	8.20%	68.48%	14.80%	71.60%	19.10%	22.15%	23.30%	38.04%	28.30%	39.13%	18.20%	22.82%
	More than a year	1.20%	0.00%	0.90%	0.00%	3.40%	0.00%	2.30%	0.00%	0.00%	0.00%	2.20%	0.00%
	Irregular	1.20%	18.48%	6.50%	14.00%	13.50%	0.00%	6.00%	1.09%	1.90%	0.00%	7.00%	67.00%
	Do not produce	54.10%	13.04%	39.80%	12.40%	12.40%	42.95%	41.40%	40.76%	28.30%	45.65%	37.60%	32.21%
Butter	<3 months	8.20%	0.00%	10.20%	0.40%	20.20%	0.67%	15.00%	17.93%	15.10%	10.87%	1.10%	2.01%
	Upto 3 months	0.00%	0.00%	4.60%	0.00%	1.10%	2.01%	0.80%	1.09%	9.40%	4.35%	6.80%	3.36%
	Upto 6 months	1.20%	0.00%	7.40%	0.00%	18.00%	8.05%	0.80%	0.00%	5.70%	1.09%	9.10%	16.78%
	Upto 9 months	23.50%	0.00%	15.70%	1.20%	13.50%	5.37%	10.50%	0.00%	11.30%	0.00%	5.70%	12.08%
	Whole year	10.60%	68.48%	14.80%	73.20%	18.00%	8.05%	23.30%	29.89%	28.30%	35.87%	17.00%	13.42%
	More than a year	1.20%	0.00%	0.90%	0.00%	3.40%	0.00%	2.30%	0.00%	0.00%	0.00%	4.50%	0.00%
	Irregular	1.20%	19.57%	6.50%	12.40%	13.50%	1.34%	6.00%	1.09%	1.90%	0.00%	11.40%	67.00%
	Do not produce	54.10%	11.96%	39.80%	12.80%	12.40%	74.50%	41.40%	50.00%	28.30%	47.83%	44.30%	51.68%

Table 21: Percentage of the HHs indicating food groups lasts from own farm production as compared to baseline

Food	Period of food last	Lhuntse		Mongar		P/gatshel		T/gang		T/yangtse		S/jongkhar	
		Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline
Cereals	<3 months	0.00	2.4	0.00	0.9	0.00	1.1	0.00	0.0	0.00	7.5	0.00	3.4
	Upto 3 months	0.00	5.9	0.00	0.9	0.00	0.0	0.00	0.8	0.00	5.7	0.00	2.3

	Upto 6 months	1.79	3.5	0.71	0.9	47.65	1.1	10.89	3.8	2.42	17.0	44.10	2.3
	Upto 9 months	2.68	7.1	1.06	8.3	0.00	5.6	0.00	8.3	2.42	5.7	0.00	5.7
	Whole year	77.68	65.9	86.57	75.0	6.14	68.5	63.31	60.2	69.35	37.7	7.64	70.5
	More than a year	0.00	3.5	0.00	10.2	0.00	18.0	0.00	16.5	0.00	11.3	0.00	6.8
	Irregular	0.00	0.0	0.00	0.0	0.00	0.0	0.00	2.3	0.00	1.9	0.00	1.1
	Do not produce	17.86	11.8	11.66	3.7	46.21	5.6	25.81	8.3	25.81	13.2	48.26	8.0
Vegetables	<3 months	0.00	5.9	0.00	7.4	0.00	5.6	0.00	24.8	0.00	17.0	0.00	9.1
	Upto 3 months	0.00	9.4	0.00	7.4	1.20	34.8	0.00	0.8	0.00	15.1	0.00	25.0
	Upto 6 months	1.06	11.8	1.18	1.9	22.29	15.7	4.33	2.3	21.00	11.3	52.69	11.4
	Upto 9 months	0.00	10.6	1.18	13.0	5.42	10.1	0.00	4.5	0.00	7.5	4.30	9.1
	Whole year	96.81	41.2	96.06	63.9	60.84	25.8	84.13	55.6	71.00	47.2	23.12	28.4
	More than a year	0.00	2.4	0.00	1.9	0.00	3.4	0.00	5.3	0.00	1.9	0.00	5.7
	Irregular	0.00	15.3	0.00	3.7	0.00	4.5	0.00	4.5	0.00	0.0	0.00	8.0
	Do not produce	2.13	3.5	1.57	0.9	11.45	0.0	11.54	2.3	8.00	0.0	19.89	3.4
Dairy products	<3 months	0.00	7.1	0.00	10.2	0.00	20.2	0.00	15.0	0.00	15.1	0.00	1.1
	Upto 3 months	0.00	2.4	0.00	4.6	0.00	1.1	0.00	0.8	0.00	9.4	0.00	6.8
	Upto 6 months	0.00	1.2	1.53	7.4	5.14	18.0	0.00	0.8	2.33	5.7	12.09	9.1
	Upto 9 months	4.08	24.7	1.92	15.7	11.68	12.4	0.00	10.5	0.00	11.3	12.09	5.7
	Whole year	89.80	8.2	92.34	14.8	52.80	19.1	71.60	23.3	68.99	28.3	45.12	17.0
	More than a year	0.00	1.2	0.00	0.9	0.00	3.4	0.00	2.3	0.00	0.0	0.00	4.5
	Irregular	0.00	1.2	0.00	6.5	0.00	13.5	0.00	6.0	0.00	1.9	0.00	11.4
	Do not produce	6.12	54.1	4.21	39.8	30.37	12.4	28.40	41.4	28.68	28.3	30.70	44.3

