GROW BHUTAN:
RNR STRATEGY 2030

A COMMITMENT TO
TRANSFORMATION, IMPACT & ABUNDANCE

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Acronyms:

AAC:	Annual Allowable Cut
ARDC:	Agriculture Research & Development Center
B2B:	Business to Business
BAFRA:	Bhutan Agriculture & Food Regulatory Authority
BLDC:	Bhutan Livestock Development Corporation
cft:	cubic foot
CSO:	Civil Society Organization
DAMC:	Department of Marketing & Cooperatives
DHI:	Druk Holdings & Investment Limited
DoA:	Department of Agriculture
DoFPS:	Department of Forests and Park Services
DoL:	Department of Livestock
FMCL:	Farm Machinery Corporation Limited
FMU/s:	Forest Management Unit/s
GDP:	Gross Domestic Product
GNH:	Gross National Happiness
GVA:	Gross Value Added
HWC:	Human-Wildlife Conflict
IoT:	Internet of Things
LDC:	Least Developed Country
LMIC:	Lower Middle Income Country
MoAF:	Ministry of Agriculture and Forests
MoE:	Ministry of Education
MoEA:	Ministry of Economic Affairs
NBC:	National Biodiversity Center
NCGS:	National Credit Guarantee Scheme
NRDCL:	Natural Resources Development Corporation Limited
NSB:	National Statistical Bureau, RGoB
OGOP:	One Gewog, One Product
PA/s:	Protected Area/s
PHA:	Potential Harvest Area
PPP:	Public-Private Partnership
RGoB:	Royal Government of Bhutan
RLDC:	Regional Livestock Development Center
RUB:	Royal University of Bhutan
SDG:	Sustainable Development Goals
TCB:	Tourism Council of Bhutan
TVET:	Technical & Vocational Education & Training
RoI:	Return on Investments

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CHAPTER 1: PREMISE

1.1 THE VALUE PROPOSITION

By 2030, the RNR sector will:

- Guarantee security of **food**, **feed** and **wood**, and ensure the transition of Bhutan from a **deficit** to a **food and resource surplus** nation
- Increase provision of **meaningful, dignified and well renumerated employment**
- Significantly contribute to **Bhutan's economy** through increase in internal commerce, value chain building, ramping up of exports, adoption of technology, and harnessing of big data
- Proactively **mitigate carbon emissions** and continue to ensure the **persistence of nature, biodiversity and ecosystem services**

1.2 PRINCIPLES

The RNR strategy 2030 seeks coherence and alignment with broader national trajectories and intends to renew focus, attention and efforts towards transforming Bhutan's RNR sector. The strategy remains cognizant of Bhutan's income levels, employment and demographic trajectories (Figure 1) and recognizes the critical role which the RNR sector plays within Bhutan's broader socio-economic domain.

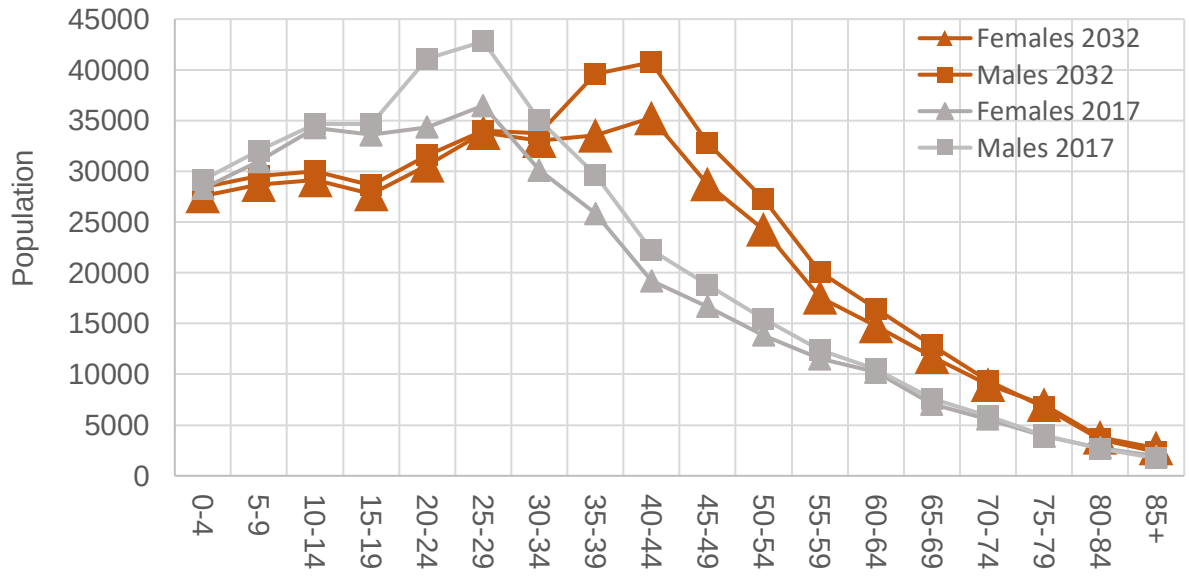


Figure 1. Population of Bhutan by Age and Sex (in 2017, and projection for 2032)[1]

It further notes the opportunities provided by increasing physical and digital connectivity and access to clean and reliable energy and rapidly evolving technology.

[1] Data from the National Statistical Bureau (NSB) of Bhutan (www.nsb.gov.bt)

Attention is also paid to the need for realigning policies and addressing trade-related bottlenecks to reap exponential dividends from the RNR sector. At its core, the RNR Strategy 2030, is a commitment to transformation and impact with clear aspirations to bring about significant benefits to the people of Bhutan in line with the aspirations promulgated in Bhutan's constitution.

The strategy also notes, with grave concern, the urgent need to address the issue of global climate change and human-wildlife conflict. It further recognizes Bhutan's imminent transition from a LDC to a LMIC and calls for the need to step up and accelerate interventions within the RNR sector.

1.3 SUMMARY OF KEY CHALLENGES

Bhutan has witnessed rapid development in recent decades. Per capita GDP has grown almost ten fold, from as low as 330 USD in the 1980s, to 3300 USD as of 2019. These achievements have mostly been realised through investments in hydropower and growth in the tourism sector. Bhutan's population has almost doubled from about 400,000 in the 1980s to almost 770,000 in 2019, and is projected to grow by another 100,000 in the coming decade, to 2032. Given this growth, imports have risen significantly while exports have failed to witness significant growth.

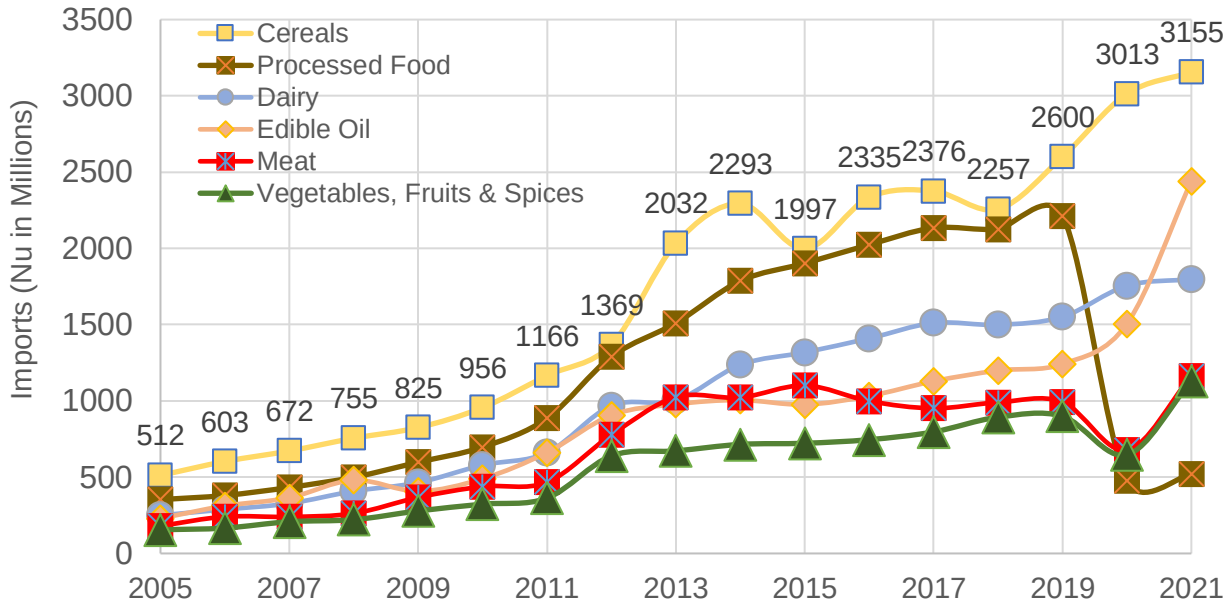


Figure 2. Food import trends for Bhutan (2005 - 2021)

Inherent structural and systemic challenges related to small and scattered land holdings (See Figures 3 and 4), with minimal inputs and low mechanization possibilities, continue to result in high production costs and limited yield. Two-third of landholders own less than an acre of wetland; while close to 33% own less than an acre of dryland.

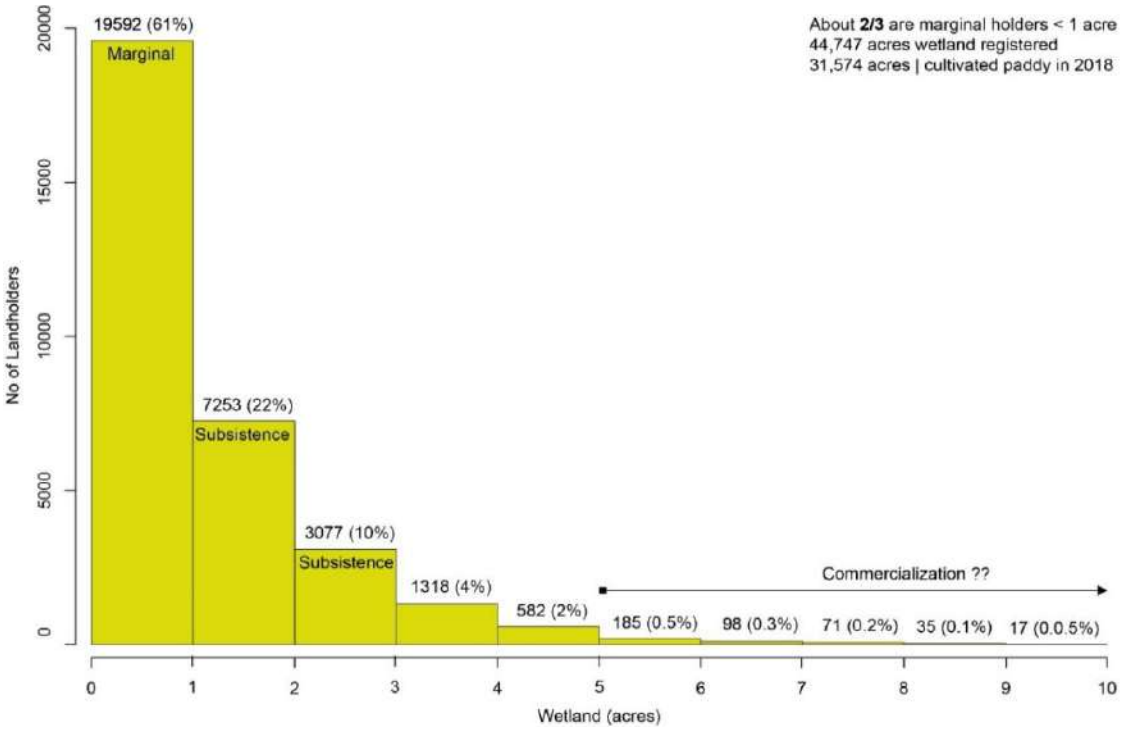


Figure 3. Wetland holdings in Bhutan

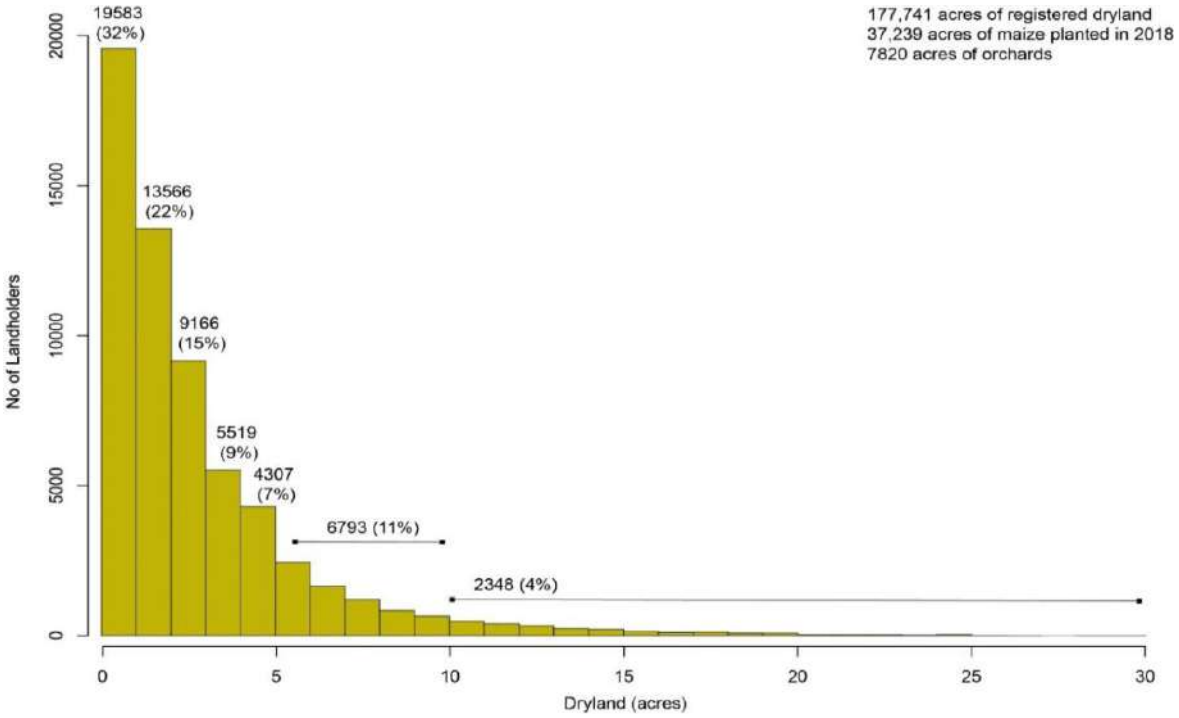


Figure 4. Dryland holdings in Bhutan

Given continued migration, particularly of youth, from rural to urban areas, farm labour is becoming increasingly scarce. This is not helped by the negative image associated with farming.

Less than 20% of arable land is irrigated. And given persistent crop and livestock loss to wildlife, and pests and diseases, almost 30% of arable land is currently left fallow. Farming remains highly vulnerable to the impacts of climate change. Yield for almost all crops and livestock produce remain below regional averages and production for most crops have plateaued over the last two decades. Post-harvest loss remains high and agri-processing infrastructure remains infantile, while markets and standards remain weak. In particular, private sector participation, is low and inconsequential.

Given all this, diets, particularly in remote areas, remain poor. As of 2017, almost 21% of children under five years of age remain stunted, and 5.9% are wasted. There is also continued prevalence of vitamin and iron deficiency. Food related waste remains high and the agri-food systems is responsible for over 15% (552 Gg of CO_2e) of Bhutan's GHG emissions.

1.4 MOTIVATION & OPPORTUNITIES

Goals for self reliance are enshrined in almost every Bhutanese policy document, and are as old as the advent of modern development itself, in Bhutan. Given the challenges of trade, and as demonstrated by the on-going COVID-19 pandemic, there is an urgent need to readjust and focus on goals related to the RNR sector.

Despite considerable constraints, the RNR sector retains significant opportunities for impact and remains consequential for Bhutan. The sector provides direct employment to almost 58% of Bhutanese population and contributes to over 19.23 % of the GDP (as of 2020)[2]. Given Bhutan's varied agro-ecological zones which allow for a wide variety of produce to be grown, opportunities to substantially increase incomes and improve livelihoods of a majority of Bhutanese by transforming the RNR sector is real and imminently possible.

Achievements thus far indicate opportunities for further growth and impact. There has been notable increase in crop yield (Figure 5) and the RNR sector's Gross Value Added (GVA) contribution increased from Nu.10 billion in 2010 to Nu. 33 billion in 2020. Food self-sufficiency measures have jumped to 97.3% in 2017 as compared to 95% in 2012[3].

Recognizing the limitations of employment creation opportunities in other sectors, urgently enabling gainful employment of youth within the agri-food sector will be crucial to ensure Bhutan's near-term and future prosperity.

[2] National Accounts Statistics 2021 published by the National Statistical Bureau (www.nsb.gov.bt)
[3] Bhutan Living Standards Survey (BLSS 2017) published by the National Statistical Bureau (www.nsb.gov.bt)

Bhutan's RNR sector is yet to reap the full dividends of innovation, focus and renewed investments. Considerable scope remains for yield improvements, technology adoption, value chain building, employment generation, and improvement of smallholder livelihoods. Sustained and focussed interventions will positively influence outcomes related to nutrition, incomes, trade balance and self reliance goals. It will also ensure that Bhutan effectively adapts to climate change and remains on track to achieving the SDGs.

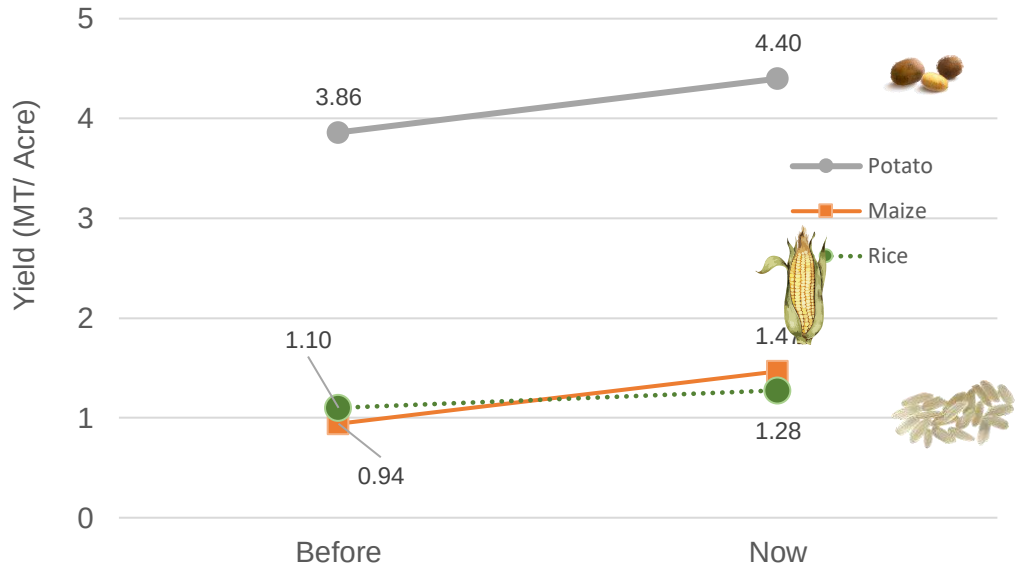


Figure 5. Yield increase for rice, maize and potato over the last 2 decades

CHAPTER 2:
THE STRATEGY | GROW, REVIVE, ACCELERATE, SUPPORT & PROTECT

2.1 STRATEGIC PRIORITY I | GROW FOR DOMESTIC CONSUMPTION

2.1.1 GROW RICE, CEREALS & PRIORITY CROPS

Bhutan continues to consume and import significant quantities of rice (Figure 6 & 7). In addition to rice (Figure 8), Bhutan also imports fruits, vegetables (tomatoes, onions and chillies) (Figure 7), pulses and cooking oil (Figure 8).

