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RNR Strategy 2040



March 2021

Ministry of Agriculture and Forests
Thimphu

Proclamation



“Throughout the centuries, the Bhutanese have treasured their environment and have looked upon it as the source of life. This traditional reverence for nature has delivered us into the twentieth century with our environment still richly intact. We wish to continue living in harmony with nature and pass on this rich heritage to future generations”

“Agriculture is not just an industry for Bhutan but also an important source of culture in Bhutan. If the power of agriculture were to decrease, so would the power of country”

- His Majesty Drukgyal Zhipa

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Foreword



I am delighted and privileged to present the RNR Strategy 2040, which outlines the strategic visions and goals of the RNR sector that will facilitate the sector to accomplish aspirations of the country and farming families of Bhutan. It also sets strategic directions to realize the full potential of RNR sector in fulfilling the mission and mandates bestowed by His Majesty the King, Constitution and the people. The Royal decrees and pronouncements have persistently guided the RNR sector in conserving the natural environment, maintaining food self-reliance, and promoting pervasive socio-economic development. For all times to come, such pronouncements

will be the cornerstone of RNR sector development.

The strategic themes of RNR Strategy 2040 (*environmental sustainability, food and nutrition security, agri-business and employment opportunities, sustainable intensification, rural infrastructures, agricultural technologies, biodiversity access and benefit sharing, and climate change*) provides focus areas of our commitment to bring about transformational change in the RNR sector. In particular, the strategy calls for concerted efforts towards building a resilient community through more proactive climate action in the sector. Our strategies aim to accomplish the strategic results of “*ensuring safe and healthy environment, achieving food self-reliance, Competitive agriculture value-chain and enhancing inclusive socio-economic well-being*” thereby realizing the RNR vision 2040 “*Sustainable natural resources and self-reliant food systems contributing to inclusive socio-economic well-being of Bhutanese*”.

Sustainable natural resource is the foundation of resilient socio-economic well-being and self-reliant food systems in Bhutan.

To realize the strategic results, RNR sector will have to develop enabling institutional framework and service delivery mechanisms in which the human, financial and physical resources are judiciously deployed to fast-track attainment of excellence in research, technology dissemination and adoption, sustainable growth in environment and economy. Further, to objectify the strategies, sector will need strong support of the government and the development partners in securing matching level of funding backed by compatible legal frameworks.

I am more than confident that, with the guidance of our benevolent Kings, the government, unwavering support of all the development partners, commitment of RNR bureaucrats and professionals, and entrepreneurial farmers, youth and private sector, the RNR sector will achieve the set goals and surpass its mission and accelerate the national economy.

Yeshey Penjor
MINISTER

Foreword

RNR sector, over the past eleven FYPs have fostered socio-economic growth and development while ensuring sustainable environment and natural resources which served as enduring foundation for the national well-being. Within the realms of Gross National Happiness and as the principal warden of our environment, RNR sector is proud to present the RNR Strategy 2040 which defines innovative resilient strategies and sets impact pathways to yet higher goals of development.



After a successful accomplishment of Vision 2020 (commitments related to RNR sector), the sector initiated the process of developing RNR Strategy 2040, as a contributory sectoral segment to the overall national strategy. The process of formulating the RNR Strategy 2040 has indeed given us the opportunities to pause and take stock on past achievements and challenges, and motivated us in crafting future vision, mission and strategies. The process has been divulging and educative, helping to develop not only reactive strategies to the emerging changes but also all-encompassing collectively driven environmental, social and economic transformation.

As a technical, interdisciplinary and service oriented sector, RNR development has to be strongly grounded on science, innovation, evidence and people-centric. With the large farm-based beneficiaries, the sector has to aggressively engage communities in designing and implementation of development interventions. The strategy document reflects the priorities and direction for the RNR sector going forward and will be the basis for the sectoral development plans. The implementation of this strategy will need sizable resources (human, financial and physical) and enabling environment. While the sector is endowed with qualified manpower and network of infrastructures developed over the past plans, it will be crucial for the Ministry to source and secure financial resources to implement the proposed initiatives. We are hopeful of the generous support of the government and our development partners in facilitating our endeavor to fulfill the national goal of healthy environment, secured food self-reliance, and enhanced well-being.