Food groups to create HDDS	Food groups to create WDDS
Cereals	Starchy staples[4]
Tubers and roots	Dark green leafy vegetables
Vegetables[1]	Other vitamin A rich fruits and vegetables[5]
Fruits[2]	Other fruits and vegetables[6]
Meat[3]	Organ meat
Eggs	Meat and fish[7]
Fish and other seafood	Eggs
Legumes, nuts and seeds	Legumes, nuts and seeds
Milk and milk products	Milk and milk products
Oils and fats	
Sweets	
Spices, condiments and beverages	

Note:
1. The vegetable food group is a combination of vitamin A rich vegetables and tubers, dark green leafy vegetables and other vegetables
2. The fruit group is a combination of vitamin A rich fruits and other fruits
3. The meat group is a combination of organ meat and flesh meat
4. The starchy staples food group is a combination of Cereals and White roots and tubers.
5. The other vitamin A rich fruit and vegetable group is a combination of vitamin A rich vegetables and tubers and vitamin A rich fruits.
6. The other fruit and vegetable group is a combination of other fruit and other vegetables.
7. The meat group is a combination of meat and fish.

12.2 List of Officials consulted

Sl.No	Name	Location	Agency	Designation
1	Karma Tshering	Tashi Yangtse	Dzongkhag Admin	Dasho Dzongda
2	Phurpa Tshering	Tashi Yangtse		DLO
3	Kinga Dechen	Tashigang		ADLO
4	Sonam Rinchen	Tashi Yangtse	Gewog Admin	Mangmi
5	Karma Wangchuk	Khamdang	Gewog Admin	Tshogpa
6	Phurpa Gyeltshen	Ramjar	Gewog Admin	Gup
7	Sonam Tenzin	Merak	Gewog Admin	Adm
8	Yenten Phuentsho	Radhi	Gewog Admin	Gup
9	Jamyang	Samkhar	Gewog Admin	Gup
10	Kinzang Nima	Bartsham	Gewog Admin	Gup
11	Sonam Dorji	Khaling	Gewog Admin	Gup
12	Kinzang Dorji	Kanglung	Gewog Admin	Gup
13	Karma Tenzin	Mongar	Dzongkhag Admin	DAO
14	Tenzin Wangchuk	Mongar Gewog	Gewog Admin	Gup
15	Sangay Zangmo	Drepong	Gewog Admin	Mangmi
16	Tenzin	Chaskhar	Gewog Admin	Gup
17	Tshewang Lhuendup	Narang, Khalong	Gewog Admin	Tshogpa
18	Tenzin Jamtsho	Lhuentse, Jaray	Gewog Admin	Mangmi
19	Mr. Cheki Dorji	Langchenphu	Gewog Admin	Livestock officer
20	Mr. Pema Lekso	Pemathang	Gewog Admin	Gup
21	Mr. Tshering Wangchuk	Pemathang	Gewog Admin	Agriculture
22	Mr.Jamyang Gyeltshen	Phuntshothang	Gewog Admin	Gup
23	Mrs.Tenzin Dema	Phuntshothang	Gewog Admin	Agriculture
24	Mr.Pema Gyelpo	Orong	Gewog Admin	Gup
25	Mr.Thinley Rabten	Pemagatshel	Dzongkhag Admin	Chief DLO
26	Dr ChiMi JaMthso	Trashigang	DVH	Management
27	Dechen ChezoM	Trashigang	DVH	Management
28	Dr Narayan Pokhrel	Mongar	DVH	Management
29	Karma Yangki	Mongar	DVH	Management
30	Karma Choki	Mongar	DVH	Management
31	Sangay Tshering	Pemagatshel	DVH	Management
32	Dr Sonam Choden	Trashiyangtse	DVH	Management
33	Karma Wangmo	Lhuentse	DVH	Management
34	Dr Sangay Letho	RLDC	RLDC	Management
35	Thrinang Wangdi	RLDC	RLDC	Management

36	Namgay	RLDC	RLDC	Management
37	Samdrup Zangmo	RLDC	RLDC	Management
38	Thukten	RLDC	RLDC	Management
39	Nanda kala	RLDC	RLDC	Management
40	Dawa Penjor	RLDC	RLDC	Management
41	Tsherwang Jamtsho	RLDC	RLDC	Management
42	Pema Yuden	RLDC	RLDC	Management
43	Wangchuk Namgay	RPPBC	RPPBC	Management
44	Kelzang Wangdi	Samdrup Jongkhar	DVH, S/Jongkhar	Management
45	Karma Choki	Mongar	DVH, Mongar	Management
46	Karma Zangmo	Pemagatshel	DVH, P/gatshel	Management
47	Kelzang Wangdi	Samdrup Jongkhar	DVH, S/Jongkhar	Management
48	Dechen Chenzom	Trashigang	DVH, Trashigang	Management
49	Mr. Tshering Penjor	Mongar	RAMCO	Asst. Marketing Officer
50	Mr. Norbu	Wengkhar, Mongar	PMU, CARLEP	Component Manager
51	Mr. Domang	Mongar	RNR-RDC	Program Director
52	Mr. Norbu Tshering	Mongar	Dzongkhag Admin	ADLO
53	Mrs. Kinga Wangmo	Thimphu	Cluster Finance	DCFO
54	Mrs. Sonam Yangdon	Thimphu	Dept. of Livestock	Asst. LO
55	Mr. Saha Bir Rai	Thimphu	Dept. of Agriculture	Chief
56	Mr. Sonam Yarphel	Thimphu	PPD, MoAL	Planning Officer
57	Mr. Tshering Dorji	Kanglung	RNR- Khangma	Agriculture Officer
58	Mr. Tenzin Lungdhok	Trashigang	KIL, Chenari	Marketing Officer