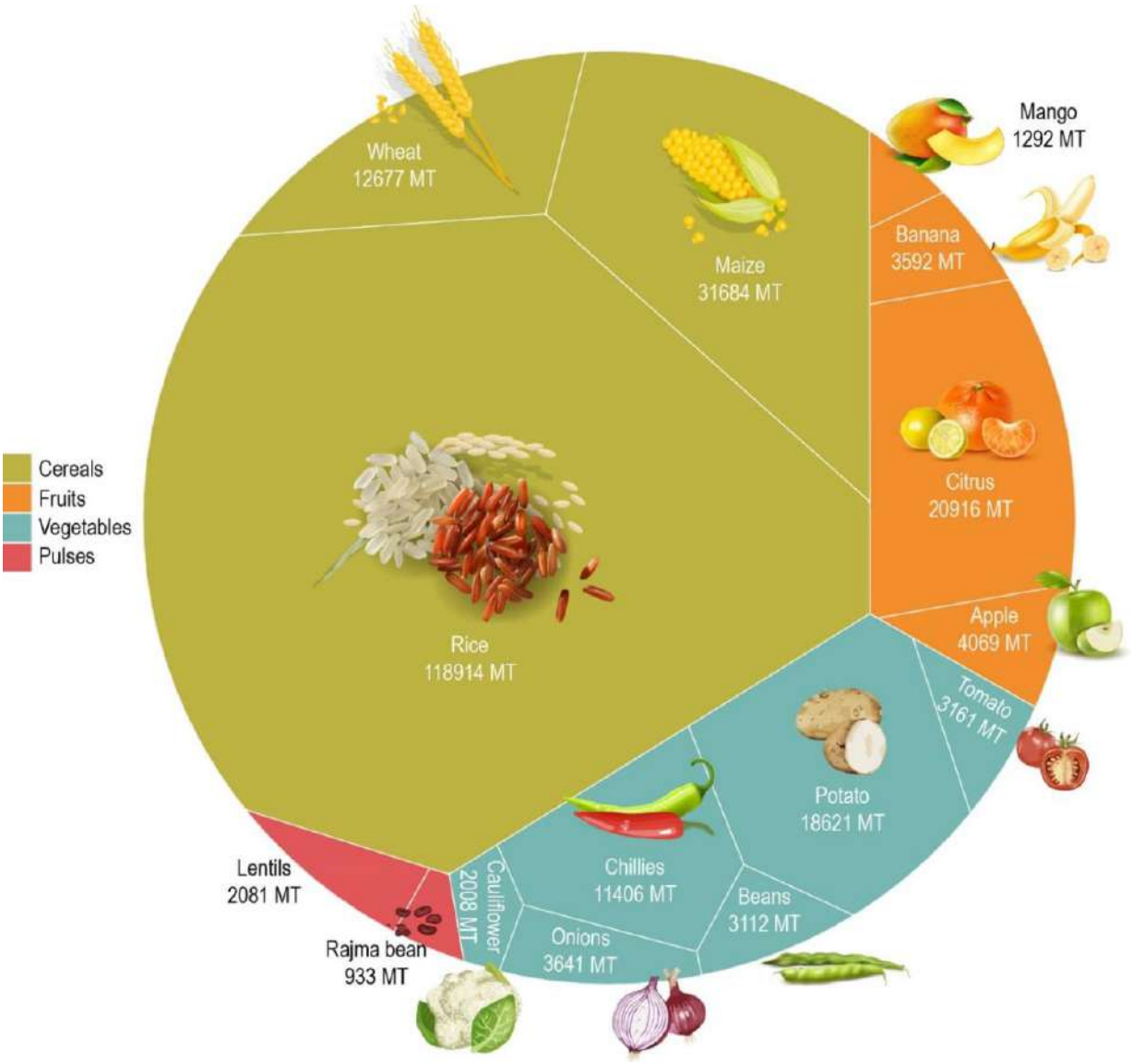


Figure 6. Requirement in MT for prioritized crops for domestic consumption[4]

[4] As per list prioritized by the DoA, MoAF

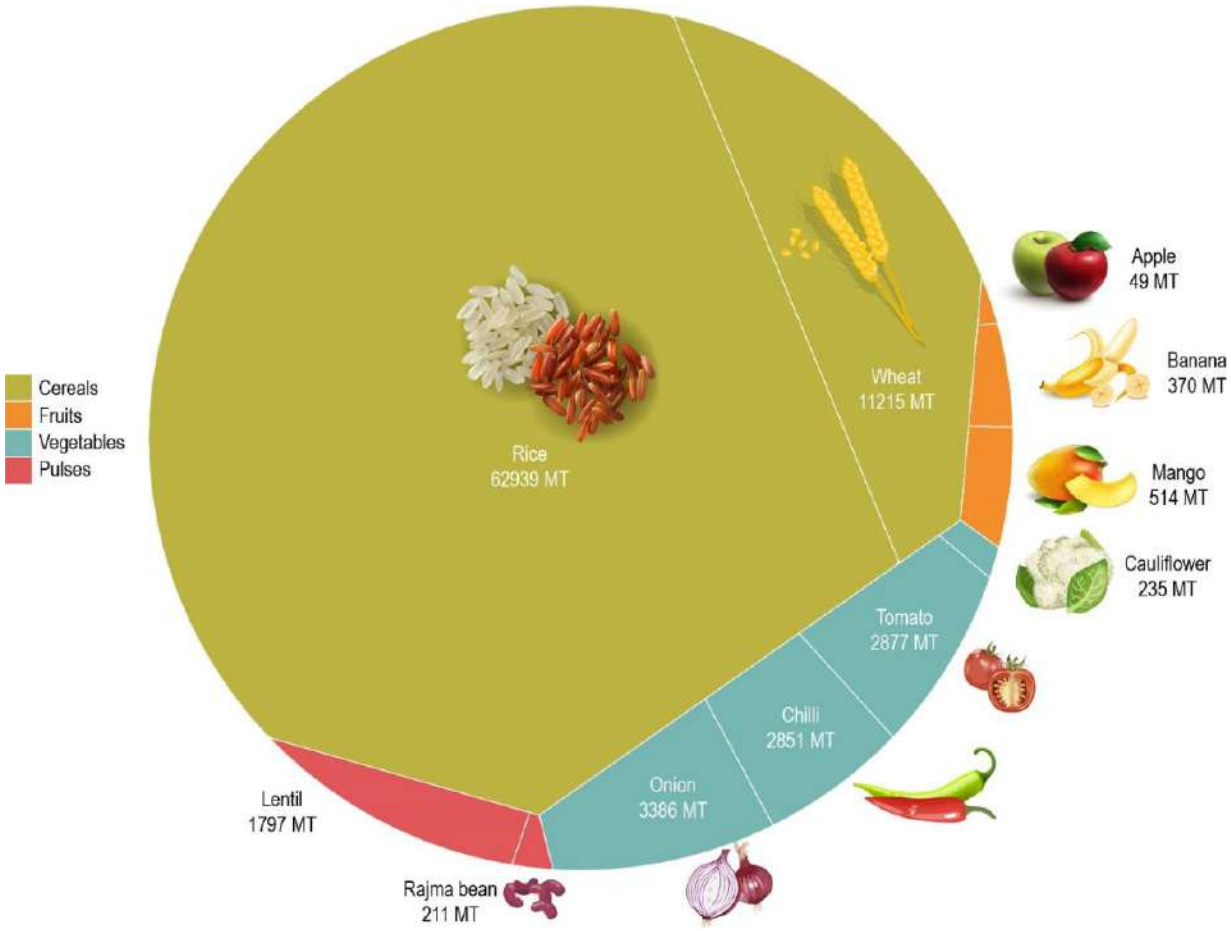


Figure 7. Priority crops imported for domestic consumption in MT

2.1.1.1 Rice:

In 2018, Bhutan produced an estimated 63,405 MT of rice as per census records from an harvested area of about 36670 acres (148 km^2). **Bhutan imports upwards of about 80 MT annually** (Figure 8) as per current import figures.

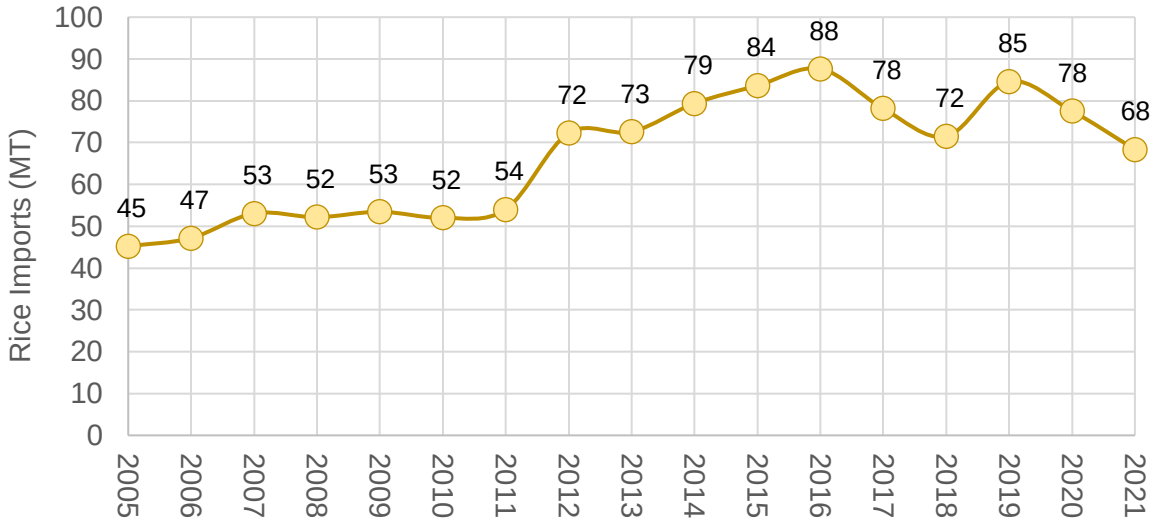
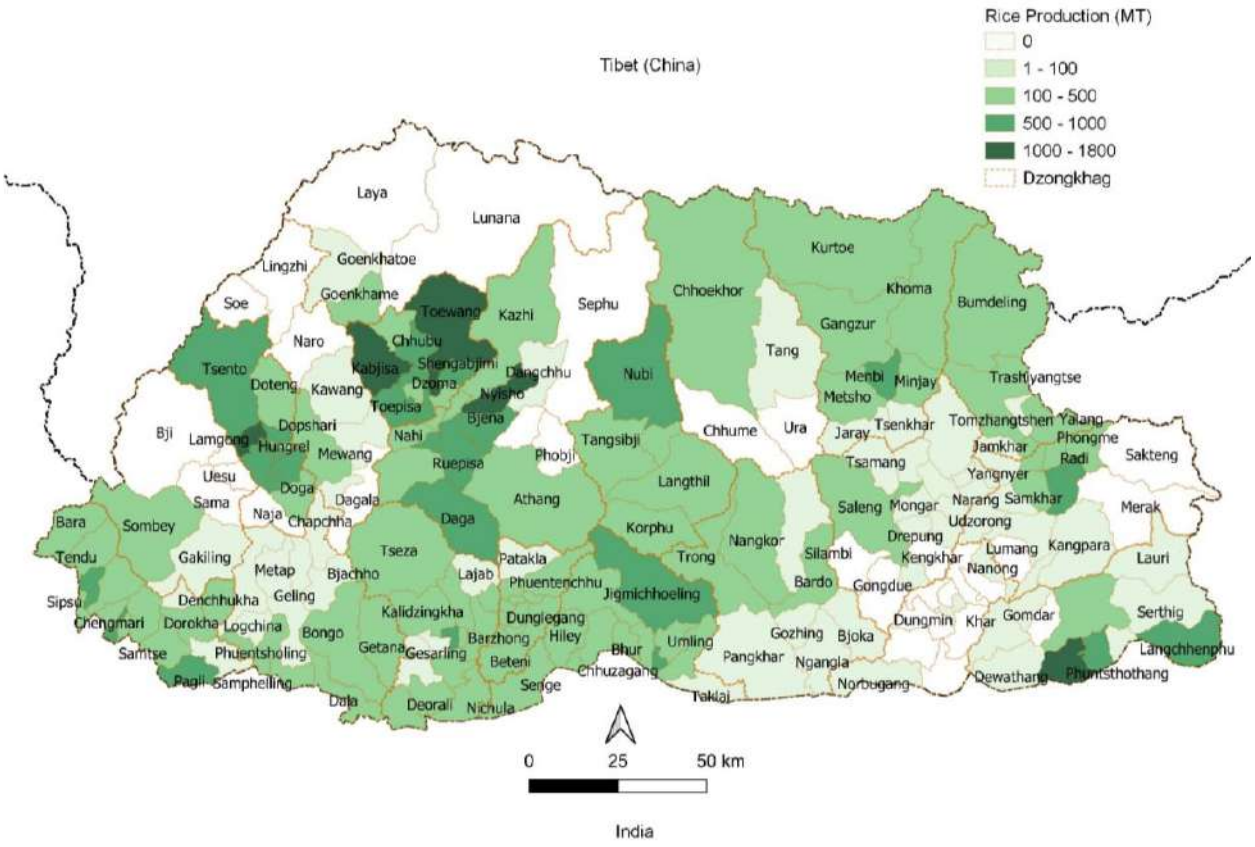


Figure 8. Annual rice imports in MT (2005 - 2021)

Employing double cropping, and considering yield at about 1.5 MT/ acre, Bhutan will need to cultivate an additional 26500 acres (107 km^2; 0.38% of forests) to produce about 80MT of rice annually. Production of 80MT of rice from mega farms will realise annual revenues of up to 4.8 billion Nu (about 65 million USD).

Either the FMCL or a new public-private venture under the garb of *Bhutan Rice Corp* should be established to manage mega rice farms at the most suitable locations across Bhutan on a priority basis. A significant number of youth can be employed to work in these mechanised rice farms and ancillary processing and packaging units.

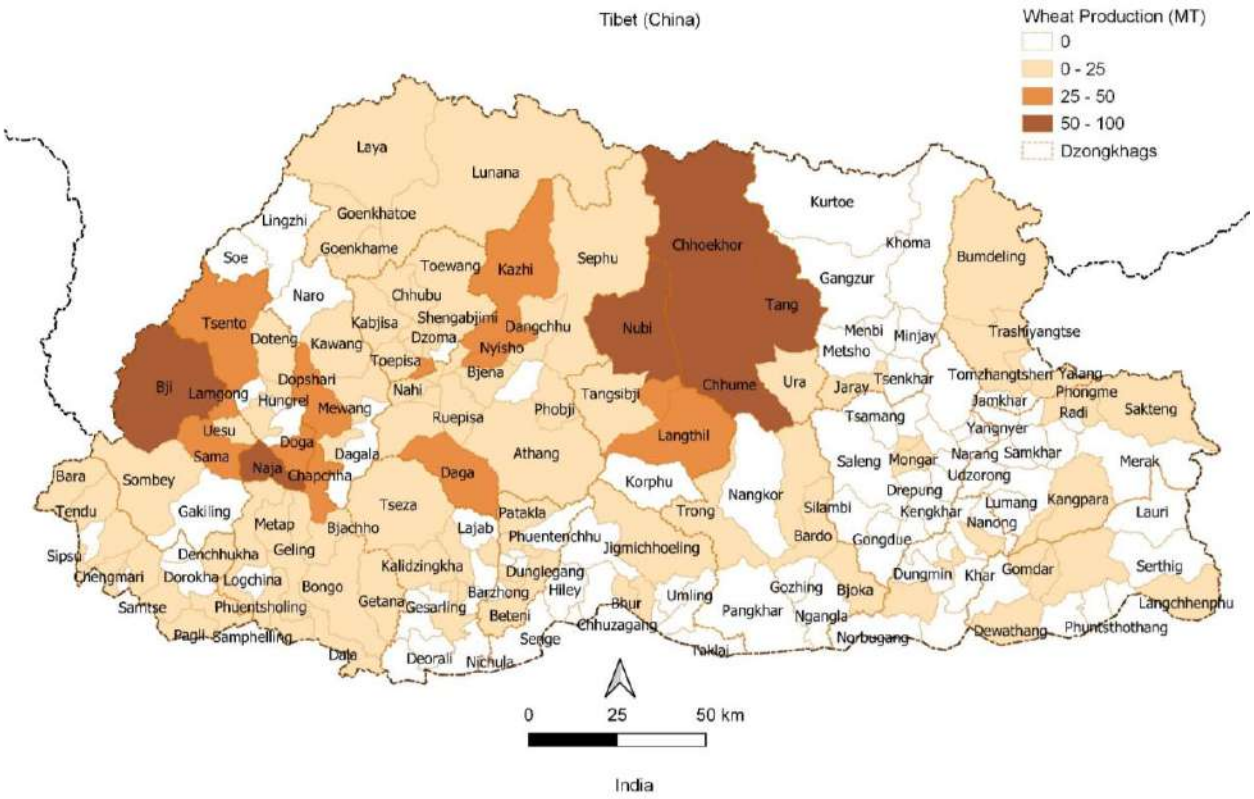
Existing rice production areas (Map 1) should be protected and supported with the provision of high yielding varieties, access to machinery, post harvest technology, and markets.



Map 1. Rice growing regions and rice production (MT) in 2018

2.1.1.2 Wheat:

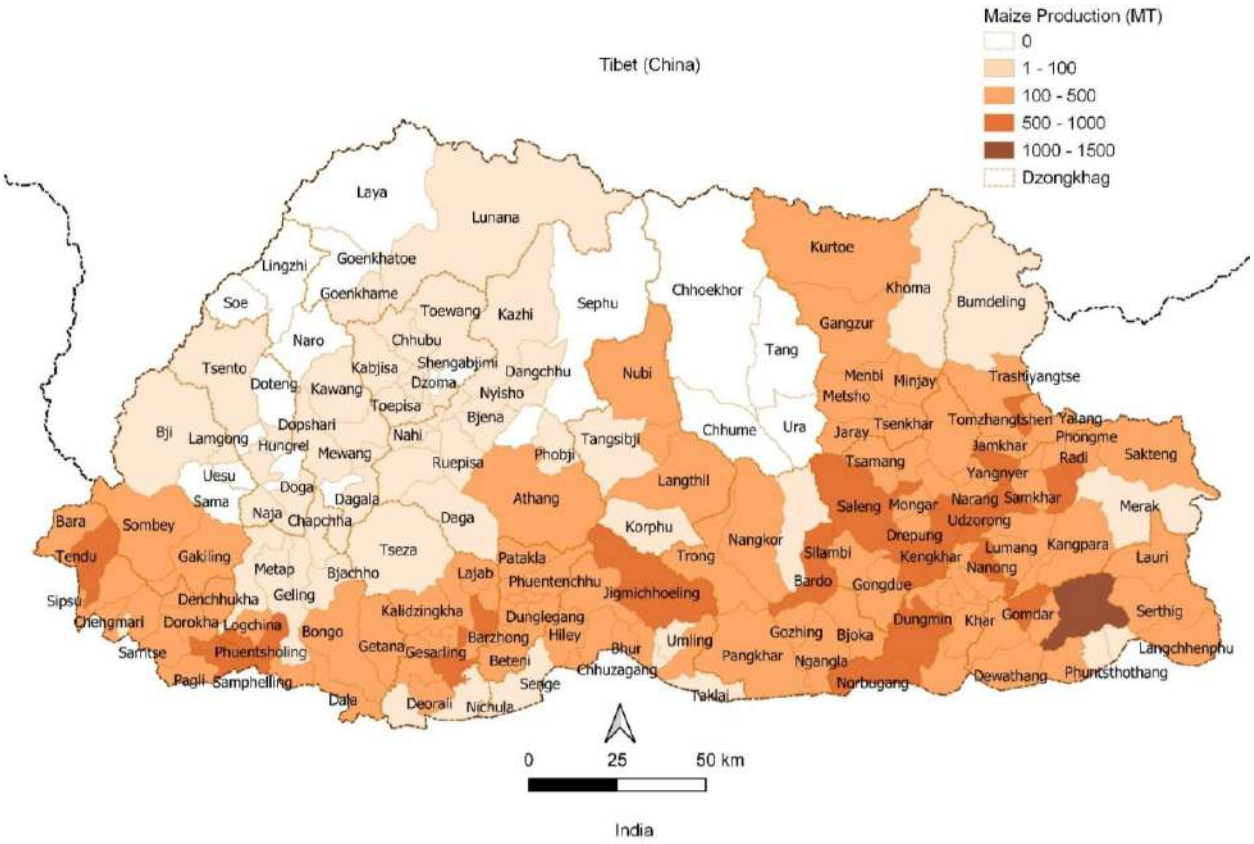
In 2018, Bhutan produced an estimated 1445 MT of wheat, and imported 11,215 MT. **Existing wheat growing farmers (Map 2) should be supported with the provision of high yielding varieties, access to machinery, post harvest technology, and markets**.



Map 2. Wheat growing regions and wheat production (MT) in 2018

2.1.1.3 Maize:

Bhutan produces a surplus of maize, estimated at 55,254 MT in 2018 (Map 3). Given the success with maize, **effort should be continued on promoting high yielding varieties, expansion and improvement of post-processing technology, and encouraging farmers to link up with private companies for manufacturing feed and value added products.**

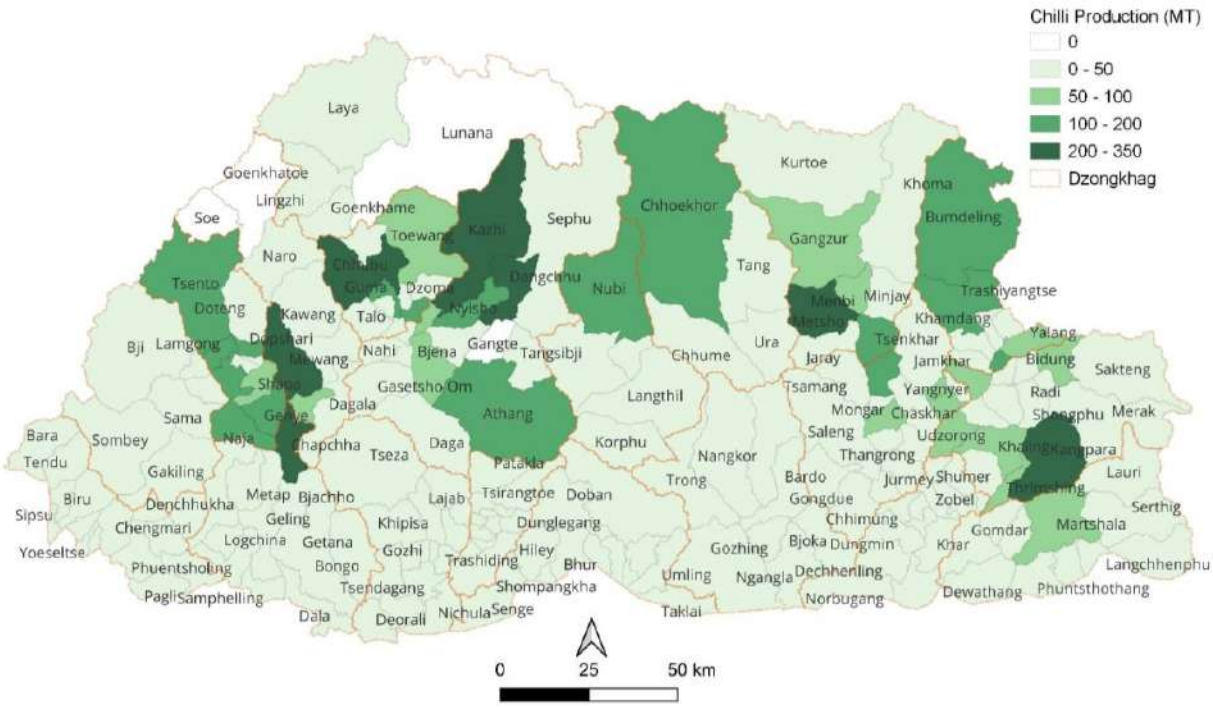


Map 3. Maize growing regions and maize production (MT) in 2018

2.1.1.4 Chillies, Onions & Tomatoes:

Despite increases in production, Bhutan is still short on essential vegetables such as chillies (Map 4), **onions and tomatoes** (Figure 7). Annually, Bhutan needs to produce upwards of 2877MT of tomatoes, 2851MT of chillies, and 3386MT of onions. In addition to production, all these commodities face considerable issues related to seasonality, pricing, storage, and demand-supply matching.

Farmer advisory services should be ramped up to ensure that growing efforts are matched with demand cycles in consumption centres. All three of these commodities are also amenable to being grown in controlled environments using precision technology. **Private entrepreneurs and youth groups in particular should be provided with capital, knowhow and technology to establish state-of-the-art hydroponic megafarms to supplement production of chillies, onions and tomatoes.**



Map 4. Chilli growing regions and chilli production (MT) in 2018

2.1.1.5 Mangoes, Bananas & Apples:

Farmers should be encouraged to grow mangoes and bananas in farmsteads and land currently left fallow. Apples orchards, particularly, around Paro and Thimphu have been neglected. **An orchard revival program aimed at improving existing orchards and creating new ones should be initiated immediately**. Farmers and landowners should be provided advisory services on varieties, orchard care, marketing and storage.

2.1.1.6 Oilseeds:

Bhutan is almost totally reliant on imports to meet cooking oil demand (Figure 9). Farmers should be encouraged to grow oilseeds and private entrepreneurs should be facilitated and encouraged, through provision of tax breaks and soft loans, to establish cooking oil production enterprises.