The RNR Strategy 2040 represents the concerted efforts of all the sub-sectors, agencies and secretariat of the Ministry of Agriculture and Forests, whose invaluable inputs have helped in shaping this forward looking and transformational strategy. Let me take this opportunity to express my appreciation to all the professionals for their inputs in drafting the Strategy document. I would also like to thank, in particular the Hon'ble Agriculture Minister for his constant guidance and support in redesigning this strategy into short/medium/long term strategies for seamless positioning of RNR development in the overall national development agenda.

Rinzin Dorji
SECRETARY

Executive Summary

Bhutan, the land of Gross National Happiness and the global leader in environmental conservation, have innately maintained harmony with natural environment over centuries by embracing ethics of holistic integration of agriculture, livestock and natural environment. The Bhutanese social landscape is a true representation of the alliance of man in the realm of nature, deriving livelihood¹ from the natural resources. Bhutanese society broadly demonstrate harmonious biosphere idolizing the five elements (ལྷན་སྐྱེ) in the livelihood system. Rationally hence, the agriculture, livestock and forest in Bhutan together comprise Renewable Natural Resources (RNR) sector², depicting an integration of primary sector of economy. More than vital component of social and cultural fabrics of the country, RNR sector is reckoned as one of the five Jewels of national economy.

Securing safe and healthy environment, ecologically balanced sustainable development, economic self-reliance, private sector engagement, and adequate livelihood are the constitutional mandate that the RNR sector upholds. Advent to the 1st FYP, RNR sector has consistently contributed to environmental conservation, enhancement of rural income, employment generation and alleviating poverty, thereby boosting the general well-being of farming population. From the start of the planned development in 1961, RNR sector progressively contributed to national GDP. In absolute term, sectoral GDP increased from Nu. 1729.78 million in 1998 to Nu. 24,971.15 million in 2017 registering an increase of 1344 %. The contribution of RNR sector is far beyond what is accounted in the GDP, since the environmental services the sector provide is colossal. According to Kubiszewski *et al.* (2012) natural resources in Bhutan contribute roughly Nu. 700 billion per year in the form of ecosystem services. If these benefits are precisely valued and integrated into the national economy, RNR sector's contribution to GDP will amplify. Several studies (*Annexure 1*) on future scenarios of RNR commodities have shown potentials to increase food production and socio-economic benefits without impairing the natural environment.

¹ A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base. (Chambers & Conway, 1991).

² Ministry of Agriculture and Forests

Bestowed with nationally important and far-reaching mandates of environment and food security, and concurrently confronted with perils of climate, trade, biotic and abiotic stresses, and political environments, RNR sector needs to be strategically positioned to deliver the espoused sectoral mandates. Moreover, the sector has to be mindful of regional and international commitments, and global innovations in agro-technologies and ICT in formulating sectoral strategy. Poised by the mandate, guided by the GNH philosophy and global commitments, the sector has set a well-balanced mission of “**ensuring sustainable social and economic well-being of the Bhutanese people through adequate access to food and natural resources**” by 2040.

Although the sector has adequate human and financial resources, it is constrained by strategic issues of frequent organizational review, policy conflict, ad-hoc derailment of plans, lack of cascading plans, exclusion of stakeholders, and absence of objective monitoring and evaluation. Additionally, the lack of accounting ecosystem services provided by the sector reflects it as non-performing sector. The take-up of commercialization drive has been very slow without any snowballing effect, as it encountered the challenge of informal value chains often shielded by deceptive practices. In general, excessive focus on small-holder farmers and exclusion of private sector has restrained innovation, mechanization, promotion of smart technologies and expeditious expansion of scale of production.

To actualize transformational change in the sector, RNR Strategy 2040 proposes eleven strategies (i) enhance production and quality of RNR commodities, (ii) enhance contribution of RNR sector to national economy, (iii) accelerate agri-business development and expansion, (iv) develop enabling policies for RNR sector, (v) strengthen research, innovation and dissemination, (vi) institute efficient RNR service delivery, (vii) enhance production efficiency of RNR commodities, (viii) promote research and innovation, (ix) diversify sustainable financing for RNR sector development, (x) mainstream sustainable management (conservation and utilization) of natural resources and (xi) enhance and promote resilience to climate change impacts to achieve the vision of “*Sustainable natural resources and self-reliant food systems contributing to inclusive socio-economic well-being of Bhutanese*”. There are 114 initiatives congruent to the 11 strategies identified by different sub-sectors spread over short term (5 years), medium term (10 years) and long term (20 years). Based on the prioritization, 75% of the initiatives were identified for the

short-term intervention, followed by 13% and 11% intervention slotted for medium-term and long-term respectively based on the ease of implementation and stakeholder benefit. The total financing requirement to implement the initiatives is projected at Nu. 21641million. The budget is also rationally distributed over short, medium and long term with 35%, 36%, and 29% respectively to maintain continuum of the initiatives. Following the past financing of RNR programs, the RNR strategy 2040 can feasibly be financed through multiple approaches of (i) public investment, (ii) grant assistance, (iii) soft loan (domestic/international financial institutions), (iv) private sector investment, and (v) foreign direct investment.