12.3 List of individuals interviewed

Name of Individual	**Gewog**	**Dzongkhag**	**Business**
Karma Dorji	Samkhar	Tashigang	Milk Transporter
Dawa	Chaskhar	Mongar	Milk Transporter
Sangay Choedra	Mongar	Mongar	Milk Transporter
Sonam Gyeltshen	Kalapang	Mongar	Mushroom Farm
Dawa	Chaskhar	Mongar	Milk Transporter
Sangay	Samkhar	Tashigang	Vegetable Trader
Jamyang Singye	Phuntshothang	S/jonkkhar	Samjong (Sales outlet and food Court)
Kinley Gankhang	Phuntshothang	S/jonkkhar	Family yogurt

Sonam Gyeltshen		Mongar	Samara Organic Mushroom farm

12.4 List of groups/cooperatives consulted

Name of cooperative	Village	Gewog	Dzongkhag	Representative
Koufuko International Ltd	Pam	Samkhar	Tashigang	Chenery Staff
Nazhoen Gongphel	Town	Mongar	Mongar	Women Group
Langchenphu Organic vegetables Group	Langchenphumed	Langchenphu	S/jongkhar	Chairperson
Wooling Samtencholing Om Namlay Tshoday	Wooling	Orong	S/jongkhar	Chairperson
Jangchubling Mandar Om Thuedrel Tshogpa	Jangchubling	Orong	S/jongkhar	Chairperson
Dewathang Milk Marketing Corporative	Dewathang	Dewathang	S/jongkhar	Milk transporter
Kangma Chikthen Gonor Dentshen	Khangma	Yurung	Pemagatshel	Secretary
Milk Collection Van: Tsharsi-Dagor	Tshartsi	Nanong	Pemagatshel	Milk Transporter
Shingchuri Semhechum Detshen	Shingchuri	Dechenling	Pemagatshel	Mr.Pema Chorten
Family Yogurt		Phuntshothang	S/jongkhar	Kinley Gankhang
Wengkhar Om Dhaytshen	Wengkhar	Mongar	Mongar	Tshewang Pelmo
Thunder Dhaytshen	Phosorong	Mongar	Mongar	Karma Lhatu
Dangling Dungkar Choeling Gonor Detshen	Rongthung	Khanglung	Trashigang	Sonam Gyeltsehn
Gonor Sanam Nyamdrup Detshen	Kidheykhar	Mongar	Mongar	Pema Yangzom
Pam Midoe Namlay Detshen	Pam	Samkhar	Trashigang	Karma
Tashi Tsheringma Namlay Detsen	Rangshikha	Samkhar	Trashigang	Ugyen
Batso Dhari Tshogpa	Chaling	Shongphu	Trashigang	Dawa Gyeltshen
Zambala Detshen	Jaibab	Mongar	Mongar	Rinzin Wangchuk
Deothang Milk Marketing Namley Tshogdey.	Kebsa	Deothang	S/Jongkhar	Yanki Lhamo

Druk Chethen Namlay Tshodue	Gongthung	Yangner	Trashigang	Tashi Penjor
Jangchubling Mandar Om Thudrel Tshogpa	Mandar	Orong	S/Jongkhar	Sonam Dendrup
Wooling Dairy Farm	Wooling	Orong	S/Jongkhar	Nima Gyalpo
Yatong Gonor Gongphel Detshen	Chasker	Chaskhar	Mongar	Tshechi
Kharnang Lamtha Lamwog Nyamrub Detshen	Babung	Chaskhar	Mongar	Kota
Gomdar Om Nyamlay Tshokdhey	Tshangchillo	Gomdar	S/Jongkhar	Kezang Dawa
Mandaire Thundrel Deltshen	Dortsun	Orong	S/Jongkhar	Tshering Phuntsho
Menjigang Om tshogdrel detshen	Menjigang	Phuntshothang	S/Jongkhar	Bim Bdr
Jersy tshochung thuendrel detshen	Gorthungma thizor	Martshala	S/Jongkhar	Namshey Dorji
Jamkhar milk desthen.	Thachama	Jamkhar	T/yangtse	Drupchu
Wangphu Yusum Thruendrel Detshen	Wangphu	Martshala	S/Jongkhar	Namgey Wangchuck
Pemathang Omley Tshongley Detshen	Pemathang	Pemathang	S/Jongkhar	Sangay Tenzin
Langchenphu Om Tshogdrel Detshen.	Langchen phu	Langchen phu	S/Jongkhar	Tenzin Lungten
Tangrong Om Detshen	Tangrong	Kortoed	Lhuntse	
Khangma Gonor Chithuen Group	Khangma	Yurung	Pemagatshel	Rinchen Chedup
Chidhen Tshephel Detshen	Nangkor	Shumar	Pemagatshel	Norbu Dema
Zambala Milk Cooperative	Norbugang	Norbugang	Pemagatshel	Pema Wangda
Tshatshidagor Norlha Detshen	Tshatshi	Nanong	Pemagatshel	Sonam Choden
Tokarie Om Tshongley Detshen	Tokarie	Nanong	Pemagatshel	Pema Wangda
Woongchilo Om Tshongley Detshen	Woongchilo	Nanong	Pemagatshel	Pemba Tshering