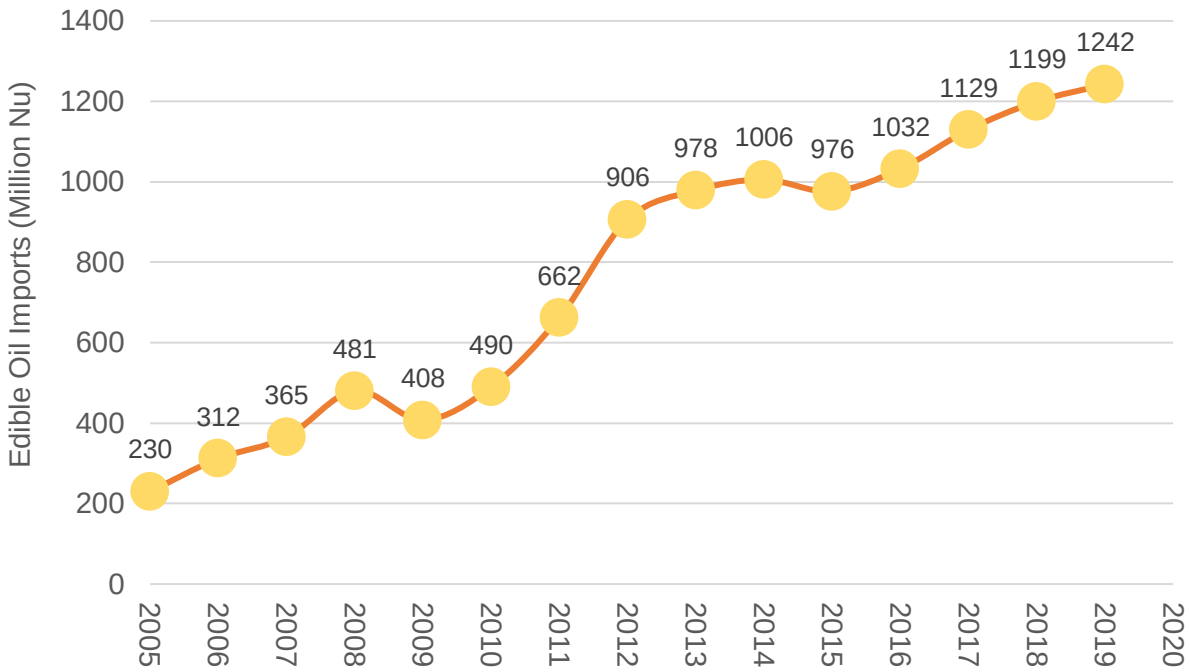


Figure 9. Edible oil imports (2005 – 2019)

2.1.2 GROW & PRODUCE MEAT, EGGS & DIARY

In 2019, Bhutan consumed a total of 11,911 MT of meat[5] (Figure 4). Bhutanese consumed beef the most at 37%, followed by chicken (30%), pork (23%) and fish (7%). Except for chevon (281MT) and chicken (1926MT), imports significantly exceeded domestic production.

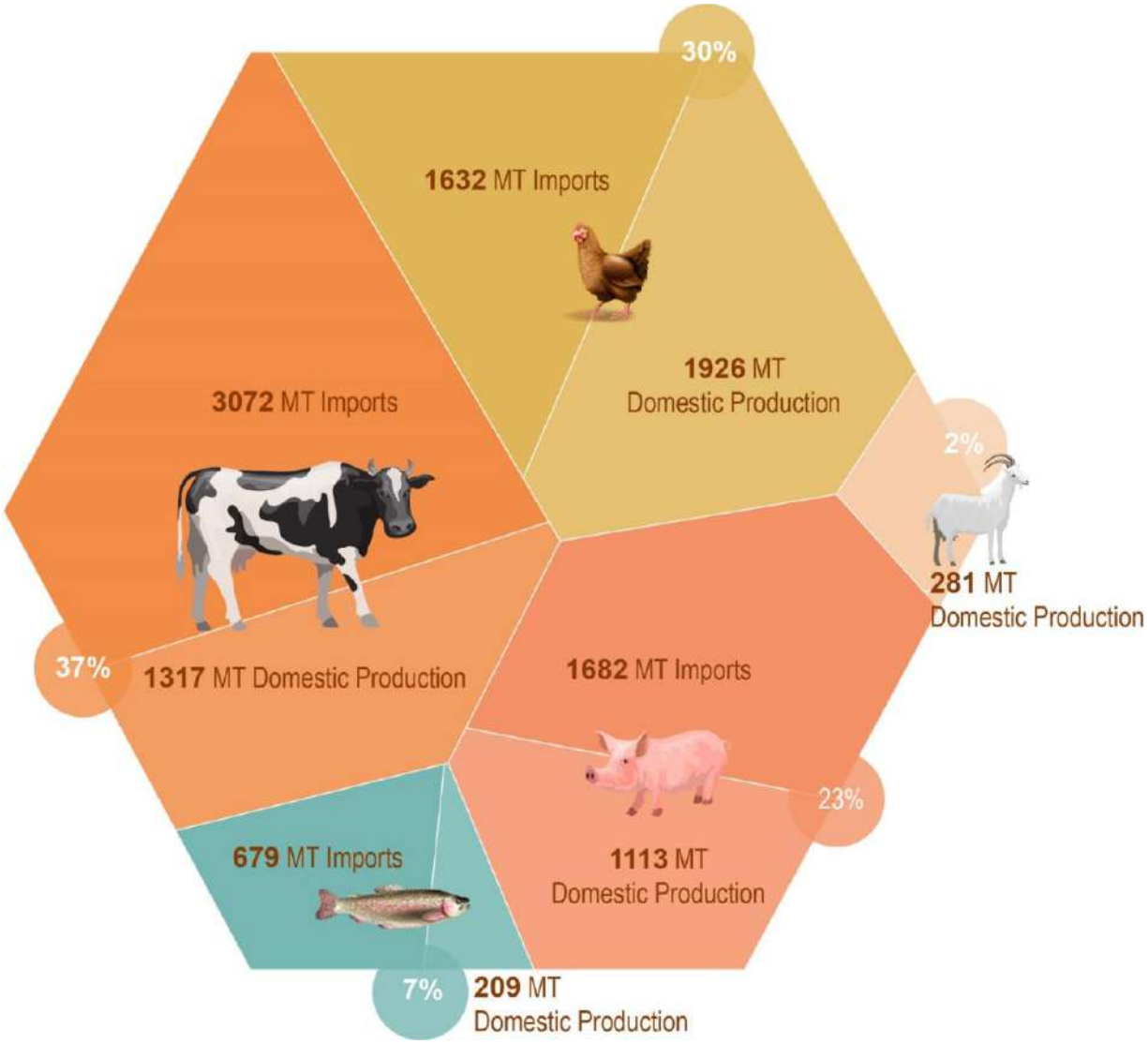


Figure 10. Total meat consumption (MT) in 2020. Percentages are the share of each meat product from total consumption.

2.1.2.1 Produce safe & affordable beef

Plans to improve the extant beef processing facility at Tsirang should be expedited. Furthermore, given the high consumption and preference for beef, establishment of proposed beef rearing and processing facilities at Samtse, Sarpang and Samdrup Jongkhar should be fast-tracked. Private parties

[5] Figures obtained from the DoL, MoAF

should be encouraged to establish these plants, where possible and appropriate, in partnership with reliable and interested Indian counterparts.

Given the Bhutan Livestock Development Corporation's (BLDC) track record and experience of supplying and processing meat, the Angus breeding and production farm at Samrang should be handed over to BLDC. The DoLS should supplement Angus production by expanding breeding farms at Chipchipe, Dovan Gewog, Sarpang (1000 acres) and Khuchitar, Tsirang (1000 acres).

To diversify beef varieties, it may also be worth exploring the possibility to import and breed Wagyu from Japan.

2.1.2.2 Expand pork production capacity

Pork is the third most preferred meat item in Bhutan after beef and chicken. Bhutan consumed a total of 2795MT of pork, of which 1682MT was imported. To offset imports, Bhutan requires over 14000 piglets per year. This requirement if projected to increase to about 21000 by 2030.

Pork production capacity should be expanded by incentivising and engaging private pig breeders. And establishment of pork production facilities should be encouraged and supported.

2.1.2.3 Continue interventions in the poultry sector

Despite notable growth in Bhutan's poultry sector and producing 1926MT chicken in 2019, Bhutan still imported 1632MT of chicken. In the coming decade and beyond, the DoL projects a requirement of up to 3.3 million DOCS annually, which will produce close to 5493MT of chicken.

Current support to farmers and private entrepreneurs should be upscaled and continued. In addition, private business should be supported to establish high-tech state-of-the-art broilers should be explored and rolled out. See Plate 1.

Plate 1. High-tech broiler house in the Netherlands[6]

2.1.2.4 Promote fisheries & fish consumption

Currently, only about 93 acres are under fish farming, and domestic production of fish is a paltry 209MT per year. Bhutan continues to import over 679MT of fish annually.

Plans to scale up both small scale farm-based fisheries as well as large scale commercial fisheries should be expedited. Farmer groups in favourable locations should be supported through the provision of fingerlings, knowhow and market linkages. Private individuals will be encouraged to establish large scale commercial fisheries. Into the coming decade and beyond, the DoL estimates requirements of up to 29 million fingerlings per annum which will produce up to 3972 MT of fish annually.

2.1.2.5 Sustain chevon production

Bhutan consumed 281MT of chevon in 2019. Current initiatives to support goat rearing and chevon production will be sustained and chevon production will be doubled by 2030.

[6] Picture sourced from https://www.nationalgeographic.com/magazine/article/holland-agriculture-sustainable-farming

2.1.2.6 Double egg production

Bhutan has seen remarkable progress in the production of eggs. **Ongoing efforts should be sustained and upscaled, and egg production should be doubled from about 169 million in 2020 (Figure 11) to 300+ million by 2030.** To achieve this, parent stock capacity will need to be increased from 8600 to more than 20000.

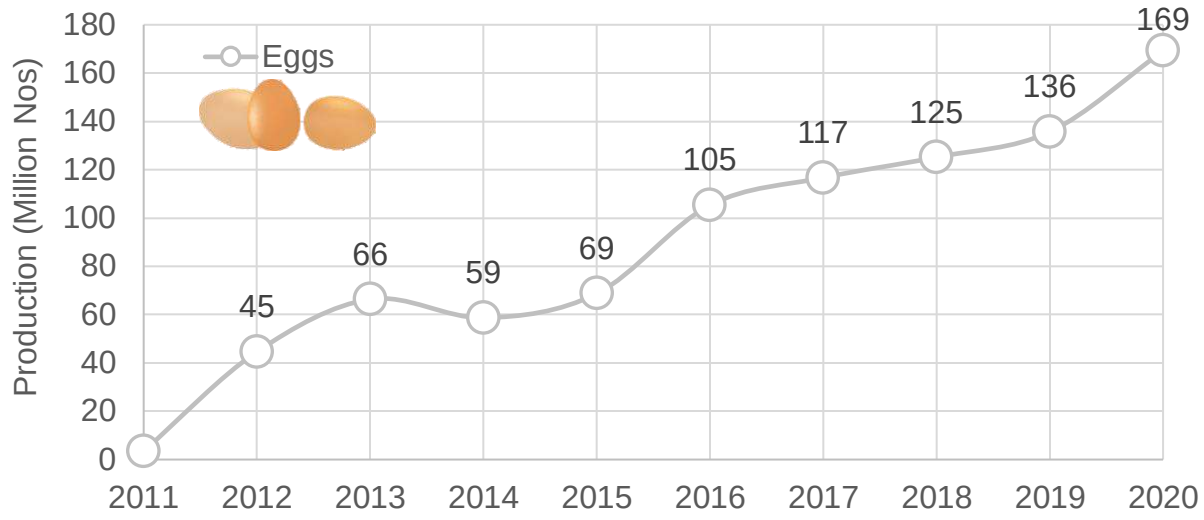


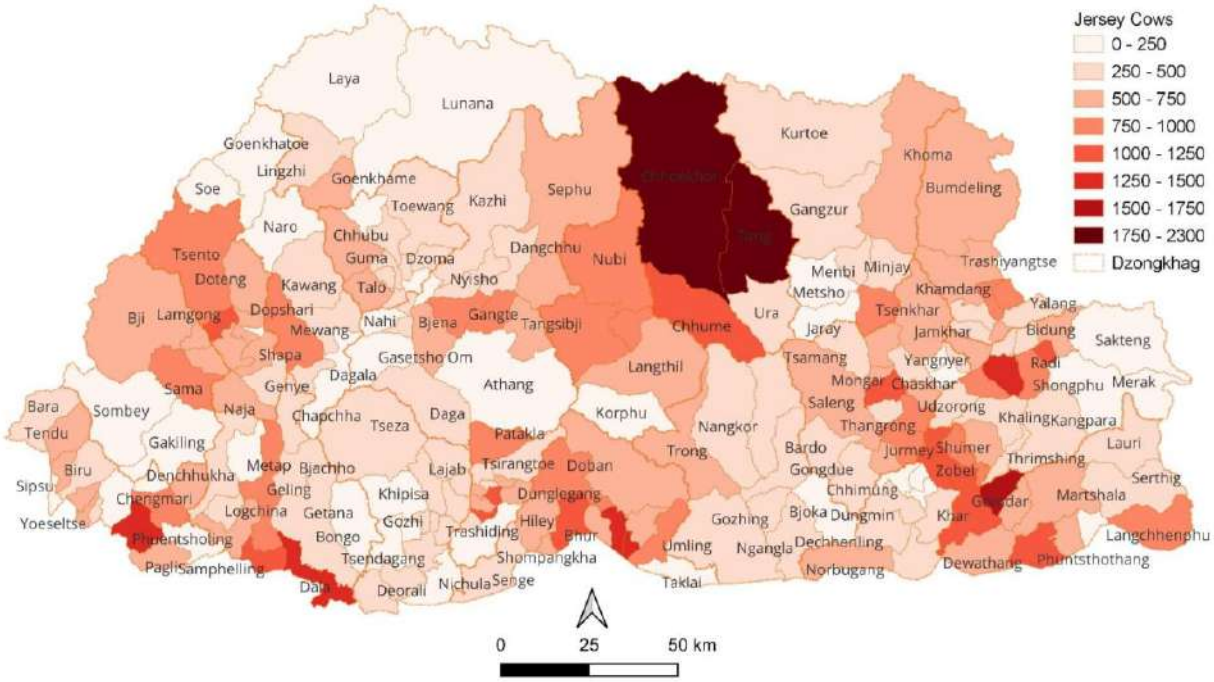
Figure 11. Egg production over the last decade (2011 - 2020)

An "egg a day for every child" should be instituted across all schools in Bhutan. This will require about 30+ million eggs a year.

2.1.2.7 Launch Bhutan's 'operation flood'

Domestic milk production rose from 47,270 MT in 2016 to 58,197 MT in 2020 (Map 5), while cheese and butter production has also witnessed significant surge over the last decade (Figure 12). Diary has been shown to be instrumental in uplifting livelihoods for smallholders in India[7]. By 2030, crossbred cattle number should be increased to 230,000 cows, and 80 additional AI centers should be established to take the total number of AI Centers to 200.

[7] https://amul.com/m/about-us



Map 5. Jersey cattle distribution across Bhutan as of 2018

Cattle rearing should be particularly encouraged for small holder marginal farmers with less than 1 acre land holding. This will supplement small holder incomes and supplement crop based livelihood strategies.

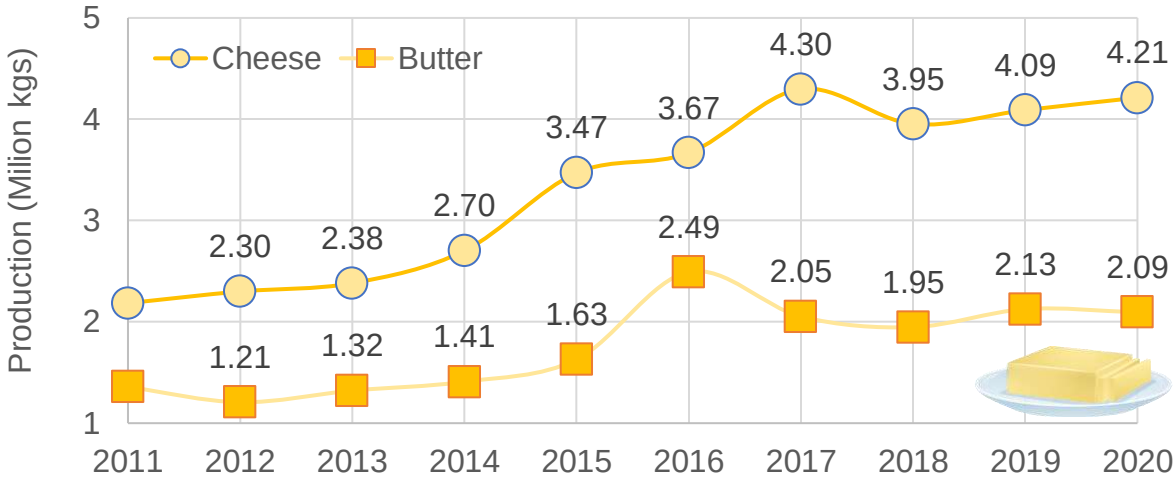


Figure 12. Cheese and butter production over the last decade (2011 – 2020)

Concerted effort should be made to form livestock cooperatives, processing and value addition units. The Kofuku[8] venture under DHI should be replicated across other potential regions across Bhutan. Fresh

[8] https://kil.bt/

milk and products should be particularly targeted at meeting demands at consumption centers, such as Thimphu, Wangdue (Bajo) and Punakha (Khuru), Paro, Phuentsholing and Galeyphug. See Map 14.

2.2 STRATEGIC PRIORITY II | GROW FOR EXPORTS

Cardamom, ginger, potatoes, mandarin, and apple remain Bhutan's key agricultural export commodities. See Figure 13.

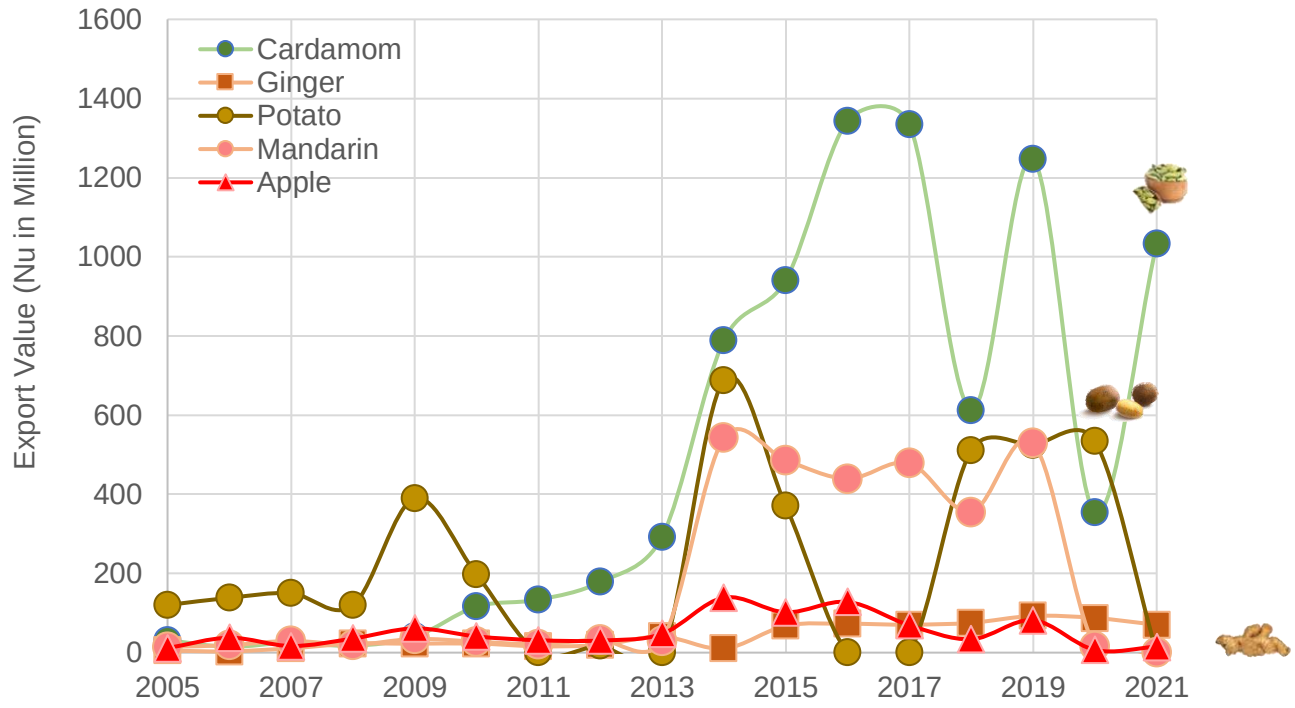
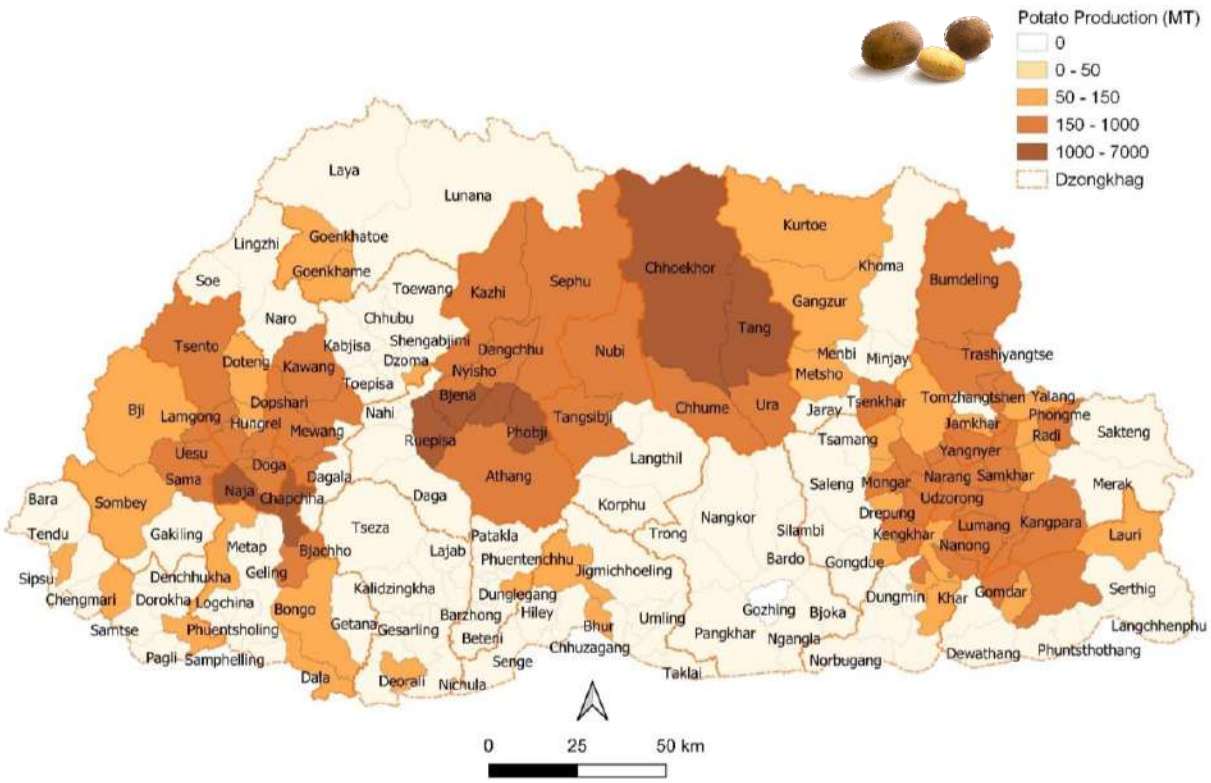


Figure 13. Export value of key agricultural commodities (2005 - 2021)

Ongoing initiatives which underpin and sustain production of these key commodities should be upscaled. Where feasible, possibilities to produce these **crops organically** should be scaled up.