The strategic framework and map evidently present the logical flow and cause-effect relationship of the strategic objectives leading to achievement of three strategic results of (i) safe and healthy environment, (ii) self-reliant food system, and (iii) inclusive socio-economic well-being thereby accomplishing the RNR sector vision by 2040. The past trends of support by the state and the development partners, is a convincing demonstration of assured support for the future initiatives embodied in the 114 initiatives of RNR Strategy 2040.

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Abbreviation

ABS	Access and Benefit Sharing
AFD	Administration and Finance
AMIS	Agriculture Market Information Systems
ARDC	Agriculture Research and Development Centre
BAFRA	Bhutan Agriculture and Food Regulatory Authority
CAC	Codex Alimentarius Commission
CBD	Convention on Biological Diversity
CBNRM	Community Based Natural Resource Management
CF	Community Forest
CO ₂	Carbon dioxide
CoRRB	Council for RNR Research of Bhutan
CPB	Cartagena Protocol on Biosafety
CSO	Civil Society Organization
DAMC	Department of Agricultural Marketing and Cooperatives
DoA	Department of Agriculture
DoFPS	Department of Forests and Park Services
DoL	Department of Livestock
DOS	Directorate Services
EDP	Economic Development Policy
ESP	Elementary Service Personnel
FAO	Food and Agriculture Organization
FCB	Food Corporation of Bhutan
FDI	Foreign Direct Investment
FGs	Farmer Groups
FMBC	Fish Museum & Biodiversity Centre
FMU	Forest Management Unit
FMCB	Forest Management Code of Bhutan
FNCA	Forest and Nature Conservation Act
FNS	Food and Nutrition Security
FRMD	Forest Resource Management Division
FYP	Five Year Plan
GALS	Giant African Land Snails
GAP	Good Agriculture Practice
GDP	Gross Domestic Product
GHP	Good Hygienic Practices
GMO	Genetically Modified Organism
GHP/GMP	Good Hygienic Practice/Good Management Practice
GNH	Gross National Happiness
GSP	General Service Personnel
Ha	Hectare
HACCP	Hazard Analysis and Critical Control Point
HR	Human Resource
HRD	Human Resource Development
HWC	Human Wildlife Conflict
ICT	Information and Communication Technology

ICTD	Information and Communication Technology Division
IHDP	Integrated Horticulture Development Project
IHR	International Health Regulations
INFOSAN	International Food Safety Authorities Network
IPCC	Intergovernmental Panel on Climate Change
IPPC	International Plant Protection Convention
IVR	Interactive Voice Response
KPIs	Key Performance Indicators
LFMPs	Local Forest Management Plans
LMO	Living Micro Organism
MAP	Medicinal and Aromatic Plants
METT	Management Effectiveness Tracking Tool
MoAF	Ministry of Agriculture and Forests
MRV	Measurement, Reporting and Verification
NBC	National Biodiversity Center
NFSR	National Food Security Reserve
NITM	National Institute of Traditional Medicine
NPHC	National Post Harvest Center
NPPC	National Plant Protection Center
NR	Natural Resource
NSB	National Statistical Bureau
NSC	National Seed Center
NSSC	National Soil Service Center
NWFP	Non-Wood Forest Products
ODE	Organizational Development Exercise
PA	Protected Area
PES	Payment of Environmental Services
PPD	Policy and Planning Division
PPP	Public Private Partnership
PSL	Priority Sector Lending
R4D	Research for Development
R&D	Research and Development
RDTC	Rural Development Training Center
REDD+	Reduce Emissions from Deforestation and Forest Degradation plus the sustainable management of forests, and conservation and enhancement of forest carbon stocks
RMA	Royal Monetary Authority
RNR	Renewable Natural Resources
SDG	Sustainable Development Goal
SDSS	Spatial Decision Support System
SFM	Sustainable Forest Management
SOP	Standard Operating Procedure
SPS	Sanitary and Phyto-sanitary
TA	Technical Assistance
UWICER	Ugyen Wangchuck Institute for Conservation and Environmental Research
WTO-SPS	World Trade Organization-Sanitary and Phytosanitary Agreement