12.5 Survey Questions

Consent

Good morning/afternoon/evening, my name is____, we are working for the project called Commercial Agriculture Resilient Livelihood Enhancement Programme (CARLEP) based in Wengkhar, Monager under the Ministry of Agriculture and Livestock. The project has been initiated in 2016 to transform Bhutan's subsistence-based rural agricultural economy into a sustainable, market-driven sector through climate-smart agricultural approaches, private sector engagement in agricultural commercialization, and strengthened community and local institutional capacities.

Since the project is coming to an end, we are conducting a survey to know more about the impacts of the project interventions, lessons learnt and some of the key challenges faced during the project implementation process. It will take about 15-20 minutes to complete the interview and all information obtain will remain strictly confidential and your answers and name will never be revealed. Please kindly arrange to provide us the answers honestly. Your valuable input will immensely help in taking decisions for future implementation of the project. So, can we proceed with the questions?

Enumerator Name: Interview date:

A: Household Information

A1 Dzongkhag: Gewog: Village:

A2 House No. CID No. GPS location:

A3 Name of Respondent:

A4 Gender of Respondent: Male/Female

A5 Age of Respondent:

A6 Marital Status: Single, Married, Divorce, Widow, Others

A7 Are you Head of Household? Yes/No

A8 Gender of Head of Household: Male/Female

A9 Qualification of respondent:

No Education	Monastic school
Non-formal Education	Primary education
Middle secondary school	Higher secondary school
Certificate	Graduate
Post Graduate	

A10 How many people actually reside in the house? Only 1 person, 2 persons, 3-4 persons, 5-6persons, above 6 persons

A11 How many people are actually available for agricultural work? Only 1 person, 2 persons, 3-4 persons, 5-6persons, above 6 persons

Are you employed in any form? Formal/Informal/None

Number of children under 0-5 years at home? Nos

Details of children (0-5 years) (can be verified from health book)

A12

Age	Gender	Weight (kg)	Height (cm)
0-5 months			
6-11 months			
12-23 months			
24-35 months			
36-47 months			
48-59 months			

B: 25% increase in HH asset and income

B1

Do you own any of the following assets?	Tick
1. TV	
2. Rice/curry cooker	
3. Water boiler	
4. Grass cutter	
5. Oil expeller	
6. Chaff cutter	
7. Refrigerator	
8. Power tiller	
9.Sprinklers	
10. Sprayers	
11. Rice huller	
12. Flake making machine	
13. Flour mill	
14. Chips making machine	

15. Improved plough	
16. Paddy transplanter	
17. Paddy harvester	
18. Paddy thresher	
19. Maize Sheller	
20. Power Chain	
21. Vehicle	
22. Electronics	

B2	**Who owns the assets of the household?**			
	Assets	Women	Men	Both
	Land			
	Livestock			
	Finance			
	Electronics			
	Farm machineries and equipment			

B3

Type of house owned.	Tick
1. Thatched/bamboo wall with banana/hay roof	
2. Thatched/bamboo wall with shingle roof	
3. Thatched/bamboo wall with CGI roof	
4. Wooden wall with shingle roof	
5. Wooden wall with CGI roof	
6. Mud and stone wall with shingle roof	
7. Mud and stone wall with CGI roof	
8. Concrete (stone or brick wall) with shingle roof	
8. Concrete (stone or brick wall) with CGI roof	
9. Don't have house of own	

B4	**Land owned (acres)**	**<0.25**	**0.25-0.5**	**0.51-1**	**1.1-2**	**2.1-4**	**4.1-6**	**6.1-10**	**>10**	**None**
	Total area of dry land owned									
	Total area of dry land cultivated									
	Total area of wet land owned									
	Total area of wet land cultivated									

Upland rice cultivated									
Total orchard									
Maize cultivated									
Potato cultivated									
Kitchen garden vegetables									
Commercial vegetable cultivated									
Total citrus owned									
Total mango owned									
Total productive mango area									
Total avocado owed									
Total productive avocado owned									
Total cardamom owned									
Total productive cardamom area									
Improved pasture									

B5. Do you own cattle? Yes/No

B6	If yes, specify the type of cattle own?											
	Type of cattle own	1	2	3	4	5	6	7	8	9	>10	None
	1. Local cattle											
	a) Milking											
	b) Dry											
	c) Pregnant											
	d) Heifers											
	e) Calf											
	i. Male											
	ii. Female											
	2. Improved cattle											
	a) Milking											
	b) Dry											
	c) Pregnant											
	d) Heifers											
	e) Calf											
	i. Male											
	ii. Female											
	3. Yak											
	4. Pig											

	5. Sheep/Goat											
	6. Poultry 7. Fish											

B7. Please provide the following details:

	Local breed	Improved cattle
Average milk yield in winter months (litre/day)		
Average milk yield in summer months (litre/day)		

Households receiving animals from distribution/restocking

B8. Did you receive any project support for the purchase of improved cattle breeds over the project years (from 2016 onwards)? Yes/No

B9. If yes, provide numbers?