2.2.1 GROW POTATOES

In 2018, Bhutan produced a total of 44,278 MT of potatoes (Map 6) and earned a total of Nu. 524 million in 2019. Potatoes remain an important export commodity for Bhutan.



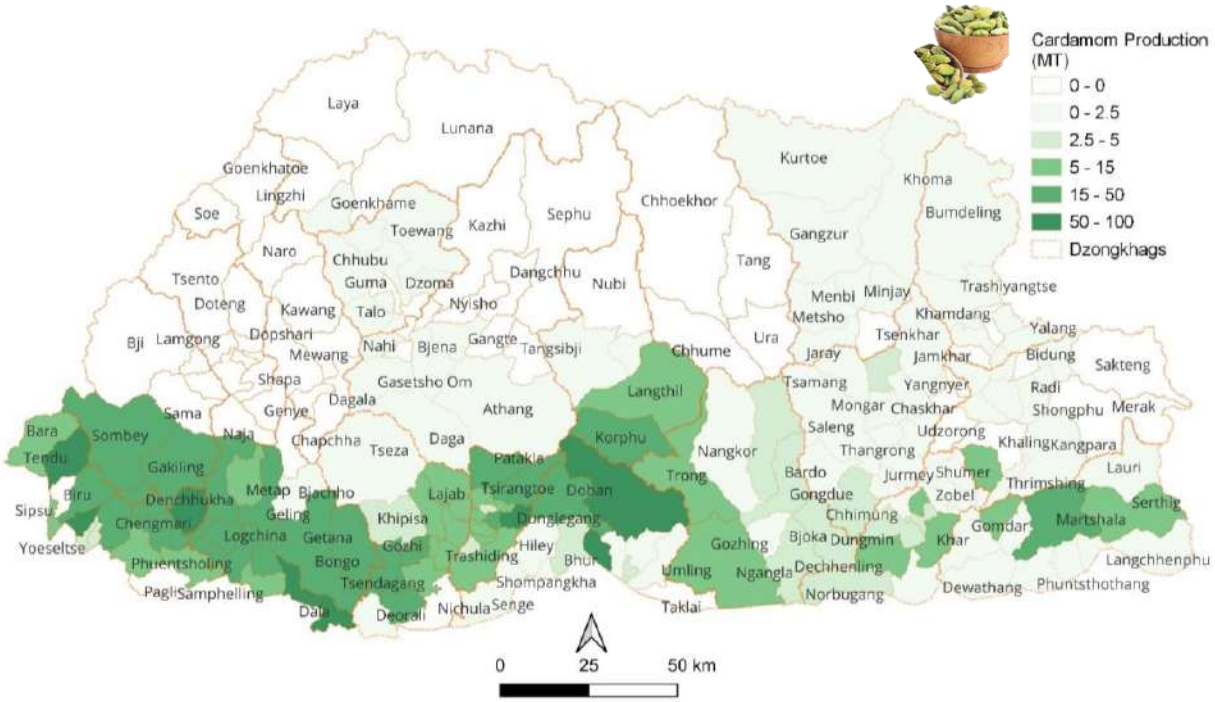
Map 6. Potato growing regions and potato production (MT) in 2018

On-going initiatives to maintain and improve potato yield and production should be sustained. Potato seed banks should be maintained while collaborative initiatives to introduce new high yielding and pest resistant varieties should be trailed and upscaled.

Price support mechanisms and guaranteed buyback schemes should be reworked on a priority basis and linkages with private parties keen to value add on potatoes should be expedited. Where feasible, potato supply into the school feeding program should be worked out.

2.2.2 GROW CARDAMOM

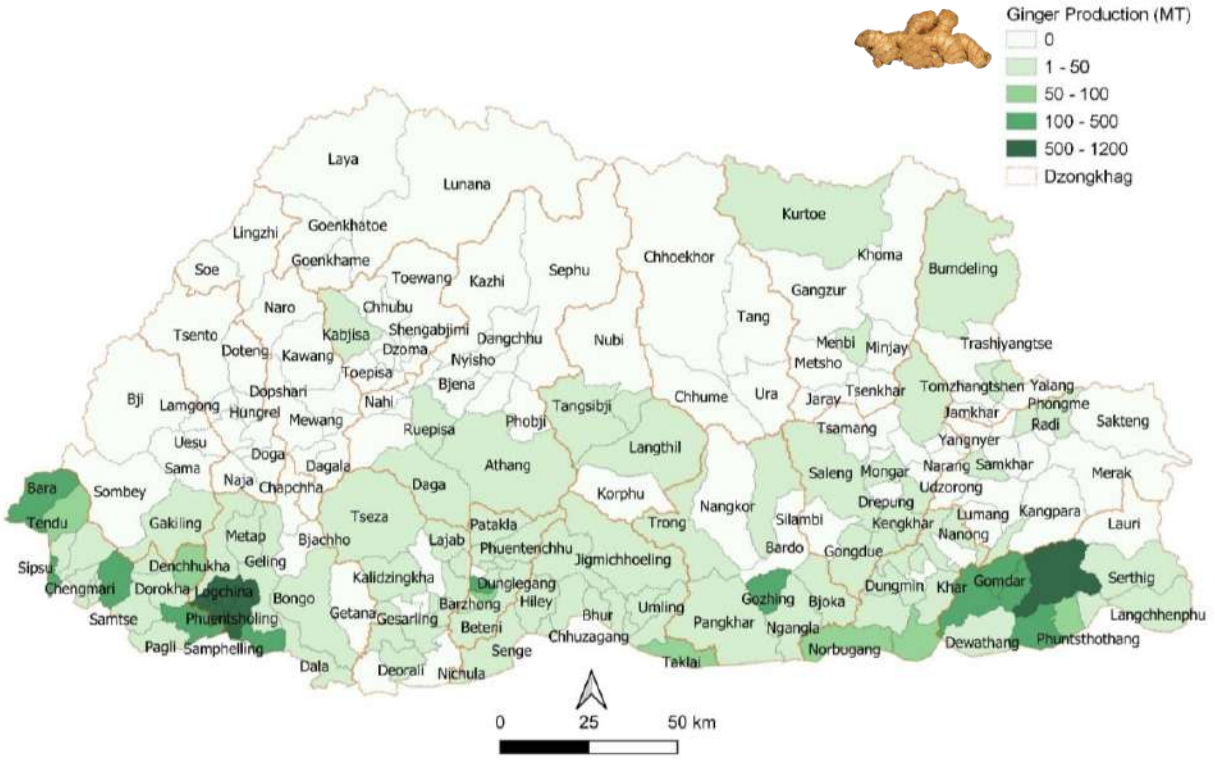
In 2021, cardamom exports exceeded 1 billion Nu in value, benefitting upwards of 23157 growers, and remain one of Bhutan's most important cash crops. Bhutan produced close to 1542MT of cardamom (Map 7) in 2018.



Map 7. Cardamom growing regions and cardamom production (MT) in 2018

Cardamom growers should be supported with access to seedlings, knowhow, drying and storing technology, and easy and timely access to markets.

2.2.3 GROW GINGER



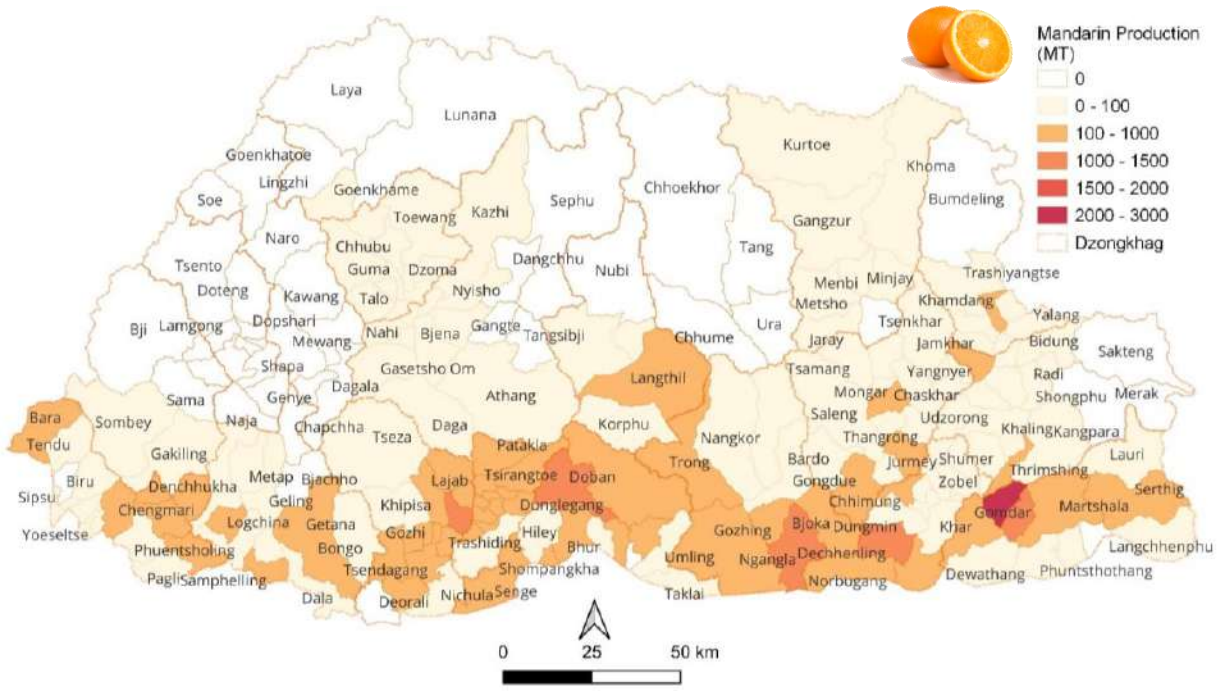
Close to 4260MT of ginger was produced in 2018 earning over 70 million Nu for ginger growers.

Price support mechanisms should be agreed on and linkages with private parties keen to value add on ginger should be expedited.

Markets for 'organically grown' ginger by 'smallholder farmers of Bhutan' should be explored and private entrepreneurs should be encouraged and supported to collate, package and export organic Bhutanese ginger.

2.2.4 REVIVE MANDARIN

Mandarin production (Map 8), despite being an important cash crop for Bhutan, has been falling (Figure 14), due to citrus greening[9].



Map 8. Mandaring growing regions and mandarin production (MT) in 2018

There is an immediate need to support mandarin growers and orchards owners with access to saplings, virus resistant varieties, and advisory services.

[9] Dorji, K., Lakey, L., Chophel, S., Dorji, S. D., & Tamang, B. (2016). Adoption of improved citrus orchard management practices: a micro study from Drujegang growers, Dagana, Bhutan. *Agriculture & Food Security*, *5*(1), 1-8.

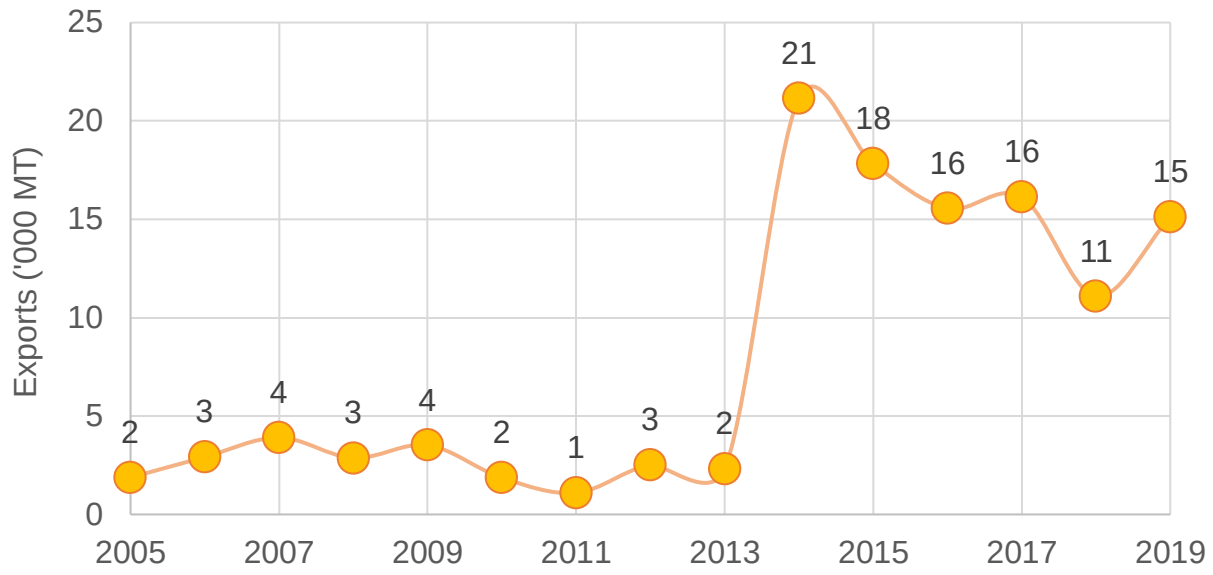


Figure 14. Mandarin exports ('000 MT) from 2005 - 2019

2.2.5 REVIVE APPLE

Similar to mandarin, apple production and exports have also plateaued over the last decade and half (Figure 15).

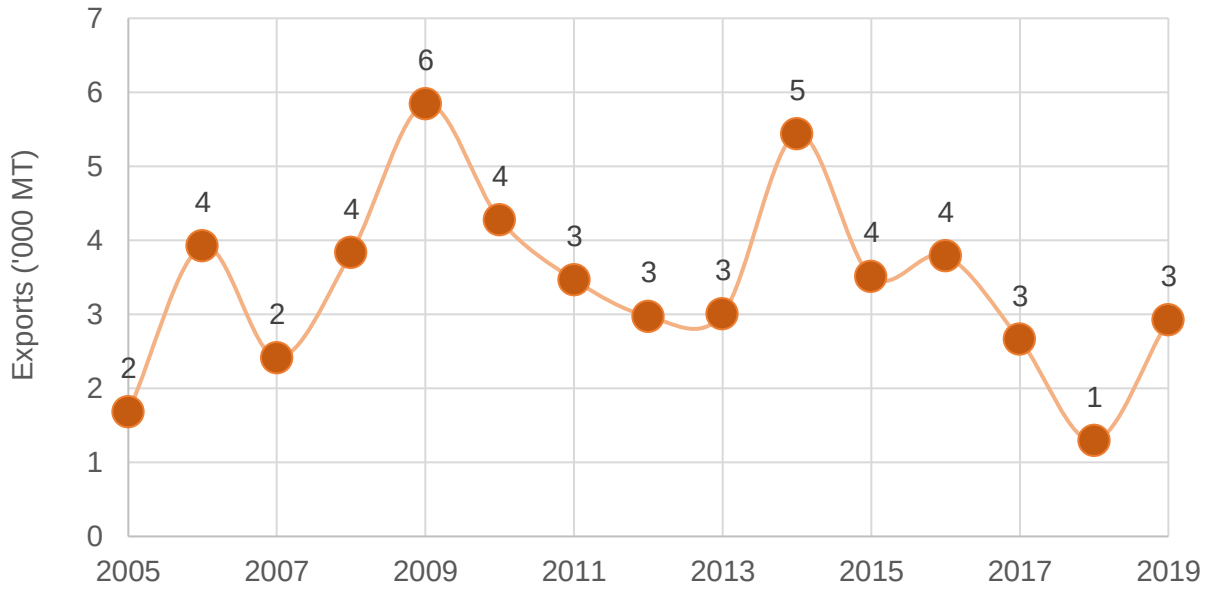
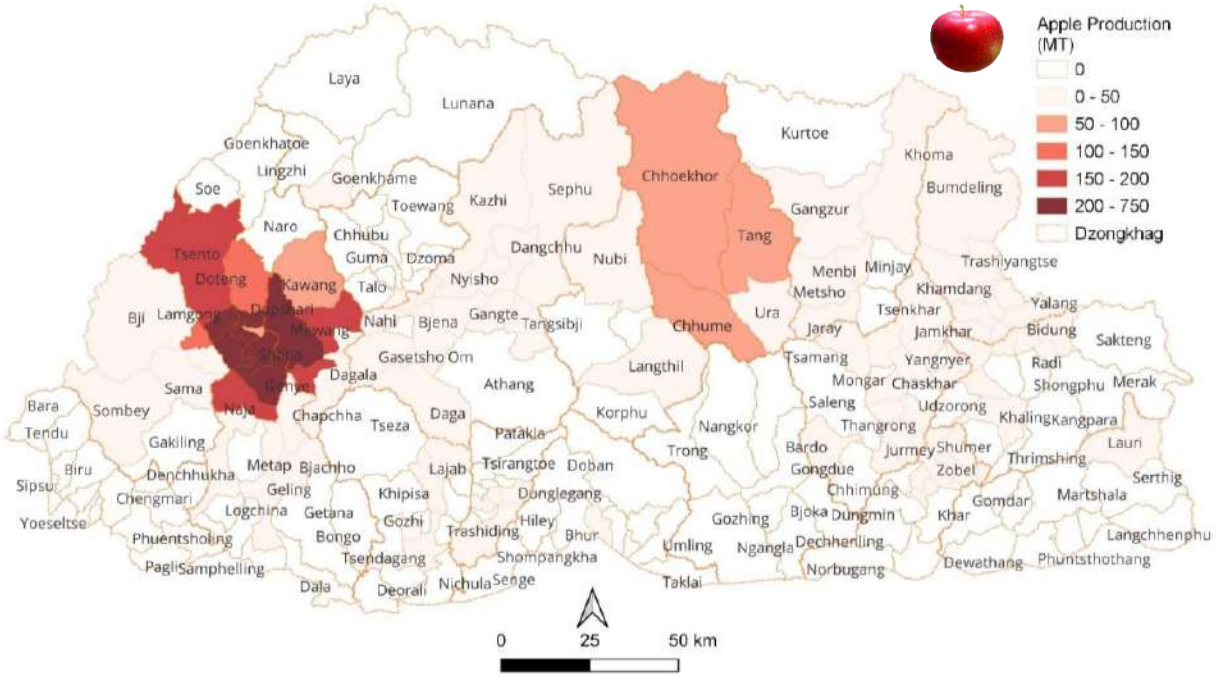


Figure 15. Apple exports ('000 MT) from 2005 - 2019

An orchard revival program should be initiated to protect and revive apple growing regions (Map 9).



Map 9. Apple growing regions and apple production (MT) in 2018

Farmer advisory services should be ramped up on apple varieties, orchard care, and packaging. Access to quality saplings and digital advisory services during planting and harvesting season should be provided.

2.2.7 GROW & PROMOTE ORGANIC FRONTIER CROPS

2.2.7.1 Buckwheat

Bhutan cultivated 4646 acres (Plate 2) and produced a little over 1990MT of buckwheat in 2018 (Map 10). Buckwheat is a frontier crop and holds immense potential to be marketed as a high value organic produce from Bhutan. Furthermore, honey bees, can also be promoted in buckwheat growing regions and maybe labelled as 'Bhutan Buckwheat Honey'.