RNR Development in Bhutan

Over the past 112 years (1907 to 2019) of benignant reign of Golden Throne, Bhutan has seen a rapid agricultural transformation, from a nomadic farming (shifting cultivation-*Tseri*) to a sedentary, modern and increasingly productive farming. Based on the historical timeline, agrarian transformation in Bhutan can be classified into three phases as (i) 1907-1970: Subsistence farming by predominantly shifting cultivators, (ii) 1970-1990: self-subsistence to part commercial, and (iii) 1990-2020: integrated and semi-commercial farming. As farming developed and transformed, so did incomes, livelihood, health, education, and economies. In the last few decades, agriculture experienced credible progress driving the economic development. The systematic planning since 1960s, introduction of legal and policy frameworks, modern technologies and machineries helped improve production of crops, livestock and improved management of natural resources. Bhutan has successfully maintained 71% of the country under natural forest cover (FRMD, 2018), representing a sink for carbon sequestration and making the country carbon-negative. Bhutan also achieved self-sufficiency in fruits (132%), potatoes (162%) and eggs (100%) and self-sufficiency

Box 1: Overview of RNR sector from 1st to 12th Plan

RNR Sector outlay against National outlay (%)	FYP	RNR GDP (%)	Farming Population (%)	RNR Sector focus
6.2%	1 st			Establishment of DoA and DoL (DoF-1951)
17.0%	2 nd			Self-sufficient food production, Nature conservation
23.3%	3 rd			Agricultural intensification and natural resources
38.9%	4 th			Agriculture as economic driver and natural resources
13.5%	5 th			Food Self sufficiency and natural resources
17.0%	6 th			Food self-sufficiency and natural resources
15.6%	7 th	38%	87%	Food self-reliance and natural resources
12.0%	8 th	33%	87%	National food security and natural resources
6.5%	9 th	28%	87%	National food security, and natural resources
5.5%	10 th	18%	63%	Market-Access-Production, Poverty reduction, and natural resources
4.1%	11 th	16%	57%	Food and Nutrition security and natural resources
2.6%	12 th	17%	54%	Sustainable food system and natural resources

in other commodities are on progressive trajectory (MoAF, 2016). This quantum jump in production is directly commensurate to the priority and investment in RNR sector (Box 1). After eleven Five Year Plan periods (1961 to 2018), agriculture continues to be a major source of employment with staggering 51.1% of its population in farming of which 61.7% are female (LFS, 2019). Further with more than 60% of population living in rural areas, the sector is recognized as vital to promote equitable development through enhancing rural prosperity and poverty alleviation. Further, Bhutanese farming continues to be highly integrated with low external input system where the use of synthetic fertilizers or pesticides is minimized maintaining yields through greater emphasis on integrated pest management and efficient utilization of on-farm resources. One of the prominent achievements of development is the alleviation of poverty from 23.2% in 2007 to 8.2% in 2017. As one of the first public sector organization instituted in 1960s, over the past 6 decades, RNR sector has evolved into one of the biggest ministries with complete reach-out in all gewogs and dzongkhags with skilled manpower and infrastructures. In particular, RNR sector is well equipped with necessary policy and legal frameworks to service the nation, environment and the rural population.

Despite the impressive progress, there are also some serious challenges and undesirable consequences to some of the initiatives. Furthermore, parallel to the overall socio-economic development, the inevitable pressure on land leading to decline of cultivable land vis-à-vis the natural resources (water and forest litters) has curtailed agricultural expansion. Certain incoherence in policies has unintentionally resulted into mounting human-wildlife conflict, population drifts, abandonment of farmland and house, feminization of agriculture, farm labour shortage, increasing farming cost and looming scale of production. These factors along with declining public investments in RNR sector have led to decline in agriculture sector's share of GDP from 24% in 2004 to 15.89% in 2018 (National Accounts Statistics, 2019). The emergent features of unattended farms and poorly managed infrastructures have made community and rural areas increasingly inhospitable and vulnerable to climate change, natural calamities and vagaries of market forces. The population drift from rural to urban area is gradually causing steady surge of unemployed and non-farming population, which is forbidding to the economy with diverging consequences of food insecurity, unemployment and deserted rural areas.