1 -2	3-4	4-5	6-7	8-9	More than 10

B10. Did you receive any other animals like poultry over the project in the past years? Yes/No

B11. If yes, provide numbers.

0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55

56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100	>100

B12	**Type of cattle shed owned?**	**Tick**
	Conventional	
	Improved	

B13. What is the production and sale of dairy products?

	Production (last year)	Quantity sold	Amount earned (Nu.)
Milk in litre			
Cheese in balls			
Butter in kg			
Chogo in kg			
Beef in kg			
Yak meat in kg			
Chivon in kg			
Chicken in kg			
Egg in Dozen			
Pork kg			
Fish in kg			

B14. How many acres of improved fodder grass do you grow?
B15. How many acres of winter fodder did you grow?
B16. How much fodder did you conserve last year? (Kgs of Silage, Hay, crop residue)
B17. How much commercial feeds did you purchase in a year? (Kgs)

C. Production and irrigation

≥ 30% increase in production of vegetables and dairy products

C1. Do you grow vegetables? Yes/No

C2. If yes, please provide the details as shown below.

	Cultivation area (acre)	Production (last year) Kg	Quantity sold Kg	Amount earned (Nu.)
Vegetables				
Radish				
Carrot				
Broccoli				
Tomato				
Onion				
Cabbage				
Beans				
Asparagus				
Chilli				
Peas				
Cauliflower				
Green leaves (in bundle)				
Ginger				
Cereals				
Rice				
Maize				
Quinoa				
wheat				
Buckwheat				
Mustard				
Cash crops				
Potato				
Cardamom				
Areca nut				
Fruits				
Avocado				
Mango				

Mandarin				
Pear				
Pineapple				
Kiwi				
Passion fruit				
Straw berry				
Persimmon				
Others (Specify)				

C5	**What is the average annual income of your household from the following sources?**	
	Income sources	In Nu.
	1. Cash crop	
	2. Cereals	
	3. Fruit	
	4. Farm labour/off farm activities wages earned	
	5. Livestock (Dairy products sold)	
	6. Enterprise	
	7. Sale of vegetables	
	8. Salary earned if employed	
	9. Livestock (Meat sold)	
	10. Poultry-eggs sold	
	11. Processed products sold	
	12. Other source of income	
	13. Remittance	
	Total	

15% reduction in the prevalence of child malnutrition

D1. Has any member of the household members participated in any project-supported activity designed to help to improve nutrition? Yes/No

D2	**Did your household consume the following food in the past 24 hours?**		
	Food made from grains and any white roots or tuber or plantains	Porridge, rice or other food made from grains, white potatoes, cassava or any other foods made from white-fleshed roots or tubers, or plantains	Yes-1, No-0
	Beans or peas	Beans or peas (fresh or dried seed), lentils or beans/pea product	Yes-1, No-0
	Nuts or seeds	Nuts, groundnut/peanut, or certain seeds	Yes-1, No-0

	Milk or milk products	Milk, cheese, yogurt or other milk products, but not including butter	Yes-1, No-0
	Meat, poultry and fish products	Liver, kidney, heart or other organ meats or blood-based foods, including beef, pork, lamb, goat, chicken, duck, other birds fresh or dried fish	Yes-1, No-0
	Eggs	Eggs from poultry or other birds	Yes-1, No-0
	Vitamin A rich Dark green leafy vegetables	Lettuce, cabbage, spring onion, coriander, fiddleheads, spinach, bitter gourd, asparagus, cyclanthera, turnip	Yes-1, No-0
	Vitamin A rich fruits, vegetables and roots	Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside ripe mango, ripe papaya etc.	Yes-1, No-0
	Other vegetables	Cauliflower, carrot, radish, tomatoes, brinjal, chilli,	Yes-1, No-0
	Other fruits	Mandarin, pineapple, banana, dragon fruit, litchi, peach, plums, guava etc.	Yes-1, No-0

D3 Did your household produce cereals for family consumption last year? Yes/No

D4 Did your household produce vegetables for family consumption last year? Yes/No

D5 Did your household produce dairy products for family consumption last year? Yes/No

D6 How long did the staple cereals lasted for household? In months

D7 How long did the vegetables remain self-sufficient for your household? In months

D8 How long did the dairy products remain self-sufficient for your household? In months

D9 Over the last 12 months, was there any periods during which, 3 meals a day was difficult for your family? Yes/No

D10 In which months, did your household faced food shortage? months

D11 Is there any improvement in food self-sufficiency as compared to previous year? Some improvement/Same/Worse

D12	**Food lasting from own farm production**							
		Rice	Maize	Potato	Vegetables	Milk	Cheese	Butter
	Less than 3 months							
	Upto 3 months							
	Upto 6 months							
	Upto 9 months							
	Whole year							
	More than a year							
	Irregular							
	Do not produce							

≥ 20,000 HH in vulnerable areas with increased water availability for agriculture production

E1. Do you have irrigation facility? Yes/No
E2. If yes, has the irrigation support reduced water shortage in your farm? Not at all, Partially, significantly.
E3. With the irrigation facility, did it enhance water supply? Yes/No
E4. Do you use irrigation (open canal/piped) system for wetland agriculture? Yes/No
E5. Do you use irrigation (open canal/piped) system for dryland agriculture? Yes/No
E6. Which of the following products have increased production with enhanced water availability?