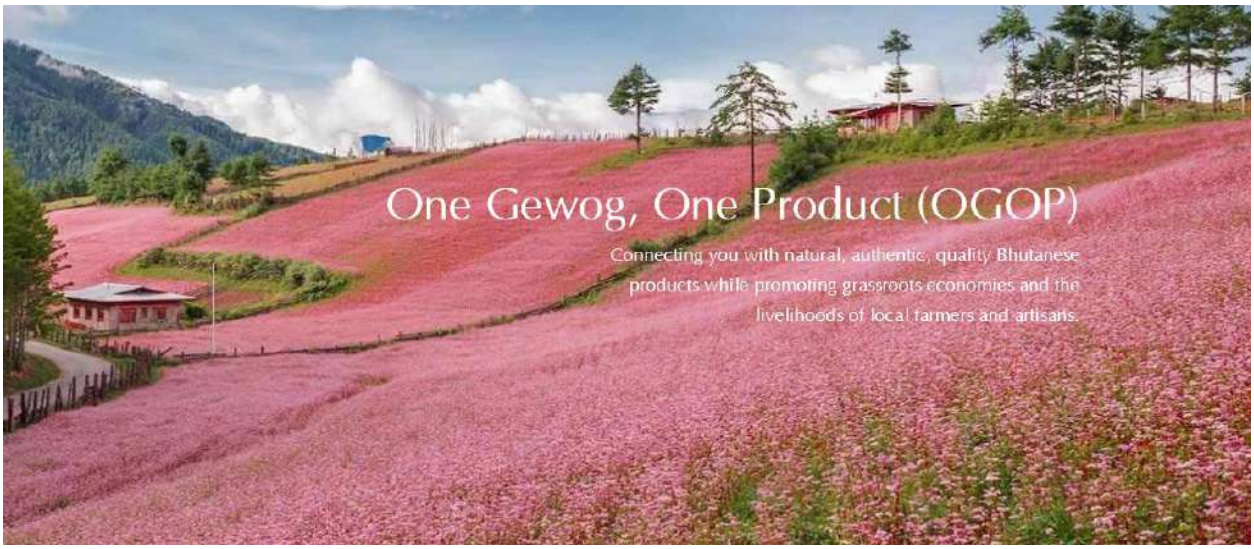
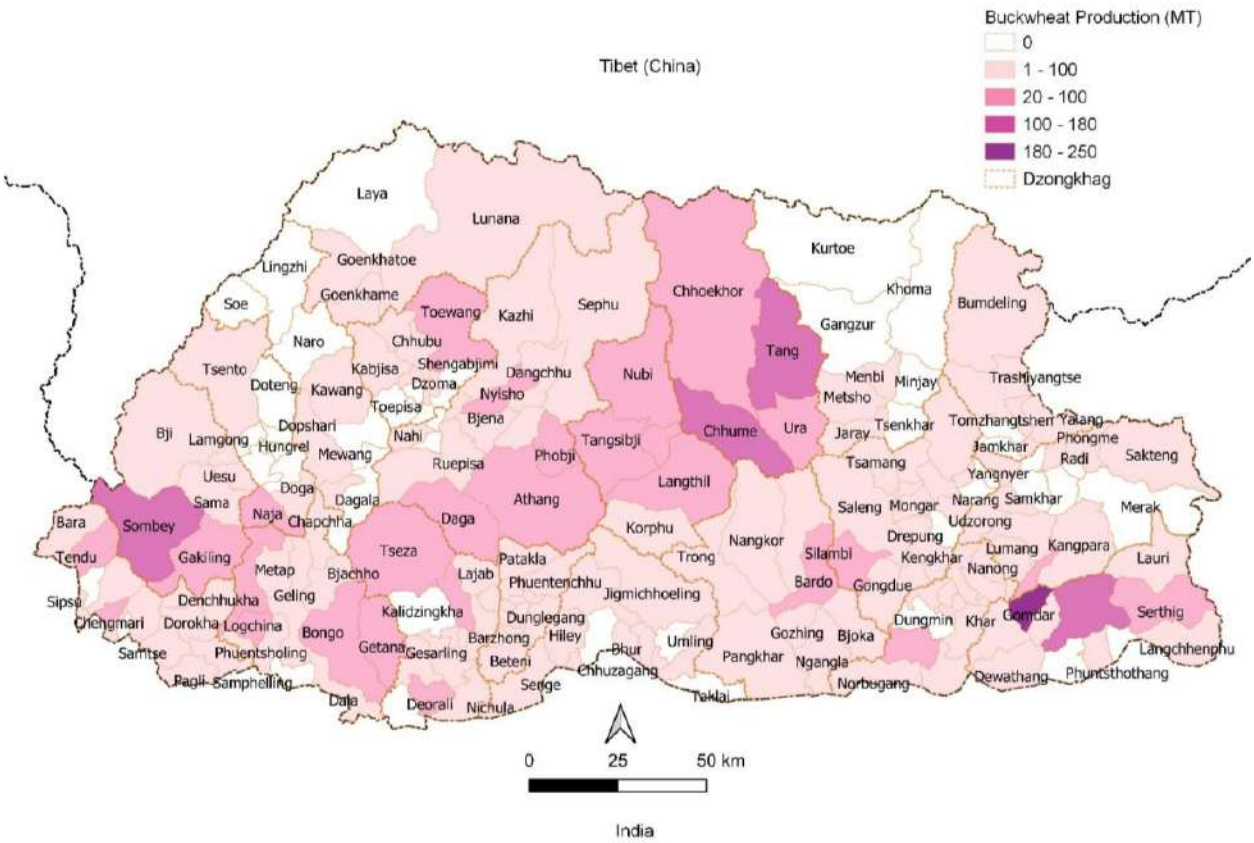


Plate 2. A buckwheat growing landscape in Bhutan[10]



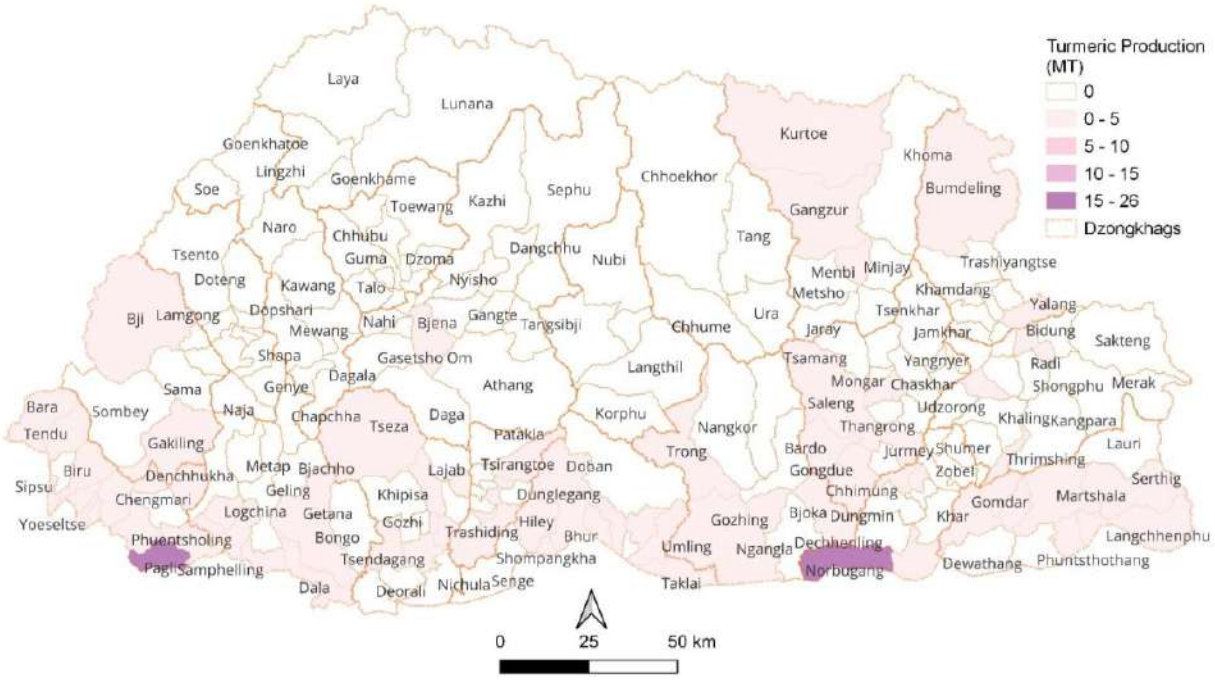
Map 10. Buckwheat growing region and buckwheat production (MT) in 2018

[10] Picture taken from OGOP, https://www.ogop.bt/

Farmers should be encouraged to continue growing buckwheat. Priority should be given to linking farmers with private entrepreneurs and aggregators interested in collating, processing, value adding and exporting buckwheat.

2.2.7.2 Turmeric & Black Turmeric

Bhutan produced 49MT of turmeric in 2018 (Map 11). Turmeric has been identified as a potential export crop for Bhutan and has the potential to be exported as a high value organic commodity.



Map 11. Turmeric growing regions and turmeric production (MT) in 2018

In addition to yellow turmeric, farmers should be encouraged to pilot and grow black turmeric (*Curcuma caesia*), a high value, perennial herb with bluish-black rhizomes. See plate 3.

Plate 3. Black turmeric (Curcuma caesia), a high value turmeric variety

2.2.7.3 Bhutan Asparagus

Asparagus production is seasonal in Bhutan, and as such holds potential to be exported as a high-value, organic, and seasonal commodity, from Bhutan.

Aggregators should be supported to find seasonal markets at high-end outlets in Delhi, Kolkatta, Dhaka, Bangkok, Singapore and Dubai. Capacity building on proper packaging and grading should be provided, standards developed, and exports facilitated via air freight.

2.2.8 WILD BHUTAN HONEY

In 2020, Bhutan produced about 44.18MT of honey (Figure 16), out of which an estimated 30.62MT was sold earning about Nu. 28 million (less than half a million USD). There is significant potential to expand honey production across high altitude alpine and sub-tropical regions of Bhutan.

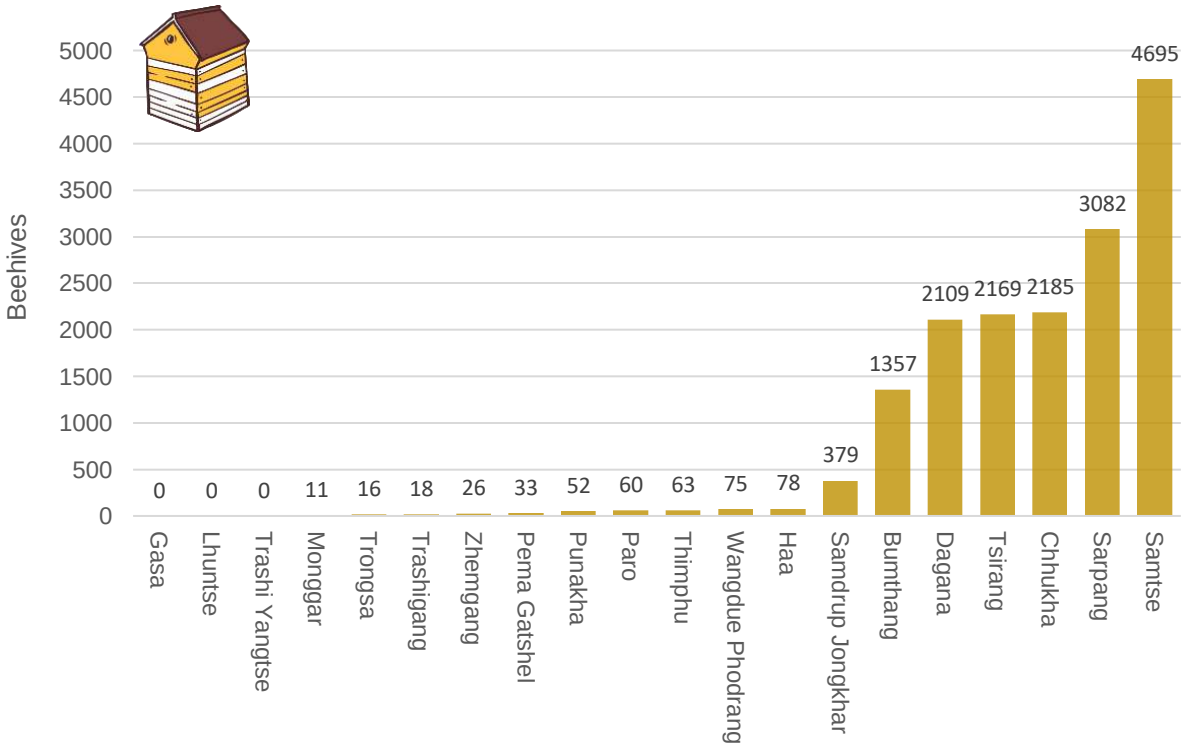


Figure 16. Number of beehives across Bhutan as of 2018

A *Bhutan Bee Cooperative* should be established to create a 10+ million USD bee enterprise by engaging youth groups across Bhutan. A 1000+ meaningful and well paying jobs can be provisioned by this initiative.

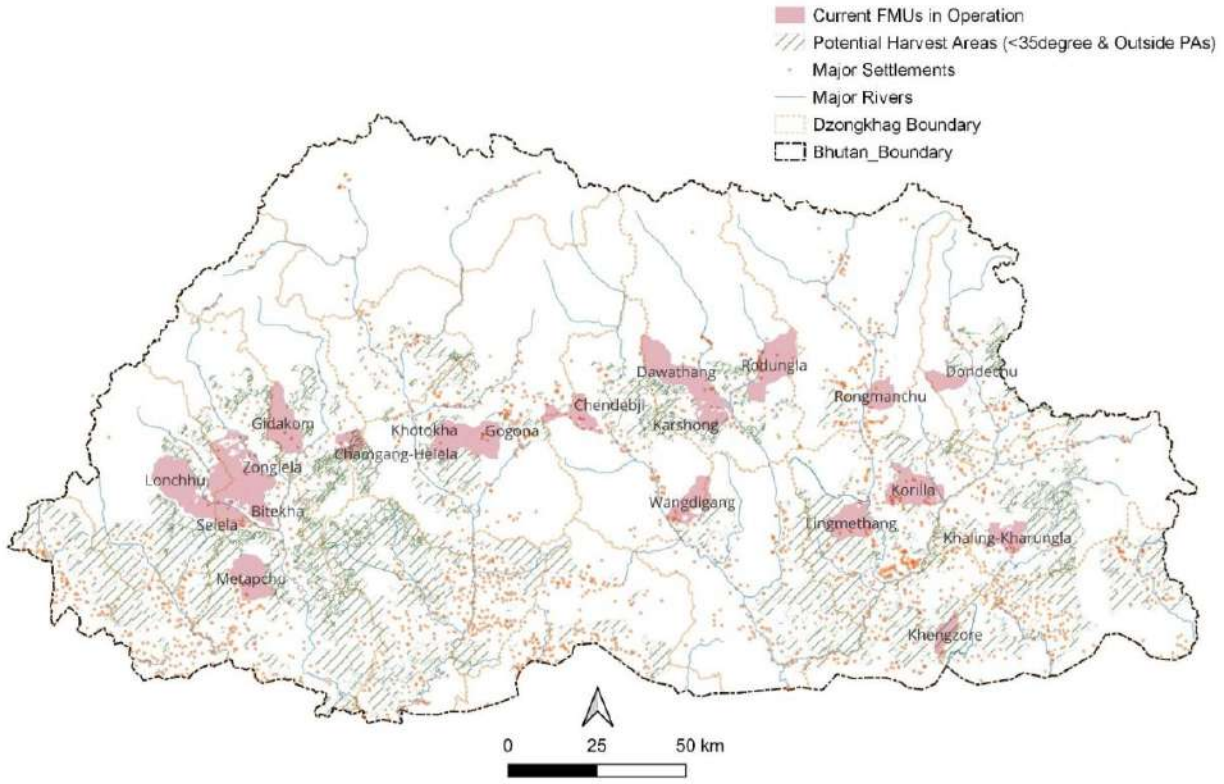
Standards could be developed, similar to the one adopted by the New Zealand Ministry of Primary Industries[11] for Manuka honey.

A 'Wild Bhutan Honey' brand under the garb of 'Honey is a Place' should be developed to align with the 'Happiness is a Place' caption used by the Tourism Council of Bhutan (TCB).

[11] https://www.mpi.govt.nz/food-business/honey-bee-products-processing-requirements/manuka-honey-testing/

2.3 STRATEGIC PRIORITY III| GROW FORESTS & MODERNISE THE WOOD INDUSTRY

As of 2022, there are 21 Forest Management Units (FMUs, see Map 12 & Table 1), with an estimated annual allowable cut (ACC)/ harvest of about 4.7 million cft of timber.



Map 12. FMU locations and 'potential harvest areas' of Bhutan

Table 1. FMUs, year of establishment, area and AAC as of 2022

No	FMU	Year of Establishment	Area (ha)	AAC (m^3)	AAC (cft)
1	Bitekha	2006	6859	4500	158916
2	Chamgang-Helela	1993	4420	1800	63566
3	Chendebji	1996	7842	6700	236608
4	Dawathang	2000	16828	12180	430133
5	Dongdechu	2001	4858	5214	184131
6	Gidakom	1977	13101	5670	200234
7	Gogona	2005	8081	6328	223471
8	Haa-East	1987	6220	500	17657
9	Karshong	1994	6000	7700	271923
10	Khaling-Kharungla	1996	7035	1300	45909

11	Khengzore	2019	4095	4100	144790
12	Khotokha	1984	9034	9800	346084
13	Korilla	1993	13131	3800	134196
14	Lingmethang	1997	10490	9400	331958
15	Lonchhu	2010	12568	6300	222483
16	Metapchu	2007	10677	5030	177633
17	Rodungla	2013	14488	14999	529685
18	Rongmanchu	2007	6400	3200	113007
19	Selela	1997	9114	11886	419751
20	Wangdigang	1992	8760	2100	74161
21	Zonglela	1992	14104	9366	330757
			194104	**131873**	**4657055**

Currently, across all forest types, less than 30% of potential harvest areas (PHAs) is managed under FMUs. See Figure 17.

Harvest levels should be raised to at least 50% of PHAs for conifers and to 10% of broadleaved forest areas by bringing the most suitable forests under sustainable harvesting regimes.

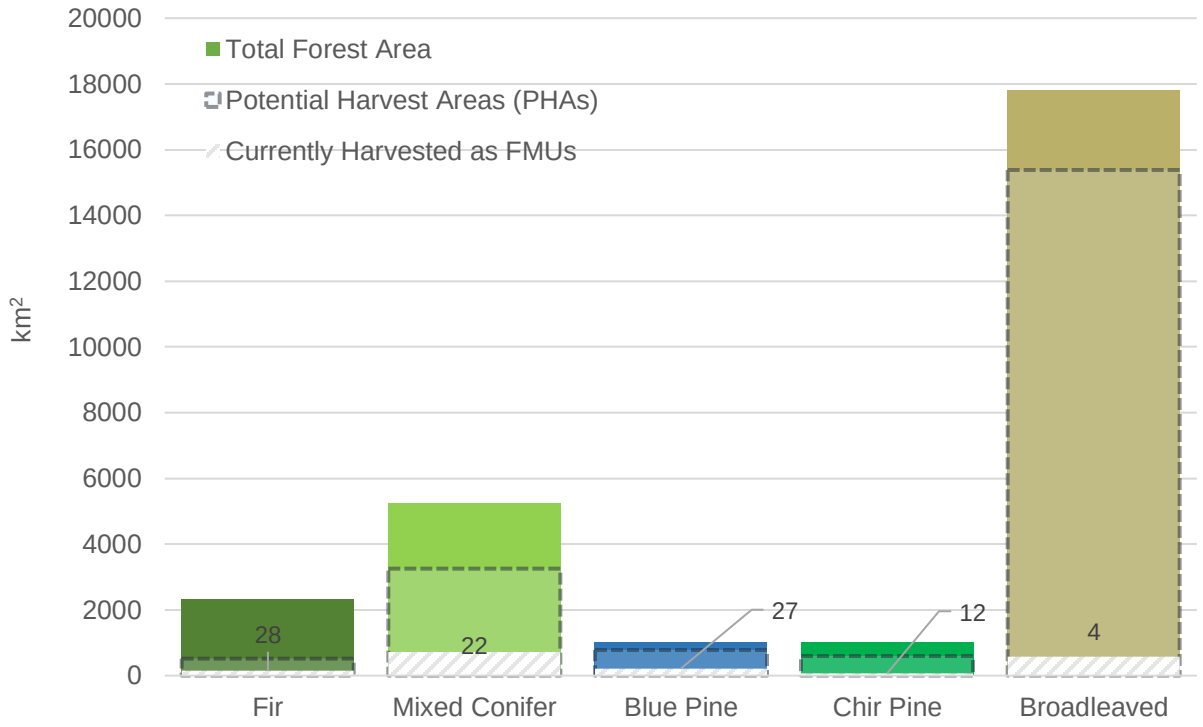


Figure 17. Total forest area, potential harvest areas (PHAs) and % under FMUs. PHAs (<30° slope and outside PAs) shown by dotted lines, and area under FMUs shown by slashed lines. Numbers depict forests under FMUs as a % of potential harvest areas (PHAs).

An additional 238,570 ha of forests (142,800 ha conifer) and (95,800 ha broadleaved) can be brought under scientific harvesting management plans.

Either an outfit of the same size as NRDCL (400+ employees) can be created; or employment within NRDCL can be doubled. **In addition, a youth based cooperative under the management of a public-private partnership arrangement can be mobilised to cater up to over 1000+ jobs within the timber value chain enterprise covering harvesting, to processing, to value addition.**

Bhutan's wood processing industry, from the ability to harvest logs, to process and kiln, remain sub-standard, and over half the sawmills are more than 20+ years old (Figure 18).

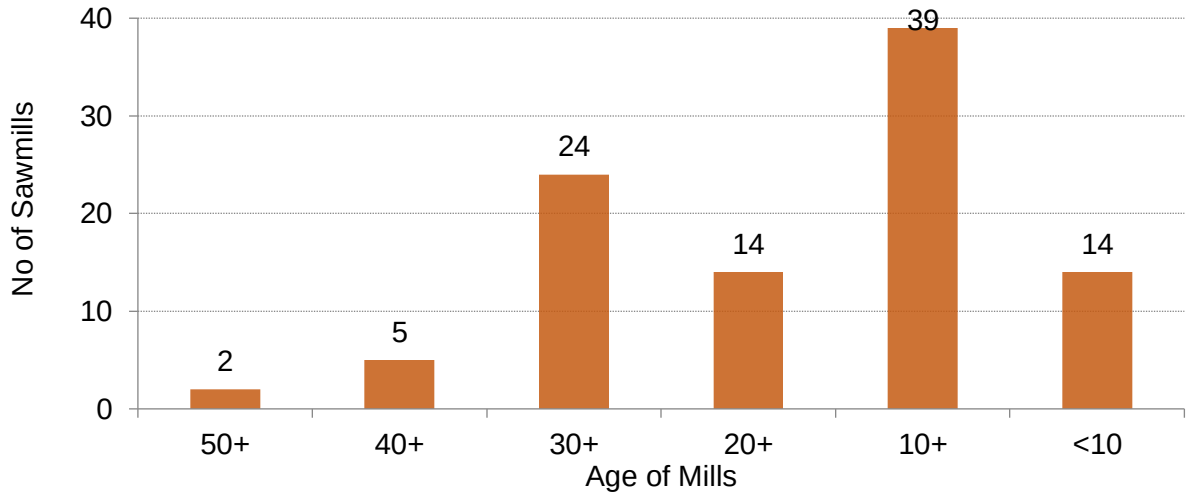


Figure 18. Number and age of sawmills across Bhutan

Immediate investment plans should be developed to modernise and support Bhutan's timber industries. And where private parties are willing to upgrade existing facilities and establish new ones, subsidies and incentives in the form of tax breaks on incomes as well as modern machinery imports should be instituted and rolled out.

The Government should assist and support the establishment of 'Business-to-Business (B2B)' connections between Bhutanese business owners and foreign companies.

An initiative under the garb of 'Build Bhutan with Wood' should be launched to encourage people to build and use wood. Private businesses should be encouraged and incentivised to pilot, test and scale up technologies such as glulam, mass timber, and engineered wood.

In particular, all rural bridges (and where possible community and institutional buildings), should be encouraged to be built with mass timber technology. See Plate 4.

Plate 4. Mass timber bridge in Montmorency Forest, Québec[12]

The RNR Big Data framework should provision for providing information on wood and timber availability. Barcodes using blockchain technology should be developed and launched to identify source of wood, track sale and timber utilization. Furthermore, information on timber availability should be made publicly available to ease public access to timber on a Realtime basis. A digital app for timber availability and price should be launched for public use as part of the RNR Big Data framework (See section 2.5.5).

[12] https://www.nordic.ca/en/projects/structures/montmorency-forest-bridge

2.4 STRATEGIC PRIORITY IV | REVIVE & STRENGTHEN MARGINAL SMALLHOLDER FARMS

Smallholder farms will remain the mainstay for Bhutanese agriculture into the coming decade, and perhaps beyond, while initiatives to upscale commercial large scale mega-farms pick up pace and scale. Almost all (98%) of Bhutan's farms are smallholders (<12 acres/ 5ha). Of this, 25%, one out of every four Bhutanese farmers, own less than 1 acre of land (wetland and dryland combined). See Figure 19. Such farmsteads of less than an acre may be better classified as marginal holders, and farm support interventions for such farms, should be tailored accordingly.

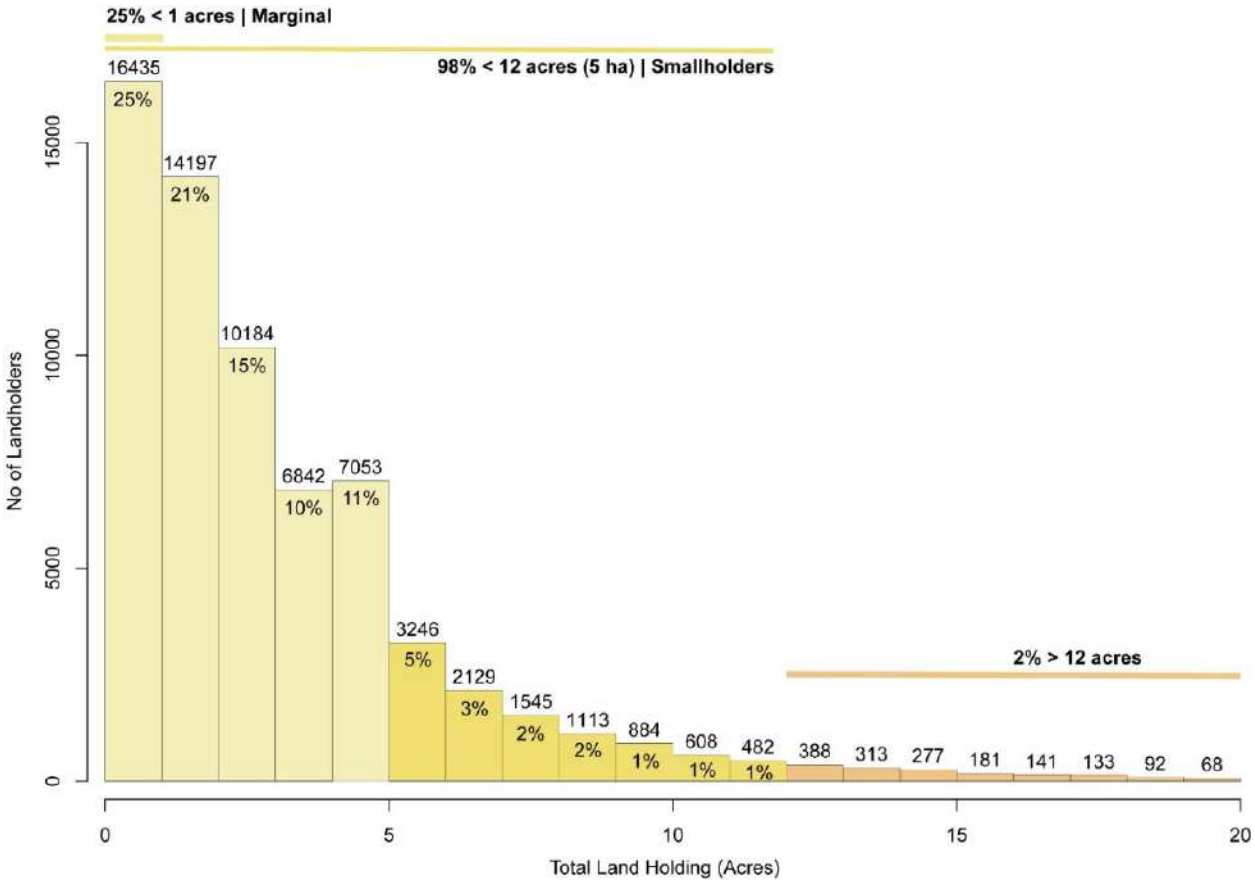


Figure 19. Land holding (wetland and dryland combined) size per landholder across Bhutan

Despite facing considerable production constraints, smallholders remain an important part of the Bhutanese socio-cultural landscape and continue to grow and provide an appreciable share of crop, feed and livestock produce, for a majority of the Bhutanese population. Figure 20 provides a summary framework for key interventions required for reviving smallholder farms and raising farm incomes.

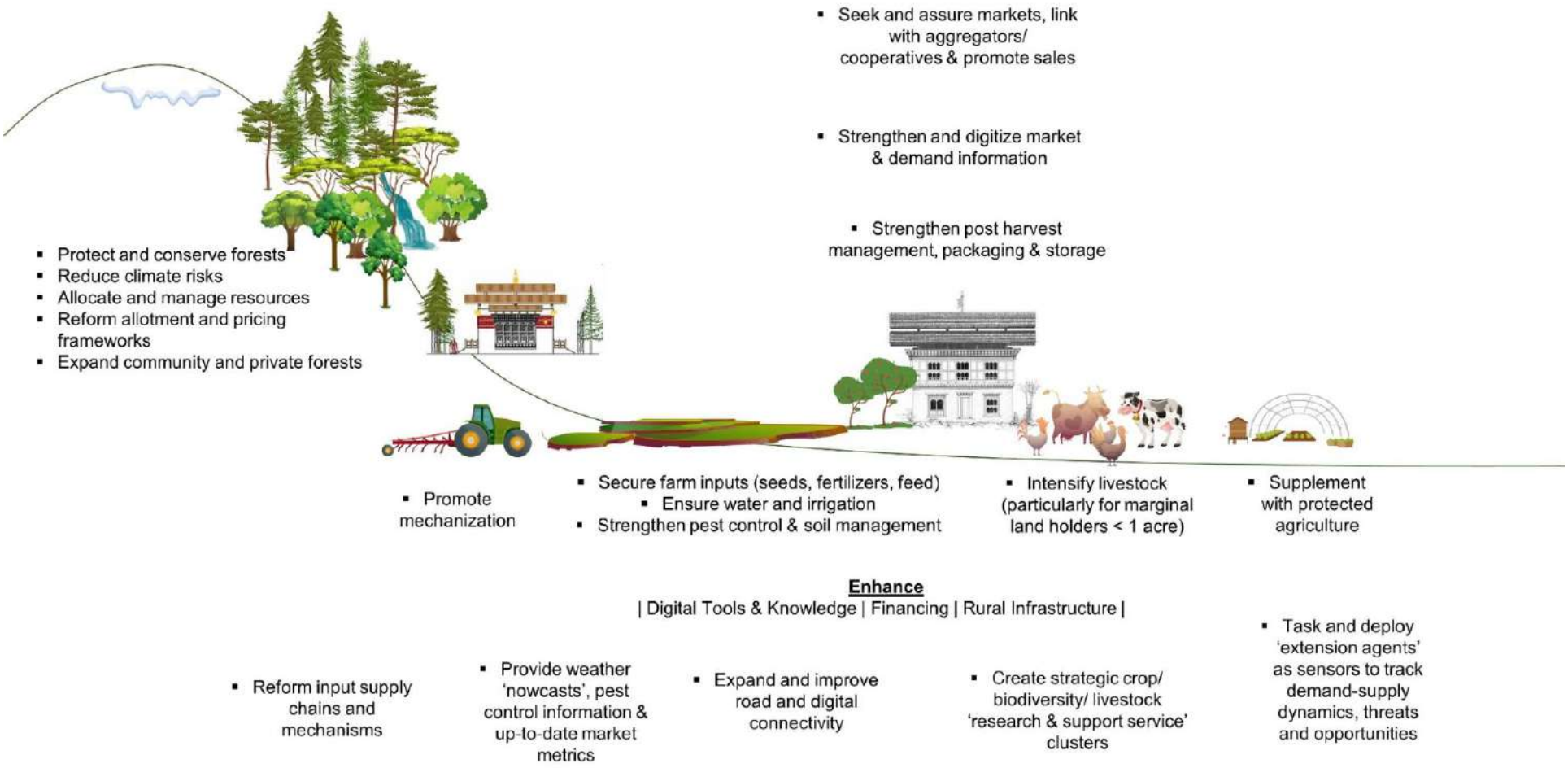


Figure 20. A framework for reviving smallholder farms and raising incomes across rural Bhutan

2.4.1 URGENTLY ADDRESS HUMAN WILDLIFE CONFLICT (HWC)

Almost one in every four farm households faced issues related to crop loss to wildlife[13], while one in every hundred faced loss of cattle to wildlife. Livestock depredation was mostly persistent in Wangdue and Trongsa. An already challenged livelihood strategy is significantly compromised by persistent and on-going HWC.

Large scale programs to wildlife proof farms across Bhutan should be upscaled. Chain-link fencing to replace and/or supplement electric fencing should be encouraged and subsidies worked out for farmers. **Cattle breed improvement, stall feeding facilities, access to feed should be ramped up to reduce free grazing and loss of cattle to livestock.**

2.4.2 UPSCALE SMALLHOLDER DIARY, COLLECTION AND PROCESSING

As part of the drive to increase crossbred cattle number to 230,000 cows, **cattle rearing should be encouraged, particularly for marginal farmers (< 1 acre).** Diary cooperatives should be expanded to cover all of Bhutan. **Such cooperatives should be organized into a Bhutan Diary Federation which can provide the scale and the framework to collect, store, process, value-add and trade diary related produce.**

2.4.3 EXPAND CLIMATE PROTECTED PRODUCTION SYSTEMS

Smallholder farms should be supported with the provision of greenhouses to expand coverage of climate protected production systems. In addition to the conventional hoop house greenhouses, geodesic domes should be piloted and scaled up. Such growing domes may be more resistant to damage from wind and snowstorms and have been shown to be more efficient at regulating temperature[14 & 15]. All such contraptions may also be fitted with efficient irrigation systems, temperature control, and automated smart monitoring systems[16].

2.4.4 SUPPORT EXPANSION OF CASH CROPS, COMMUNITY FORESTS & FOCUS EFFORTS

Bhutan's OGOP[17] initiative under Her Majesty the Queen's Project Office has made remarkable advancements and continues to significantly benefit the lives of farmers all across Bhutan. The single most important lesson that the OGOP model offers is the need to focus.

[13] Estimated from RNR Census 2018 data
[14] https://arcticacres.ca/news/winter-greenhouse-gardening
[15] http://geodomas.eu/agriculture-soliutions-farming-biodomes-greenhouses-geo-domes/
[16] https://farmfromabox.com/
[17] https://www.ogop.bt/

A Gewog wise framework should be adopted to advise farmers on what would be most beneficial and profitable cash crops for them to grow and rear. And in order to supplement incomes, community forests should be expanded.

2.4.5 INCREASE ACCESS TO SERVICES, TECHNOLOGY & MARKETS

Smallholder farms still face difficulty in getting adequate access to irrigation, farm machinery, seeds, fertilizers and allied farm inputs.

A dedicated one-stop 'agri-solution outlet' should be established in every Dzongkhag engaging interested private parties. Such outlets should provide all farm related inputs and machinery.

The issue is also compounded by lack of access to markets, information and post-processing facilities. Ongoing initiatives to scale up cooperatives should be continued. Farmers and cooperatives should be encouraged to liaise with aggregators and agri-based processing facilities so that their produce finds markets and translates into sizeable incomes.

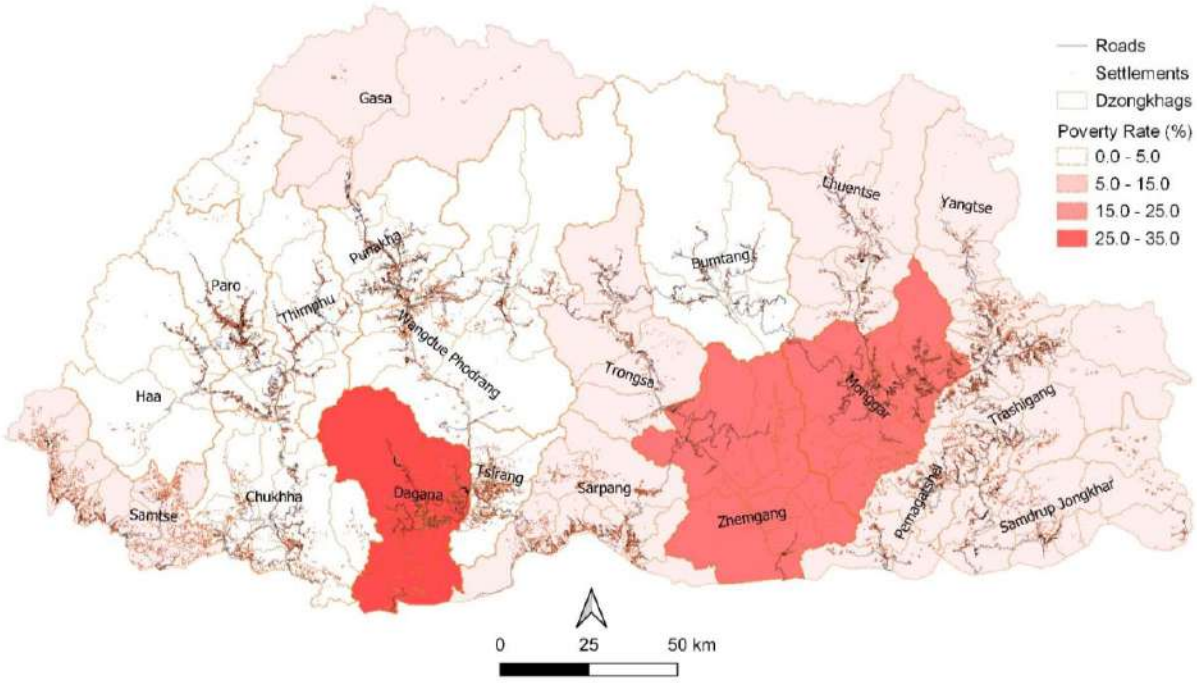
In order to assure some level of price parity and to support negotiation capabilities of farmers, **current market produce price should be made available to farmers through text messages on a weekly basis by the MoAF.**

2.4.6 SUPPORT AGGREGATORS/ COOPERATIVES & DIGITAL MARKET LINKAGE PROVIDERS

There are currently about 100 RNR-based cooperatives and 667 farmer groups across Bhutan. These cooperatives play an important role in providing economies of scale and standard building while aggregators ensure that produce get to market. Aggregators should be particularly encouraged for participation in Dzongkhags which continue to exhibit notable levels of poverty (Map 13).

A standard online registry should be created for all cooperatives and aggregators across Bhutan. Furthermore, digital platforms[18] & [19], which connect farmers to markets should also be supported through encouraging farmers to register and participate.

[18] https://www.sibjam.com/
[19] https://www.greenhands.bt/



Map 13. Poverty levels across Bhutan as per the 2017 NSB poverty analysis report

2.4.7 INSTITUTE A "PRODUCED BY SMALLHOLDER FARMS" LABEL

In addition to an *Organic Bhutan* label, where export commodities are concerned, **provide an additional label of 'produced by smallholder farms',** much like artisanal products across the world. It is understood that smallholder farms have a lower carbon footprint and positively influence biodiversity persistence. As such, the 'produced by smallholder farms' label will positively supplement Bhutan's organic label.

2.4.8 IMPROVE FACILITIES IN RURAL AREAS

Farm labour attrition and increasing movement of youth to urban areas is often cited as a key challenge of the RNR sector. **Renewed attention should be paid to enhance liveability and vibrancy of rural areas,** and comprehensive investments made to increase internet speed, access to quality health, water and sanitation facilities, while reducing local administrative drudgery related to antiquated institutions.

2.5 STRATEGIC PRIORITY V | ACCELERATE AGRI-FOOD SYSTEM TRANSFORMATION & IMPACT

In this rapidly changing world of uncertainties and disruptions, our priority is clear. We need to accelerate the transformation of our agri-food system to ensure food security and economic growth and employment generation. Grappling with the COVID-19 pandemic, the same need was felt by nations all across the world, as reflected in the UN Food Systems Summit last year, calling all member nations to transform existing food systems to accelerate progress on SDG-2030.

The COVID-19 pandemic came as a wakeup call. It exposed the deep fractures and vulnerabilities in our agri-food system. It revealed the critical food insecurity facing the nation and the broken food supply and value chains within our agri-food system. It made us realize how seriously dependent we have become to imported foods from other countries. The pandemic also put a spotlight on our fragile and vulnerable economy. According to the national accounts statistics 2021, our economy recorded a negative growth of -10.08% in 2020, which is 15.83% drop as compared to a growth of 5.76% in 2019. The GDP dropped to Nu 171.57 billion in 2020 from Nu 178.56 billion in 2019. Similarly, the Gross National Income (GNI) of the economy contracted by 7.23%, a total drop of 13%.

Such crisis almost always leads to change. It has made us pause, reflect, and reset our priorities. And it has given us the courage to take bold and decisive actions to build a better future.

Transforming the agri-food system is one of the greatest challenges and opportunities of our time. Indeed, we have some unique challenges, but farming is not easy anywhere in the world. Even the most advanced countries continue to face difficulties and uncertainties, in spite of their huge investments and incentives, and advancements in science, innovations, and technologies. Beside a few nations like Singapore, no other country has achieved higher-middle income status without modernizing and transforming their agri-food sector.

The RNR sector touches the lives of all people. With its presence in every remote corner of the nation, it serves the un-served and reaches the unreached. It is the sector that is closest to the people and nature. The RNR sector now needs to accelerate its impact and go the extra mile to not only provide the essentials of life—food, nutrition, air, and water—but also drive the nation's economic growth and job creation.

The strategy to enhance production and productivity of the prioritized crops for food and nutrition security is covered under section 2.1 and 2.4. In this section, we focus on the strategy to accelerate RNR sector's contribution to the economy and job creation. We have outlined six pathways for accelerated intervention. These pathways are closely interconnected and together they will have immediate impact on the economic recovery and build a sustainable foundation for economic growth and employment generation.

2.5.1 DEVELOP RNR HUBS

A Value Chain and Food Systems Approach

To establish the foundation for the transformation to take off, we need to move from the incremental and siloed actions to a systems approach and develop integrated agri-food value chain systems. This will jumpstart the transformation and will establish pathways for agriculture products to move from the farms and aggregators to markets and consumers. Agri-food value chains bring products from farmers and producers to the processors, distributors, traders, buyers and consumers. An integrated value chain system would address most of the problems facing the farmers and buyers today. The farmers are unable to sell their products, while the buyers and traders are unable to get the products they need.

An integrated value chain system would bring down the transaction costs arising out of inefficiencies in distribution and logistics and help stabilize food prices. It would make safe and healthy foods accessible and affordable to our people. In addition, it would address the mismatch between the producers (farmers) and markets—and establish sustainable pathways for youth and private sector engagement.

2.5.1.1 RNR Commercial Farms (Production Hubs)

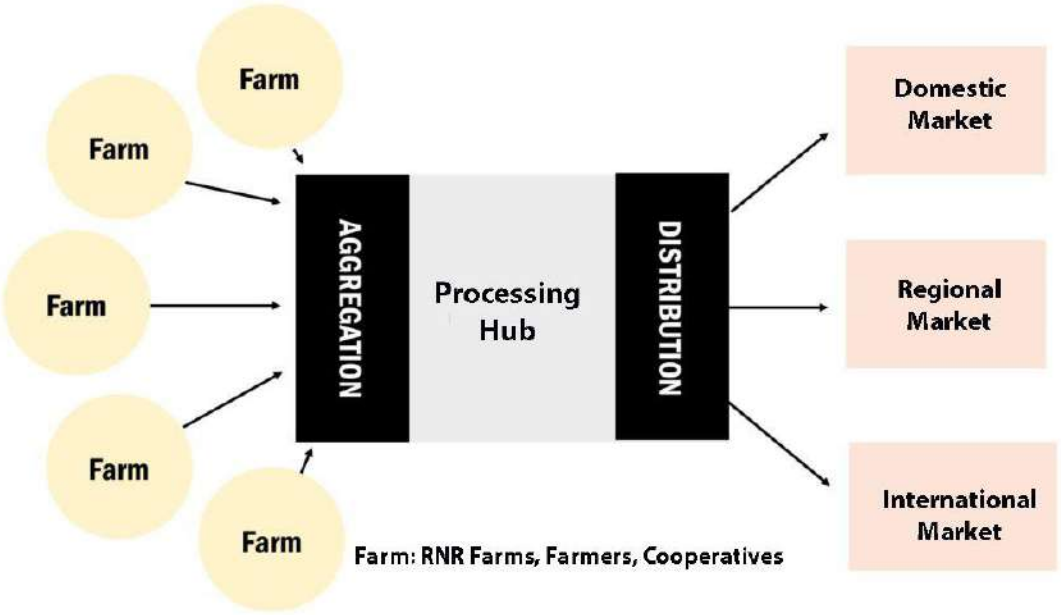
Develop RNR commercial farms in different parts of the country using state- and private-owned lands that remain fallow and unutilized. Such farms will undertake large-scale production of prioritized commodities (see section 2.1), based on market demand from the RNR processing hubs, NSHFP, and other domestic and export markets. The program would undertake sustainable land and infrastructure development, invest in mechanization, technology and innovation, and better seeds and other farm inputs. As a production hub, it would provide trainings and employment to youth interested in farming and farmers. It would supply farm inputs like seeds, fertilizers, and pesticides, and advisory services to the farmers. It would also provide farm machineries and equipment rental services, aggregation, storage, transportation, and primary processing and packing services to the farmers in the area.

The RNR farms would also engage in contract farming with smallholder farmers, farmer's groups (FG), cooperatives and other producers.

2.5.1.2 Develop Regional Processing Hubs

The RNR farms will be linked to the integrated processing hubs through an integrated value chain system, to ensure market and buyers for their products. We will establish four integrated processing hubs in different regions of the nation. The processing hub in eastern region, based in Gyalposhing or Lingmethang, will cover all the eastern districts— and connect to the regional markets through Nanglam and Samdrup Jonkhar. The processing hub in central region will cover Bumthang, Tongsa and Zhemgang—and connect to the regional markets through Galephu and Panbang. The processing hub in the central western region will cover Gasa, Punakha, Wangdi, Dagana, Tsirang and Sarpang—and connect to the regional markets through Galephu and Kalikhola (?). The processing hub in western

region will cover Thimphu, Paro, Haa, Chukha and Samtse—and connect to the regional markets through Phuntsholing and Samtse. These hubs would connect to the domestic markets and international markets through Thimphu and other urban centers. And the regional hubs will be connected to the railway links the government plans to build to the Indian bordering areas.