	Tick
Vegetables	
Cereals	
Fruits	

E7. What types of Irrigation system (dry land) do you use for vegetable production?

	Tick
Pipe Networking System	
Drip Irrigation	
Syntax and reservoir tank	
Sprinkler System	
Surface irrigation	
Rain Water Harvesting	
Hand Watering	
Rain fed irrigation	
Drinking water taps	

E8. Agriculture land under irrigation

	Tick
<0.25acre	
0.25 to 0.5 acre	
0.51 to 1 acre	
1.1 to 2 acres	
2.1 to 4 acres	
4.1 to 6 acres	
>10 acres	

E9. How much of fallow land were brought under cultivation through project intervention in the past 6 years? In acres (under cultivation)

Reduced water shortage vis-à-vis production needs
E10. Do you still have water shortage for production? Yes/No
E11. Is there increased of production due to availability of water? Yes/No

Households supported with increased water availability or efficiency
E12. What was the primary source of water for irrigation before the project?
E13. What is the main source of water for irrigation now?
E14. Is the amount of water from the irrigation adequate for production? Yes/No

Resilient Agricultural Production
6000 HH adopt sustainable agricultural practices

F1. What type of agricultural practices do you use as per the following?

	Tick
Ridge (bed) cultivation	
Manure application	
Fertilizer application	
Local seeds	
Improved seeds	
Double cropping	
Crop rotation	
Land development (terracing, consolidation etc.)	
Hedge rows plantation	
Pasture cultivation	
Local cow breeds	
Integrated past management	
Crop diversification	

Adoption of new/improved inputs, technologies or practices
F2. Did you adopt any new livestock production technologies? Yes/No
F3. Which of the livestock technologies you have adopted?

	Tick
Milk Processing and Packaging	
Fodder conservation technology	
Clean Milk production	
Bio-gas	
Improved fodder grass plantation	
Winter Fodder cultivation	

Artificial Insemination (AI)	
Improved Cattle shed	
Total Mixed Ration	
Others specify	

F4. What are the agriculture production technologies you or your household adopted?

	Tick
New Vegetable Production techniques	
Post-harvest Technologies	
Plant Protection	
Farm mechanization and Land Development	
Soil and Water Management	
Greenhouse and Poly-tunnels	
Drip Irrigation	
Sprinkle Irrigation	
IOT based automation	
Composting (Heap compost or vermicomposting)	
Solar Dryer	
Orchard management (pruning, thining etc.)	
List down other technologies	

G. Production Resilience, Diversification and Innovation

Support to cope with the effects of climate change with sustainable land management practices

G1. Did you receive for environmentally sustainable and climate resilient technologies and practices over the project years? Yes/No

G2. If yes, choose the support received from the following list?

	Tick
Land management	
Fodder slips	
mushroom	
Upland paddy	
Improved pasture seeds	
Native poultry	
Stress tolerant seeds and seedlings	
Rain water harvesting	
Efficient irrigation	
Crop diversification	

Vegetable Production Intensified and Expanded

300 new vegetable farmer groups (4500 HH) established and functional

G3. Are you a member of any of the vegetable/dairy farmers groups? Yes/No

If yes, which group do you belong to:

	Tick
Dairy	
Vegetable	
Both	

G4. When did you join the group?

G5. Is the group functional? Yes/No. If no, what is the reason?

G6. How did it benefit you by joining those group?

	Tick
Access to input supplies	
Production support	
Access to market	
Access to finance	
All of the above	

G7. What is your role in the group? (chairperson, etc.)

	Tick
Chairperson	
Treasury	
Secretary	
Member	

Increased smallholder income from Crop and Livestock Value Chains
70% of the agricultural enterprises established have a positive outlook on their profitability and sustainability (FDG for group? (Ask questions to individual enterprise)

G12. Do you consider yourself as agricultural entrepreneur? Yes/No

G13. If yes, what type of enterprises you are engaged?

	Tick
commercial mushroom	
commercial dairy	
commercial vegetable production	
commercial poultry	
Fruit/fodder nursery	
Others specify	

Support rural producers that are members of a rural producers' organization

G14. Are you a member of the producer organization? Yes/No

G15. Did you get any support from the project? Yes/No

G16. What type of support did you get from the project?

G17. Which of the following agricultural inputs are readily accessible?

	Tick
Local variety paddy seeds	
Improved variety paddy seeds	
Local variety maize seeds	
Sprinklers	
Sprayers	
Dairy concentrate feed	
Poultry concentrate feed	
Improved cattle	
Pullets (Poultry birds)	
Manure	
Fertilizer	
Insecticides/pesticides	
Agriculture tools	
Green house	
Power tiller	
Improved packaging materials	
Paddy transplanter	
Paddy harvester	
Paddy thresher	
Maize sheller	
Improved milk churner	
Access to credits	
Post harvest/agro processing units	
Milk processing units	
Collection and storage centers	
Marketing sheds for products	
Linked to schools for vegetable sale	
Marketing to traders across border	
Chuff cutter	
Farmers training	
Post harvest equipment	
Others to specify	

Persons trained in production practices and/or technologies

H1. Did you or your family member involve in any training activities conducted by CARLEP? Yes/No

H2. In which of the following activities were you (or any member of your household) involved?