The processing hubs will have most of the inter-dependent agri-food facilities and services in one area like storage and warehousing, grading, packing and packaging, transport and distribution, farm input shops like seeds, fertilizers, pesticides, and feeds, and farm machineries, tools and equipment, wholesalers and distributors, training and extension services, and banking and financial services. Within the area, there will also be RNR sector agencies like ARDC, RAMCO, RLDC, and FMCL. It will be the "go to place" in the region for everything related to the agri-food system.

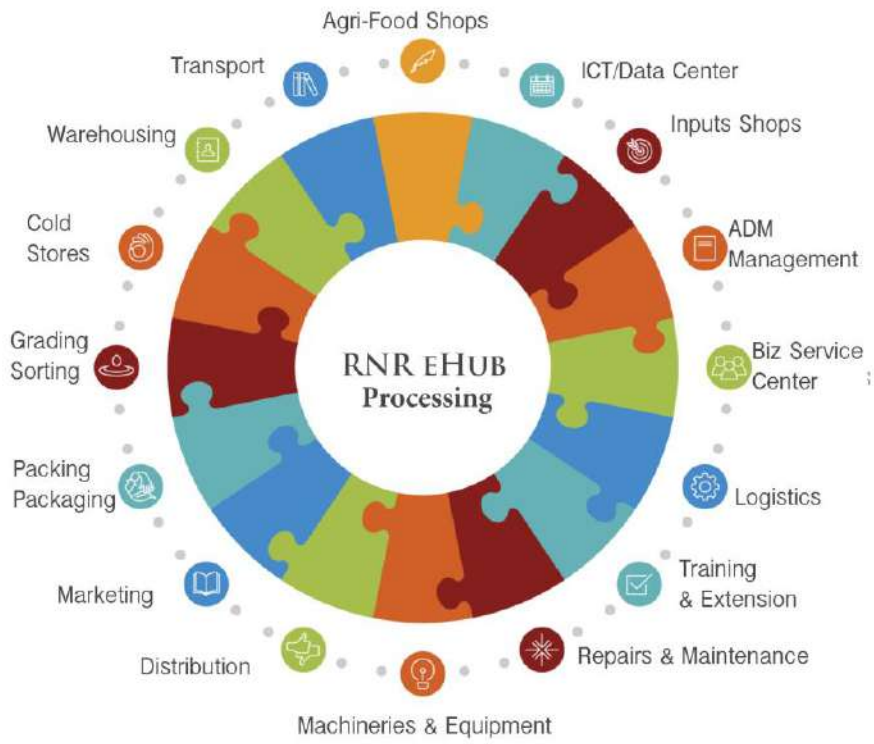


Figure 21. RNR eHub schematic showing functions and services
Artwork – FAO, good practice template

Such hub and spokes and integrated value chain models have been successful not only in other countries but also in our own nation with Koufuku International Limited (KIL) in Tashigang. See box 1 below.

Box 1: KIL is an integrated dairy/milk processing plant that provides all the services and facilities in the dairy value chain like milk collection, transportation, storage, chilling, processing, marketing and distribution. KIL has been facing problems until CARLEP, an integrated agri-food project funded by IFAD, came to their rescue. With investment from CARLEP, KIL started producing processed block cheese, an import substitute product, and the company started doing well. There is good demand for their processed cheese—Dzambala Cheese—throughout the country. Compared to imported processed cheese, Dzambala is believed to be a lot more nutritious and has many health benefits. KIL will also be producing yogurt to supply to all the schools in the entire eastern region. At present, the dairy farmers in eastern Bhutan can hardly meet half of KIL's demand for milk. In the coming years, the Department of Livestock plans to upscale dairy farming in all six eastern districts.

By 2030, among others, establishing the RNR hubs would enable the RNR sector to achieve food security, generate revenue, and provide employment and farm and off-farm business opportunities for thousands of youth.

Ethiopia – Mega Agro-Processing HUB

Ideally, the RNR commercial farms and processing hubs should be developed and operated by the private sector or professionally run cooperatives or in a PPP mode. Otherwise they should be developed and operated by a government SOE with a clear strategy and action plan to privatize in a few years.

2.5.2 ACCELERATE RNR MARKET DEVELOPMENT

In marketing, we have one of the greatest challenges and opportunities to transform Bhutan's agri-food system. Unless the market is secured, no sustainable transformation from subsistence to commercial farming can take place; no meaningful increase in production and productivity can happen, and no youth and private sector engagement can be sustainable. Unless the farmers and producers are sure they can sell their products, they will not increase their production. Unless the market is secured, increase in production of prioritized commodities (section 2.1) will not be sustainable. And the RNR commercial farms (mega farms) will not be economically feasible, unless buyers for their products are secured through the regional processing hubs and other means. At present, the lack of market access and organized marketing system, is one of the weakest links in the agri-food system. The challenge now is to make the weakest link a key driver and enabler of the transformation.

2.5.2.1 DOMESTIC MARKET

There is a huge untapped domestic market in the form of import substitution, national schools and hospitals feeding programme, and rapidly increasing urban population and tourism.

2.5.2.1.1 Import Substitution

Dependency on imports to ensure food sufficiency remains high, especially for staple foods. Today, Bhutan continues to import large quantities of rice, potato, chili, vegetables, and livestock products—with rice being the major commodity of import at 60,267 MT of rice worth Nu. 1.88 billion. In all, the total annual import of agriculture and livestock products in 2018 was Nu.3.83 billion, and Nu.1.94 billion

respectively (VNR 2021). And almost every agro processing plant imports raw materials from the neighboring countries. This is one of the reasons for the worsening trade imbalance. With continued urbanization, demand for imported products, especially processed foods, will continue to grow.

It will be a big challenge to compete with the easily available imported products, especially in terms of price. However, we need to strategically make our own products more accessible and affordable, not only for economic reasons, but also to ensure that our people eat healthy, safe and nutritious foods. We should provide special incentives, subsidies and financial packages to make import substitution work. Every nation employs strategic fiscal and monetary measures to develop, protect and promote their own agriculture and private sector. Such measures are short-term investments for long-term gain.

The continuing success of the processed cheese by Koufuku integrated milk processing plant in Tashigang, in competing with the processed cheese from India of well established brands like Amul and Britannia gives us hope and inspiration. After all, India is the world's largest producer of milk.

Accelerate investment in production and processing of agri-food commodities for import substitution. Accelerate production of priority commodities (see section 2.1) and accelerate establishment of RNR commercial farms and regional processing hubs (see section 2.5.1).

2.5.2.1.2 Implement National School and Hospital Feeding Programme (NSHFP)

Every year, the school feeding programme alone is about Nu. 1.86 billion covering around 79,000 students. In addition, there is a substantial budget under the hospital feeding programme. The NSHFP provides reliable source of income and market for the farmers while ensuring that our children and patients eat safe and healthy foods. The FMCL youth farms and BLDCL would supplement the supply of food and livestock products that the farmers are unable to produce or supply. And the NSHFP is expected to generate employment for around 4,000 youth and it also contributes to import substitution.

Accelerate the implementation of NSHFP in all 20 Dzongkhags and resolve the teething issues. And also explore the feasibility of including the Dratsangs and armed forces.

2.5.2.1.3 Growing demands from urbanization, tourism.

The demand for fresh and processed food products will increase as the population urbanizes, incomes rise, and consumption habits change. Increase in food production through large scale commercial farms, integrated processing hubs and improved supply chain and market system would help meet the increasing demand. In a few years, the tourism sector would bounce back and start growing. In keeping with the high value tourism policy, the government should encourage all tourist hotels and restaurants to serve locally produced safe and healthy foods. Similarly, the government should require the restaurants and catering service providers to serve locally produced foods at all government sponsored events and meetings.

2.5.2.2 EXPORT MARKET

With brand Bhutan and green premium, our organic and high value agri-food products have good opportunity to enter the regional and international markets, especially if we focus on high-end niche markets. People all across the world know about Bhutan's high environmental standards. For export, we already have a successful homegrown model in the "high value, low volume" tourism policy. With this transformative approach, the tourism sector has achieved unprecedented growth since 1970s, creating huge business and employment opportunities for our people and generating the much needed foreign exchange revenue for the nation. We need similar success in developing export market for our high value, low volume RNR products.

We should begin by strategically focusing on a few high value products, especially organic and nature based commodities. We have abundant forest resources including high value non-wood forest products and medicinal herbs that remain largely untapped and unexplored. Bhutan is endowed with a rich biodiversity and the huge bio-prospecting potential could result in various income generating opportunities.

Our success in export market development would provide opportunities for our farmers to earn better incomes and encourage the educated youth and private sector to take up farming. In fact, it would determine the long-term survival and success of our smallholder farming and youth and private sector engagement.

2.5.2.2.1 Develop Regional Market

There is a huge market potential for our organic and high value food products in the rapidly growing, health conscious and ultra rich, population in India and Bangladesh, the two top markets for Bhutanese exports. By 2030, India would have the third-largest number of high income households in the world. And by 2040, India would surpass the USA to become the second-largest economy in terms of purchasing power parity (PPP), as per a report by PricewaterhouseCoopers (IBEF).

Beside the continuing effort to increase export of usual products like potatoes, mandarin, cardamom, summer vegetables, etc., we should now strategically focus on developing niche market for Bhutanese organic and high value food products for the ultra rich households and luxury hotels in Delhi, Kolkotta, Dhaka and other urban centers in the region. By 2030, India alone is projected to have a shortfall of around 42 million tonnes of vegetables and fruits. Using air freight for bulk export of Bhutanese produce should be tested for economic feasibility and upscaled accordingly.

And according to the draft 21 Century Economic Roadmap, there are huge opportunities for export of wood-based forest products. Moreover, recent studies suggest that the use of timber resources for building construction reduces the carbon footprint by 75% if it replaces conventional materials like steel and concrete.

Frameworks for trade negotiations with India and neighbouring countries should be mainstreamed as annual programme activities of the MoEA, and agenda items related to import/ export lists, and entry/exit ports should be annually agreed upon for the forthcoming year. Implementation of rail link project, between Hashimara and Phuentsholing, Kokrajar and Gelephu, Patshala and Nganglam, Rangia and Samdrup Jongkhar and Banarhat and Samtse, should be fast tracked.

The government should also consult, collaborate and learn from the lessons and best practices of the Bhutanese private companies exporting agri-food products to India like the Tashi, Yangphel (Big Cola) and Zimdra. Some of them seem to have cracked the code in exporting products to the regional markets. Beside their Indian distributors, some of them have even established subsidiary companies in India to market and distribute their products.

2.5.2.2.2 Develop International Market

Leverage Brand Bhutan and Bhutan's green premium to develop niche international market for Bhutanese organic and high value premium products like wild honey, organic green tea, organic turmeric, ginger, buckwheat, etc. In 2020-2021, India's export of organic products grew by 51%, a total of 888,180 million tonnes with a value of more than USD 1 billion. India exports organic products mainly to the USA, the European Union, Canada, the UK, Australia, Switzerland, Israel and South Korea. The GOI plans to make Northeast India a hub for organic farming and the world's capital for organic products with a distinct identity (IBEF).

In the short term, Bhutanese people will continue to choose the readily available and affordable imported rice. Therefore, we need to urgently develop international market for premium Bhutanese rice, to sustain the proposed increase in rice production with commercial rice farms (see section 2.1.1.1).

By 2030, quadruple exports and establish successful niche markets in at least eight countries like Singapore, Thailand, Malaysia, Dubai, the USA, etc. Based on the needs of the importing countries, ensure necessary certification, standardization and quality control for the prioritized export products. Diplomatic channels and trade liaison officers in Bhutanese embassies and mission offices should be tasked with finding export market space. We should also take advantage of Bhutan Friendship Associations abroad and influential international tourists visiting the country. Support should also be provided to Bhutanese private parties to make B2B connections with foreign counterparts. Following a thorough scoping of extant produce, done in collaboration with OGOP, Bhutan should launch a Bhutan Outlet in Delhi, Kolkatta, Dhaka, Singapore, Bangkok, Tokyo, and New York. We should also strategically participate in international and regional agri-food trade fairs and annually organize at least one impactful agri-food trade fair in the country, focusing on export.

2.5.2.2.3 Initiate a Grand Challenge

To ensure long term success and sustainable growth in export market, initiate a grand challenge to develop at least three exclusive Bhutanese food commodities that receive international recognition as some of the best products in the world or, at least, in the region. These commodities will have GNH certification as GNH food products. With special focus on quality, we should strategically work on a few products to achieve such recognition. There already are some products with high potential like the wild honey. We could have the Uurka Bangala and Droley chilli, from the land of Aema Datshe, being sold at premium international markets, as the world's best chilli. Also we could have the world's best organic tomato sauce, wild honey, and organic green tea being served exclusively at the world's best hotels and resorts. This is one of the most effective strategies to promote "high value, low volume" products. Again, we can learn from our own tourism sector. The Snowman trek is rated the world's toughest trek, the Tour of the Dragon is considered one of the most difficult cycling races, and the Snowman Run is the world's toughest race.

2.5.2.3 E-Market and Digital Solutions

Develop e-market platforms, digital solutions and user friendly digital apps, as an important component of the RNR Big Data and digital agri-food system (see section 2.5…). Such digital solutions can link the physical markets to an electronic platform and provide a national market for agriculture. Bhutan's e-Commerce can grow rapidly due to widely available internet connectivity, convenience, and ease of payment. Digital platforms have the potential to accelerate the development of markets and connect farmers to buyers—and offer important services like price information for inputs and outputs, enable demand and supply aggregation, and facilitate e-marketplaces.

2.5.3 YOUTH AND PRIVATE SECTOR ENGAGEMENT

Even in most advanced nations, entrepreneurship and small businesses are considered the main engine of economic growth, job creation and innovation. There has not been much success in entrepreneurship and small business development in Bhutan. Therefore, our economy is still weak and fragile with a narrow tax base—and Bhutan's private sector is still very small, after six decades of planned economic development. At present, youth entrepreneurship and small business development programmes are conducted by different agencies in silos and fragmented manners, without much regard to the actual rate of success in new business creation and long term impact. Such practices could end up destroying the career, lives and dreams of many youth.

The RNR sector should follow a different approach and provide custom designed youth engagement packages. It should include employment and in-the-field trainings at the RNR commercial farms for at least a year, basic entrepreneurship and business management trainings, access to special financial packages, handholding, incubation and mentoring services.

2.5.3.1 Develop Farming Businesses

Beside entrepreneurship and business management trainings, the RNR commercial farms will provide in-the-field trainings, including skilling and up-skilling programmes, and incubation services to youth interested in taking up farming. After undergoing the trainings, youths will have the option to continue working at the RNR farms or start and operate their own farms. For youth who wish to start and operate their own farms, the RNR farms and agencies like ARDCs, BLDCs, RAMCO and others will help develop hybrid modern farms, custom designed for the individual youth or youth cooperatives.

2.5.3.2 Develop Off-Farm Businesses

Accelerated development of integrated agri-food value chain systems and the RNR commercial farms and processing hubs (see section 2.5.1) will create business opportunities for youth and privates sector engagement in farming, aggregation, transport, sorting, grading and packing, farm inputs supply, farm machineries and equipment rental services, training and extension services, post harvest handling and processing, marketing, distribution and trading. We should create an enabling environment, through policy support, incentives, tax exemptions, easy access to finance, and user-friendly digital services, for such ecosystems of entrepreneurial ventures to develop, sustain and prosper.

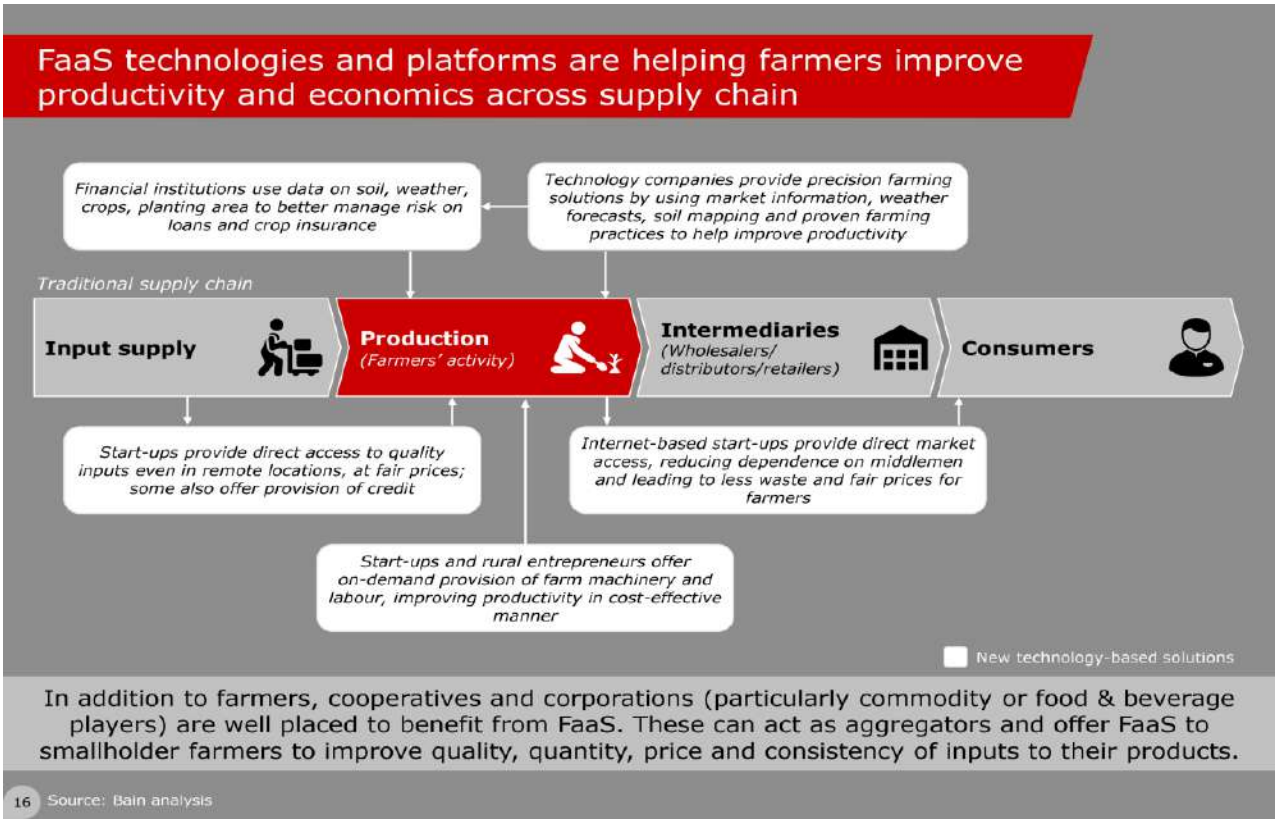
2.5.3.3 Develop Lead Farmers Networks

We should train educated farmers and youth to become lead farmers and have them provide basic extension and advisory services in their villages. Also train them to provide basic animal health services for veterinary (curative) care and artificial insemination. In addition, train them to feed information into the RNR Big Data system, from all across the country.

2.5.3.4 Promote FaaS (Farming as a Service)

Encourage youth to start customized FaaS based services. FaaS solutions have been adopted globally and FaaS startups are growing rapidly. It is considered the next big moment in agriculture and farming. FaaS can help address inefficiencies across the agricultural supply chain, such as low productivity, lack of farm mechanisation, access to markets and data asymmetry. It provides innovative, professional and affordable technology and solutions to farmers and farming communities, on a subscription or pay-per-use basis. Its services cover three broad categories: **farm management** (information sharing, analytics and precision farming tools), **production** (on-site services to enhance production and productivity like equipment rental, labour services and utility services), and **access to markets** (connecting farmers with suppliers of inputs like seeds and fertilisers, as well as buyers and consumers of their produce). FaaS has

a lot of potential. It would push the much-needed process and product innovations in agriculture, including multipurpose agricultural equipment, tools for real-time data capturing and analysis, aggregation of farmland and farm produce, and financial technology for the farmers.



Unless we make farming profitable, sustainable and attractive for the youth, there will be no real farmers in Bhutan in about two decades from now.

2.5.4 RNR ECONOMY

Accelerate growth in RNR Sector's Contribution to GDP

In 2020, the RNR sector recorded a growth of 4.57 percent. This was one of the highest growths compared to the past years. However, at the macro level, the sector's share of GDP at 19.23% is the lowest in comparison to the industry and service sectors at 34.41% and 46.36% respectively (NAS2021). The sector's contribution to GDP had declined from 24% in 2004 to 15.82% in 2019. The RNR Strategy 2040 states that the sector's actual contribution would be much more than what is reflected in the existing reports, since the environmental services provided by the sector were not taken into account (in the GDP calculations). According to Kubiszewski *et al*. (2012) natural resources in Bhutan contribute roughly Nu. 700 billion every year, in the form of ecosystem services.

Beside the economic recovery and food sovereignty, the most urgent need for the nation today is to build a sustainable and broad-based economy, and create employment and economic opportunities for the people. The RNR sector is in a good position to play a key role in fulfilling these goals and aspirations. Economic opportunity in the manufacturing and mining sectors is limited. Hydropower and tourism, two important pillars of our economy, remain vulnerable and unsustainable, as we learn from the ongoing pandemic and escalating impacts of the climate change.

By 2030, our goal is to grow the RNR sector's GDP contribution to 30% by accelerating the implementation of the following economic measures.

2.5.4.1 Generate Income from RNR Hubs

Within the next three years, accelerate establishment of the RNR commercial farms and regional processing hubs (see section 2.5.1) in a mission mode. This would not only help the nation achieve food security, it would also generate huge revenue for the nation and create business and employment opportunities for thousands of people.

2.5.4.2 Generate Income from Commercialization

Through establishment of RNR hubs, contract farming and improved export markets for organic and high value food products, accelerate commercialization of agriculture. With this, farming will become profitable and attractive for the farmers and interested youth, as they earn much higher income. The goal is to create opportunities for every farming household to earn attractive income.

2.5.4.3 Generate Income from Off-Farm Businesses

Off-farm business opportunities in areas like input production and supply, farm machineries and equipment rental services, aggregation, storage, transportation, processing, distribution and trading would not only generate income and employment for youth and private sector, but also revenue for the nation (see section 2.5.1. and 2.5.3). In addition, many new business opportunities will emerge for youth as we embrace agri-tech and digital farming like youth oriented FaaS based services, vertical farming, and organic, agro-ecological, and climate smart agriculture and farming.

2.5.4.4 Generate Income from Forest

There is a huge potential to generate income from Bhutan's rich forest and biodiversity resources, especially from sustainable harvesting of timber, high value non-wood forest products (NWFP) and medicinal herbs that remain largely untapped and unexplored. The forestry sub-sector should not only

protect our rich environment and forests and keep Bhutan carbon negative and a global ecological hotspot, but also generate sustainable income for the nation and people.

2.5.4.4.1 Sustainable Forest Management

There is a good potential to generate income from sustainable harvesting of timber. According to several reports, Bhutan has 1,001 million (M) m3 of forests and natural vegetation, and 7,434 floral and faunal biodiversity. However, the economic returns from the "vast" natural resources so far have been negligible (KOL, 23 March 2021). Only 5 percent of the total forest area is used for commercial production. And since the enforcement of the Forest and Nature Conservation Act 1995, the annual production of timber has been decreasing drastically. In 2019, timber production was 0.20 million m3 compared to 1.60 million m3 in 1992. Since 2016, the forestry and logging sector has experienced negative growth.

According to some reports, Bhutan harvests only 3.7% of net annual increment, which is 0.05% of the total growing stock. Therefore, there is a huge scope for Bhutan to increase its timber harvest without causing permanent damage to the environment. However, extraction of timber is difficult in a mountainous terrain, with poor accessibility and infrastructure, and fragile geological conditions.

Based on Bhutan Trade Statistics 2019, Bhutan imported wood and forestry products worth Nu. 2.18 billion in 2018 and it has the highest import growth rate. By some unofficial estimates, the potential revenue from the export of wood-based products could equal that of hydropower revenue. And according to the MoEA, sustainable harvesting and processing of more timber could lead to Nu. 50 billion in annual revenue and Nu. 194 billion in value addition. Moreover, recent studies suggest that the use of timber resources for building construction reduces the carbon footprint by 75% if it replaces conventional materials like steel and concrete. A more realistic analysis and estimate are provided in section 2.3.

2.5.4.4.2 Renewable Non-Wood Forest (RNWF) Products

There is a huge potential to generate income from Bhutan's rich and diverse renewable non-wood forest (RNWF) resources. Like cordyceps and mutsutake mushrooms, our forests may have other high value renewable products that could generate sustainable income for the people. It may be true that harvesting RNWF products in some areas may cause human-wildlife conflict. But here again is an opportunity to go the extra mile and find innovative means to transform human wildlife conflict into human wildlife co-existence.

2.5.4.4.3 Bio-prospecting

Bio-prospecting, the exploration of natural resources for micro and macro molecules, biochemical and genetic information, has the potential to generate huge revenue and provide employment to thousands of youth. Bhutan is endowed with a rich biodiversity and there exists huge potential for bioprospecting worldwide. Natural resources have been an important source of pharmaceutical products, cosmetics,

nutraceuticals, fragrances, veterinary products, organic pesticides and many more. Many of the modern drugs that are currently available are derivatives of natural products. For instance, herbaceutical market as a sunrise industry offers great opportunities for Bhutan. There is also increasing demand for cosmetics, nutraceuticals, fragrances and other organic products.

2.5.4.4.5 Eco-Tourism

Bhutan's National Parks have immense opportunity to generate huge revenue for the nation from eco-tourism. We should relax some of the unnecessary restrictions and allow responsible tour operators and other service providers like luxury glamping and eco-lodge developers to operate in certain areas of the National Parks. We could learn from the best practices of some of the world's best national parks and eco-tourism destinations.

2.5.5 GROWING THE FUTURE: NEXT-GEN AGRICULTURE AND FARMING

What will the next generation of Bhutan's agriculture and farming look like in a new era of agri-tech and digital farming revolution? Nations in different parts of the world are leveraging the latest technologies like AI, IOT, drones, robotics, precision farming, nanotechnology, big data, and block chain to transform their agri-food systems. India is one of the leading nations on this front. For Bhutan's agriculture to be successful in such a future, we must strategically home grow our own model of farming and agriculture. While we take advantage of the emerging technologies and innovations, our next generation of agriculture and farming must also be rooted in the values of GNH. While, in the short-term, we establish conventional commercial farms to ensure food security, in the long run, we must move more strategically towards organic agriculture and agro-ecological and permaculture farming—an approach that is in line with our GNH values, ensuring long-term balance between food production and the sustainability of natural resources.

Bhutan must choose wisely and promote technologies that could best serve her present and future needs.

2.5.5.1 Leverage the Dawn of Ag 4.0: IoTs, Drones and Blockchains

Globally, there has been an incredible surge in the Internet of Things (IoT) movement, with smart devices becoming ubiquitous, and increasingly being able to share information with one another. As we engage in a digital world, Bhutanese farms will become increasingly connected and enmeshed into the IoT. Realtime data collection and use, will become the norm, and farmers will and should be empowered through the use of such technology. It should also spell an end, for the need to enter the same data into different platforms for different users at different times. This should free up time for EAs and agri-service providers.

Smart and widely available farm sensors will be deployed to monitor farm conditions related to soil and animal health, temperature, moisture, and prevalence of pests and diseases. These sensors can be supplemented with drones equipped with advanced sensor technology to assess crop yield, and spot potential weed and disease problems from the sky. All such data can be automatically and seamlessly synthesised within the IoT in real-time. This abundance of analytics will finally allow farmer to engage in precision agriculture by allowing fine tuned real-time decision making.

2.5.5.2 Plant Based Meat

Plant-based meat is one of the emerging innovations that could have a huge impact in Bhutan, given the negative religious sentiments associated with abattoirs and meat processing units. Touting the need to reduce negative environmental impacts of producing meat, there is a growing global movement to produce meat in controlled environments from both animal cells and plant based materials. Start-up companies have started to produce artificial beef (Plate 5), pork, chicken and even fish. In 2020, Singapore became the world's first country to approve sale and consumption of artificial meat. By 2030, cell-based meat market is projected to reach USD140 billion.

Plate 5. Sample of a lab grown beef

2.5.5.3 Vertical Farms

Vertical farms, using both hydroponics and aeroponics, have been in use for quite sometime and continue to gain traction given the ability to grow consistent high quality produce on a year-round basis, especially in urban areas. Furthermore, automated systems allow for maximising water and energy use efficiency. Vertical farming systems have huge potential and can be promoted in future to produce priority crops for Bhutan such as chillies, onions and tomatoes, in addition to growing a whole array of vegetables, especially in urban areas.

Establishing artificial meat processing facilities and vertical farms could be feasible in future, as the high capital investment required in such ventures comes down.

An Israeli Greenhouse

2.5.2 LAUNCH RNR BIG DATA

Big data has the power to positively impact the entire value chain and must be increasingly and urgently harnessed to play a greater role in transforming Bhutan's RNR sector. The big data framework must be increasingly adopted for enhancing real-time decision making for all actors along the value chain, as well for stock taking, and adaptive planning. See Uber's big data platform.

Bhutan will design and launch a RNR Big Data Center which will allow and facilitate the use of an ensemble of digital tools ranging from apps which provide crop advisory services to early warning on weather, and incidences of pests and diseases. To assist service delivery, such digital platforms will also be designed to support agriculture and livestock extension agents.

Digital tools to collect real time data on farm conditions will also be a part of the package. This will seamlessly allow and empower farmers to seek data on inputs and markets; while aggregators can synchronise produce distribution in the market; and agri-based industries can improve production and value-addition cycles.

2.6 STRATEGIC PRIORITY VI | SUSTAIN AND SUPPORT THE TRANSFORMATION

2.6.1 FINANCE PRIVATE SECTOR GROWTH & PARTICIPATION

The current National Credit Guarantee Scheme (NCGS)[20] of the RGoB should be continued and supplemented with an additional tranche of up to 20+ million USD, to be solely dedicated for financing RNR sector related enterprises.

Given the risks and high volatility associated with RNR based enterprises, and recognizing the immense internal value for Bhutan, the interest rate for RNR related enterprises, may have to be lower than the current rate applied by NCGS. And in order to achieve scale and spur the deployment of large scale ventures, loans should not be less than a million USD.

To ensure long term sustained financing for the RNR sector, the current CSI bank should be upgraded to a full fledged agricultural bank.

2.6.2 BUILD A ROBUST INPUT SUPPLY CHAIN & EXPAND FARM MECHANIZATION

The current mechanism to supply inputs such as seeds, fertilizer, and other related farm inputs are not efficient, and continue to fail, to deliver adequate quantities. The farm shops which were commissioned in response to tackling this issue remain weak, lack economies of scale, and are not serving their purpose. All current farm shops should be closed.

Interested private parties should be engaged to establish dedicated 'agri-food solutions' outlet in all 20 Dzongkhags. Such outlets should also be allowed to import hybrid seeds in partnership with reliable regional and global suppliers[21]. All such outlets should be linked to the regional eHubs and existing ARDCs and LRDCs. In order to optimize delivery of inputs, the MoAF should organize annual regional demand forecasting workshops, where private outlet operators should be invited. Extension agents should be tasked with gathering information from farmers on input requirements for the coming year.

Where possible, and as farmer capacities increase, a digital dashboard for requisitioning inputs, should be made publicly available. This should be a part of the RNR Big Data framework. To ensure that farmer's without access to smartphones are not left out, such systems should also provision for making requisitions via text messages or through social media platforms such as wechat/ whatsapp.

[20] https://www.ncgs.gov.bt/
[21] https://www.syngenta.com

All such Dzongkhag outlets should also be mandated to supply and rent farm related machineries and encouraged to employ youth groups who will be trained in maintenance and operation of farm machines. A TVET program to train youth in this aspect should be rolled out.

2.6.3 BUILD RNR RELATED INFRASTRUCTURE & INSTITUTE AN RNR INFRATSRUCTURE FUND

To support the grow Bhutan framework and to revive smallholder farms, **there should be renewed push on improving and maintaining existing farm roads, in addition to building new ones**. The **irrigation master plan should be re-examined, and locations prioritized,** for seeking funds to ramp up the reach of irrigation. Furthermore, on-going initiatives to expand drip-irrigation systems should be promoted and scaled up.

An RNR infrastructure fund should be created and mechanisms to plough back revenues from use of farm roads and irrigation channels should be worked out and implemented.

Post processing and storage facilities still remain wanting in Bhutan. **Building of planned cold-storage facilities (Table 2) should be expedited and mechanisms to manage all such facilities through PPP models should be seriously considered.**

Table 2. Existing and planned cold storage facilities across Bhutan

	Agency	Location	Type	Capacity	Status
1	NPHC	Paro	Cold Store	80 MT	Functional
		Lingmethang	Cold Store	100 MT	
2	FCBL	Phuentsholing	Cold Store	100 MT	Functional
		S/Jongkhar	Cold Store	100 MT	Functional
		Gelephu	Cold Store	160 MT	Under construction
		Wangdue	Cold Store	300 MT	
		Khaling	Cold Store	300 MT	
3	M/s Nob Bhutan Pvt. Ltd.	Nobding, Wangdue	Cold Store	1,900 MT	Functional
4	Thimphu Dzongkhag	Wangsisina, Thimphu	Cold Store	140 MT	Functional
5	M/s Satsam Cold Store (Pvt)	Satsam, Paro	Cold Store	250 MT	Functional
6	M/s Shangrila Cold Store (Pvt)	Thimphu	Cold Store	30 MT	Functional
7	Gasa Dzongkhag	Khatoe, Gasa	Cold Store	10 MT	Functional
8	DAMC/ FCBL	Pasakha, Phuentsholing	Pack House	18,715 MT (estimated)	Pipeline
9	DAMC/ FCBL	Zhemgang	Cold Store	180 MT	Pipeline
10	DAMC	Majathang, Samtse	Cold Store	180 MT	Pipeline
11		Dagapela, Dagana	Cold Store	120 MT	Pipeline
12	FCBL	Gangtey, Wangdue	Potato Warehouse	500 MT	Pipeline
13		Bumthang	Potato	500 MT	Pipeline

			Warehouse		
14		Khaling, Trashigang	Potato Warehouse	500 MT	Pipeline
15		Pasakha, Phuentsholing	Cold Store (for potato)	3,000 MT	Pipeline
16	AWP	Mongar	Cold Store	300 MT	Pipeline
		Paro	Cold Store	300 MT	Pipeline
		Chukha	Cold Store	300 MT	Pipeline
		Thimphu	Cold Store	300 MT	Pipeline

2.6.4 TRANSITION TO ZERO-CARBON ENERGY IN THE RNR SECTOR

In keeping with Bhutan's aspirations to remain carbon neutral, value chain building within the RNR sector should transition away from fossil fuels. **Infrastructure related to storage and post-processing enterprises should be encouraged to adopt renewable energy and electrification of agri-food related transportation facilities should be promoted.**

2.6 STRATEGIC PRIORITY VII | PROTECT THE FOUNDATIONS

2.7.1 ADDRESS CLIMATE CHANGE RELATED THREATS

The impacts of climate change are projected to worsen into the coming century. Increasing risks from erratic weather, and emergence of novel pests and diseases, are projected to severely disrupt production and constrain yields.

Climate protected agriculture for both crops and livestock should be scaled up. Research into climate resilient varieties for priority crops, emerging pests and diseases, along with water efficient drip irrigation systems should be frontloaded and financed. A 'research grand challenge' framework should be developed for the RNR sector with participation from the RUB and the CSO fraternity. ARDCs and LRDCs should prioritize research and also enter into MoUs with relevant RUB colleges.

Digital monitoring of emerging threats should be mainstreamed as part of the RNR Big Data framework and the MoAF should produce, in collaboration with partners, an annual climate risk assessment report.

2.7.2 INSURE CROP, LIVESTOCK AND FARM PROPERTIES

Small holder farms remain vulnerable to climate related risks and continue to lose produce and livestock to weather related events as well as wildlife.

The RGoB will subsidize and provide initial capital to establish **innovative insurance schemes with relevant partners to insure crops and livestock**. Such schemes will boost farmer confidence and assure livelihoods at times of disasters and calamities.

2.7.3 PROTECT LOCAL PRODUCERS, STREAMLINE MSP SCHEMES & RATIONALISE PRICES

Bhutanese farm produce remain comparatively more expensive than imports obtained from India. Farmers are discouraged to produce on a yearly basis due to shifting demand, preference and market prices. **Minimum support price mechanisms should be reassessed and streamlined on an urgent basis, and demand forecasts provided to farmers to plan production more efficiently**. Wherever possible, market mechanisms should be allowed to play out to regulate costs. Government interventions should be limited only to emergency situations.

2.7.4 RECAST LEGISLATION & SAFETY NETS

Due to Bhutan's focus on meeting self sufficiency goals, many extant policies are catered to meeting local demand, sometimes at the expense of resources, such as hardwood timber, going to waste. In the livestock sector, cattle provision for marginal farmers have also not been prioritised. Policies should be adjusted to balance local demands against opportunities to earn incomes and expand exports.

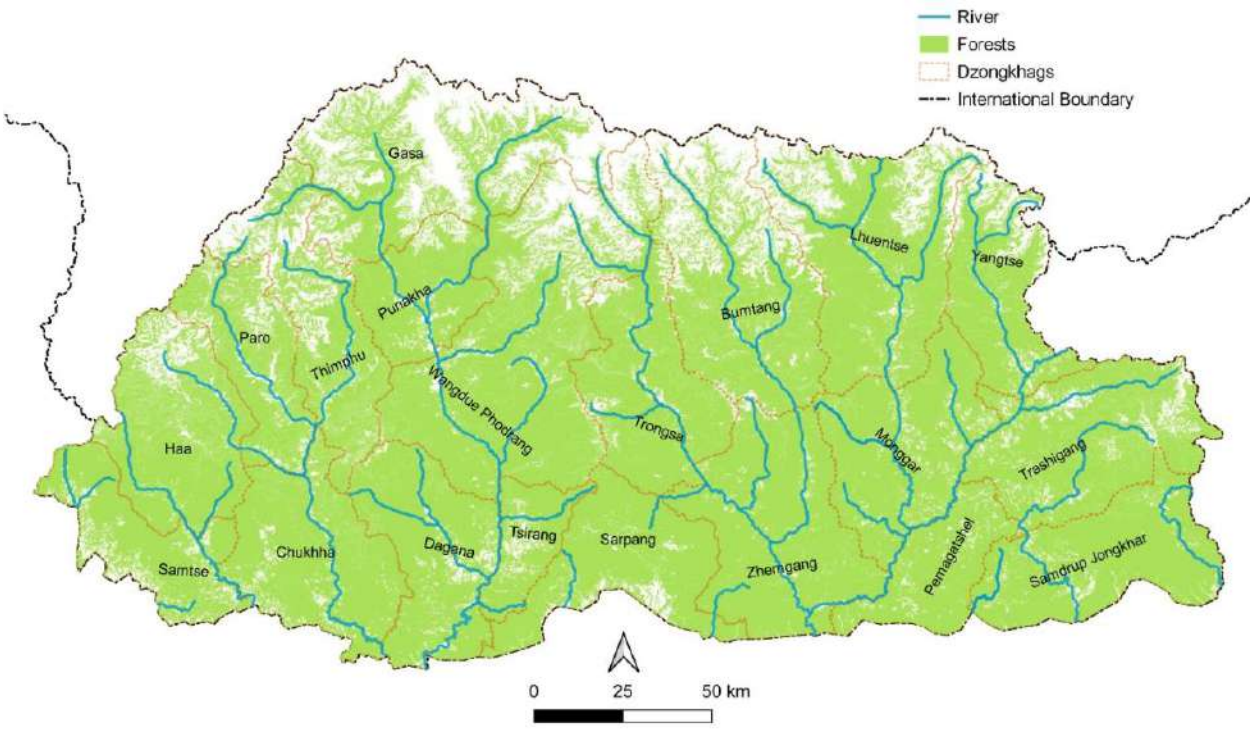
Timber exports should be allowed, if auctioneers fail to find buyers after two auctions. Cattle should be promoted for marginal land holders and rice exports allowed for high end destinations.

2.7.5 SCIENCE & SERVICE

MoAF based research outfits should prioritize service provision to farmers while ensuring that research priorities are tabulated. Such tabulated research priorities should then be outsourced to competent RUB based Colleges or CSO counterparts. Annual research grants may be provided by the RGoB for key challenges which needs to be scientifically addressed. In particular, for crops of strategic importance for Bhutan, professorial Chairs at RUB or private colleges should be endowed, to take up long term research of strategic interest.

2.7.6 PROTECT FORESTS, BIODIVERSITY, CATCHMENT AND ECOSYSTEM SERVICES

Bhutan's forests are integral to ensuring water, energy and a vital ecosystem services. Importantly, forests which sequester close to 8.5 million tons of CO_2e annual GHG emissions, keep Bhutan carbon negative.



A comprehensive project to ensure protection of Bhutan's forests from increasing climate risks should be developed and implemented.

2.7.7 SAVE AND MANAGE INDIGENOUS AND HEIRLOOM BREEDS

In the pursuit of growth and yield improvement, Bhutan has lost many native and indigenous varieties and breeds, of both crops and livestock. On-going efforts at the NBC to conserve indigenous and heirloom breeds of crops, livestock and wild biodiversity, should be sustained and strengthened. This will be particularly important as climate change impacts may necessitate development of novel varieties based on endemic origins.

Chapter 3: THE ROADMAP

Recognizing Bhutan's imminent graduation to a lower middle income country, a phased approach for implementing the strategy is recommended.

3.1 INVESTMENT PLANNING | 2022 – 2023

Investment plans should be detailed out for 10 big ticket initiatives:

- Operationalise commercial rice and honey farms and production of priority crops (employing mega-hydroponics)
- Transition to abundant production of safe and affordable meat, diary and eggs
- Finance private sector participation for establishing agro-based enterprises and industries
- Reform and ensure input sufficiency (seeds, feed, fertilizer, crop protection materials)
- Revive smallholders and raise farm incomes by minimising human-wildlife conflict and climate proofing farms
- Modernise the timber industry, promote 'build with wood', and ensure protection of forests and catchment areas
- Expand farm infrastructure and establish the infrastructure fund
- Develop markets and standards for a prioritized list of produce:
    - Bhutan Wild Honey
    - Bhutan Buckwheat
    - Cardamom, ginger, oranges, apples, potatoes
- Establish the RNR Big Data Center, and restructure service and science delivery
- Operationalise a nation wide 'Crop and Livestock Insurance' scheme

From July 2022 till June 2023, the big ticket initiatives should be designed into project proposals with clear fiscal requirement outlays.

Furthermore, all project elements and strategic priorities stipulated in this strategy should be incorporated into sectoral and agency plans with clear targets, deliverables, and implementation frameworks. Funding should be sought on a priority basis, and committed by 2023, to ensure implementation of all key and priority programs and projects.

3.2 EXECUTION 2024 – 2028

The strategy should be translated into projects and actionable programs which reaffirms commitment to meeting the broad goals of the strategy. All projects should be ready for implementation starting early 2024, a year and half hence.

Project and program implementation should align itself to addressing key challenges, **and the RNR sector should focus attention and energy on meeting strategic priorities. Protection of smallholders should be guaranteed while transitioning to, and scaling up, commercial and next gen farms. Science and big data should be leveraged to build efficiencies and remove redundancies.**

Key infrastructure should be expanded and **financing made widely accessible to truly enable private sector growth and participation.** Policy shifts should be accelerated to enable ease of private sector participation.

The RGoB will foster and leverage partnerships to build synergies along the entire RNR value chain. A farmer and private entrepreneur first approach will be adopted, and information and services ramped up, to empower farmers and youth, thereby trebling farm incomes by 2030. Farming will be increasingly viewed as a business enterprise and farmer advisory services will be tailored to maximize RoIs.

Using the established Big Data framework, the RNR sector will be nimble, adaptive and flexible. The sector, harnessing the power of real time analytics, will proactively track progress, contain and address issues, and ensure the rapid transformation of the sector to create significant value for Bhutan.

3.3 CONSOLIDATION & SCALING UP 2029 – 2030

The RNR sector acknowledges the rapid pace with which world is radically advancing and evolving. Following a five-year implementation of game-changing strategic priorities, the sector will build on on-going analyses, synthesise lessons learnt, and urgently chart the next trajectory. Where needed, radical course corrections will be made. Inefficiencies will be weeded out, and resetting of delivery mechanisms and institutional arrangements, will be swiftly carried out. There will be immediate and expanded scaling up of successful initiatives. And a renewed, far-reaching and wide-ranging post 2030 RNR strategy will be crafted, to continue delivering significant impacts from the RNR Sector for Bhutan and her people.