Trainings	Tick
Vegetable Production (inputs and equipment)	
Dairy Development (inputs and equipment)	
Irrigation management	
New Vegetable Production techniques	
Post-harvest Technologies	
Greenhouse and Poly-tunnels	
Drip Irrigation	
Sprinkle Irrigation	
Composting (Heap compost or vermicomposting)	
Solar Dryer	
Milk Processing and Packaging	
Fodder conservation technology	
Clean Milk production	
Bio-gas maintenance and construction	
Improved fodder grass plantation	
Winter Fodder cultivation	
Improved Cattle shed	

Strengthened Agricultural Institutions and Policies for Improved and Resilient Agricultural and Marketing Practices

H3. Are you able to access market information through smart phones? Yes/No
H4. Are you using those market information in investment decision-making? Yes/No
H5. How would you rate your satisfaction on the market information, fair distribution of incentives, cost and other aspects? Highly satisfied/moderately satisfied/not satisfied
H6. What are the top market places for vegetables?

Markets	Tick
Schools and institutions	
Middle man or regular contract buyer	
Local Market within short vicinity	
Thromde Market within the region	
Local Farm Shops (FCBL)	
Export to India	
None	
Out of the Region	

H7. What are the top market places for dairy products?

Markets	Tick
Schools and institutions	

Middle man or regular contract buyer	
Local Market within short vicinity	
Thromde Market within the region	
KIL diary plant (Chenary)	
Local Farm Shops (FCBL)	
Export to India	
None	
Out of the Region	

H8. Do you or your group have a trader or a person who usually buys in bulk to be sold somewhere? (Yes/No)

H9. Has this arrangement improved your access to market? (Yes/No).

H10. Do you have bio gas plant? (Yes/No)

H11. In a day, for how many hours do you use bio gas for cooking?

	Tick
Less than or equal to 30 Minutes	
30 minutes to 1 hour	
1 hour to 2 hours	
2 hours to 3 hours	
3 hours to 4 hours	
4 hours to 5 hours	
5 hours to 6 hours	
more than 6 hours	
Non-functional	

H12. What were the source of energy for cooking before biogas installation?

	Tick
Firewood	
LPG Gas	
Kerosene	
Electricity	

H13. Did the use of other source of energy increased or decreased or remained same after the project?

	Tick
Increased	
Decreased	
Remained Same	

H14. Do you face any problems while using biogas? Yes/No.

H15. If yes, what are the problems?

	Tick

Lack of skilled operator	
Poor equipment design	
Insufficient dung input	
Labour intensive	
Gas leakage	
Stove problem	
Minimum gas production	
Far from kitchen	

Households reporting a significant reduction in the time spent for collecting water or fuel

H16. Did the use of biogas reduce use of other sources of fuel? Yes/No

H17. If yes, please select from the following:

	Tick
Fire wood	
LPG	
Kerosene	
Electricity	

H18. Did you use any of the following drudgery reduction equipment?

	Tick
Chuff cutter	
Biogas	
Smart irrigation/efficient irrigation	
All of the above	

H19. If yes, what is the reduction of time spent for collecting water/fuel/fodder?

	Tick
0-1	
1-2	
2-3	
More than 4	

H20. Are you able to access weather information from any of the sources? Yes/No

H21. If yes, which of the following services do you use?

	Tick
BBS TV	
Radio	
Wechat	
Telegram	
Whattsapp	

Facebook	
Peers	
Agriculture extension center	

H22. How beneficial is the green house?

	Tick
Enhanced production	
Production throughout the year	
Cultivation of various products	
Easy farming	
Convenient	

H23. How did the dry land irrigation benefit you?

	Tick
Enhanced production	
Utilization of barren land	
Cultivation of various crops/vegetables	
Self sufficiency	

H24. How did the wet land irrigation benefit you?

	Tick
Enhanced production	
Enhanced land utilization	
Cultivation of various crops/vegetables	
Self sufficiency	

H25. How did the land development benefit you?

	Tick
Enhanced production	
Enhanced land utilization	
Cultivation of various crops/vegetables	
Self sufficiency	

H26. Which of the following facilities do you use?

	Tick
Milk processing center	
Milk collection center	
Milk collection shed	
Irrigation channel	
Dry land irrigation	
Collection store	

12.6 Checklist for Key Informant Interviews and Focus Group Discussion

Objectives:
The main objectives of the group discussion and key informant interviews are:

- Discuss the impacts of the project implementation activities through seeking their views and perceptions.
- To identify social impacts and issues
- To unfold the current status of the beneficiaries and have a comparative data before and after the project intervention
- To collect the gender segregated data especially on the impact of program on gender equality
- To find out the participation of the rural households in project activities and their rate of adoption.
- To see the satisfaction level of the project beneficiaries

Focused Group Discussion (FGD)

1. To conduct FGD with a dairy group or cooperative comprising of group executive and few members (desirable to have more participants in a group). Ask the following open-ended questions:

- Name of the group and number of members and year of group formation
- Group savings
- Business diversification
- How much milk was collected initially when group was formed and what is the current collection volume
- Members interest in herd size expansion
- Support received from the project and its benefit in terms of production enhancement and income generation
- Sustainability of the group
- Marketing of the milk and dairy products
- Youth and women participation
- Opportunities in dairy farming
- Challenges in dairy farming
- Future outlook of a group
- Impact of climate change on dairy farming
- Ownership and management of dairy value chain infrastructures
- What effect, if any, do you feel the project had on the community in which you live? Please describe
- What project interventions do you think are the most useful to you as a small holder farmer?
- Suggestions and recommendations (future efforts)
- Lessons learnt

2. To conduct FGD with a vegetable group comprising of group executive and few members. Ask the following open-ended questions:

- Name of the group and members in a group, year of group formation
- Group savings
- Business diversification
- Type of vegetables grown
- Group members interest in expansion of vegetable farm
- Support received from the project and its benefit in terms of production enhancement and income generation
- Sustainability of the group
- Marketing of the vegetables
- Youth and women participation (Women leadership)
- Opportunities in vegetable farming
- Challenges in vegetable farming
- Future outlook of a group
- Impact of climate change on vegetable farming
- Suggestions and recommendations
- Lessons learnt

3. Women group (Vegetable or any other women groups)

- Type of group
- Establishment year
- Name of the group
- Literacy of the group executive and members
- Group savings
- Support received from the project
- Sustainability of the group
- Marketing of the produce or product
- Membership expansion
- Issues and challenges
- Suggestions and recommendations
- Lessons learnt

Key Informants Interview

1. Interview at least one agricultural entrepreneur (Livestock/Agriculture) from the randomly selected gewogs and ask the following questions:

- How is it being an agricultural entrepreneur?
- How long have you been into this business?
- Are you making a living from your enterprise better than earlier times?
- Do you think that your enterprise is profitable and sustainable?
- Support received from CARLEP
- Opportunities and challenges
- Recommendations/suggestions
- Lessons learnt

2. Interview at least one local government leader (Gup/Mangmi/Gewog ADM/Tshogpa) and ask the following open-ended questions:

- Human wild-life conflict
- Views on vegetable production and marketing in the gewog
- Views on dairy production and marketing in the gewog
- Land development practices and its impact
- Pest and diseases
- Involvement of Local Government in Project planning and implementation
- Village decision making by poorer households and women-headed households
- Climate change
- Extension service delivery
- Farmers training and its impact
- CARLEP interventions, lessons learnt and success

3. Interview at least one or two aggregators or traders or middle men (both livestock and Agriculture) from the gewog and ask the following open-ended questions:

- Name of the trader/aggregator
- No. of years into the business
- Type of products aggregated and traded
- Quantity aggregated or traded
- Is it a profitable business?
- Profit margin per kg or per MT
- Support received from CARLEP or any other projects
- Opportunities, issues and challenges
- Lessons learnt

4. Interview with Koufuko International Ltd. and ask the following questions:

- Current volume of milk collection and processing
- No. of groups supplying milk to the plant
- Marketing of the products
- Milk collection trends
- Profitability of the plant
- Future expansion plan
- Corporate social responsibility
- Profit plough back mechanism
- Issues and challenges
- Support provided by CARLEP

5. Interview with milk transporters

- Name of the transporter
- How long have you been transporting milk?
- From how many farmer groups do you collect milk
- Monthly income

- Maintenance and fuelling of cars
- Income from transporting business
- Support provided by CARLEP
- Issues and challenges
- Suggestions and recommendations

6. KII with DLO and DAO and RNR Research Centres

- What type of support did you receive, please explain.
- What can you say about the dairy and vegetable value chain improvement? How it has benefited in terms of income generation and the market development? Please explain.
- What can you say about the access to market facilities and infrastructure development?
- What are the problems and challenges faced during the implementation of the project? What are the lessons learnt during the project implementation process?
- Are there adequate facilities to sell and market the products? What are the problems and issues?
- What can you say about the nutritional enhancement with the project interventions? Does people have adequate knowledge about the nutritional aspects?
- What are the environmentally sustainable, climate change and technology practices in vegetable farming and livestock? Can you elaborate on this?
- What is your view on group formation and improvements over the years due to project interventions?
- How successful are the rural enterprises in enhancing the rural livelihoods, marketing and income generation activities?
- Did you get any opportunity to attend trainings or workshops conducted by the project? If so, what type of trainings did you attend? Are the trainings useful and in what way?
- What do you think about women participation in the agriculture and livestock activities? Is there gender equality in terms of farming activities as well as decision making? Are they willing to take those activities equally as men? If not why?
- What are the opportunities created by the project in terms of production, processing and marketing? How it has increased production and income generation?
- Is there readily available farming tools and seeds in the local farm shops? If not why?
- Do you think that there is increased in adoption of livestock production or agriculture technologies over the years? In what way?
- What are the factors that allowed increase in production of milk or the agriculture production over the years?
- Which of the project strategies and interventions would you consider to be key success factors? Please explain.
- How project has enabled in enhancing engineering norms for building climate resilient irrigation systems?
- How vegetable and dairy development policies are enhanced through the project? What are the regulatory frameworks being developed through the project for private sector development in agriculture sector?
- Do you have any other suggestions or comments about the project interventions as well as for future improvement of the project?