The finite growth of secondary and tertiary sector in the country curtailed by the exploitable natural resource base, provides a vital signal to invest in agriculture sector that promote equitable development through enhancing rural prosperity, poverty alleviation and conservation of natural environment. More specifically, development of agriculture sector implies increased production and productivity of crops, livestock, conservation of environment, generation of employment opportunities, and thereby improved living standard of the peasants. More pertinently, investment in Bhutanese agriculture sector will have direct influence on the following strategic areas (Figure 1):

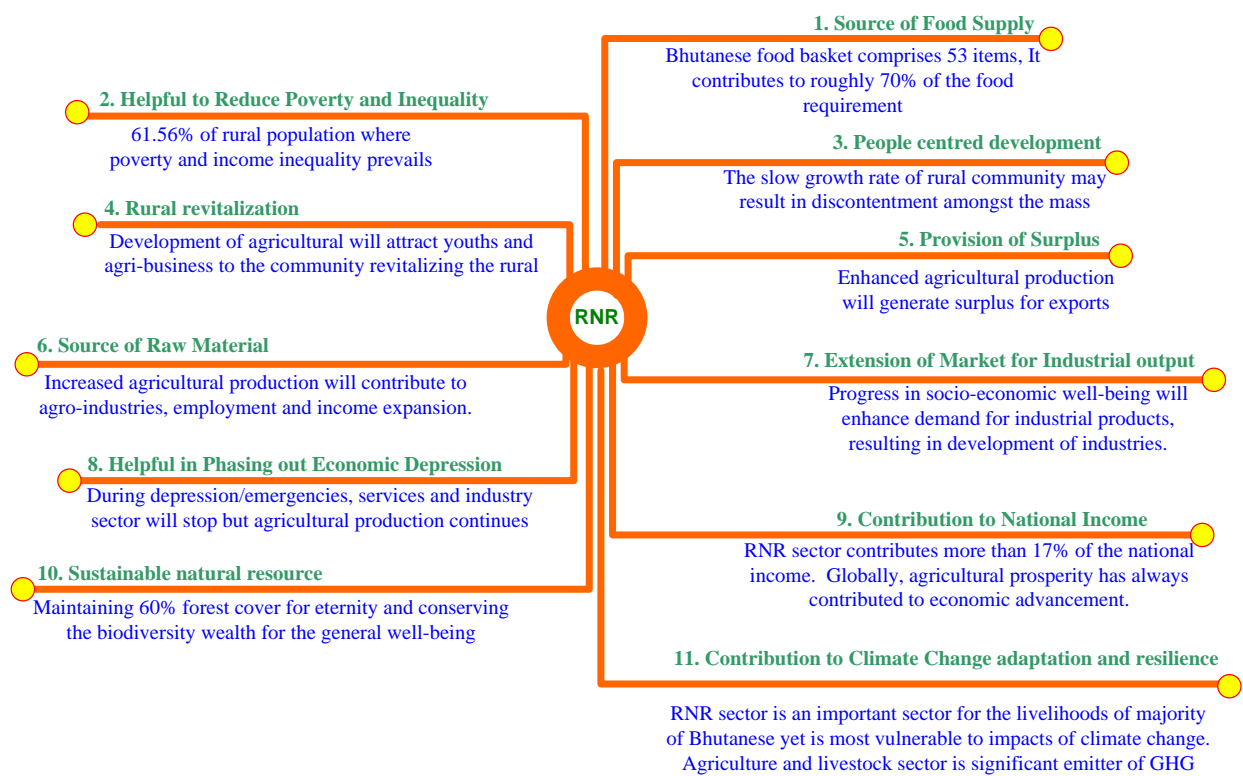


Figure 1: Eleven strategic reasons for supporting RNR Sector

RNR Sector at a glance

The Renewable Natural Resources (RNR) comprise natural resources that can be replaced or replenished by natural processes or human actions. Plants/crops, animals/livestock, forests and the whole range of biodiversity are renewable natural resources. Some aspects of the environment such as soil quality, assimilative capacity (of water and land) and ecological support systems are called semi-renewable because they are regenerated very slowly on a human time scale. In Bhutan, the RNR sector is defined to comprise both fully-renewable and semi-renewable natural resources. The Ministry of Agriculture and Forests (also referred as RNR Sector) comprise four technical departments (Agriculture, Livestock, Forests and Park Services, and Agricultural Marketing and Cooperatives), 2 non-departmental agencies (BAFRA and NBC). Ministry also has Secretariats (PPD, RDTC) and Directorate Services (RSD, HRD, AFD, Legal, ICTD) which supports operations of the Ministry.

Forests and Natural Resources

Bhutan's "green" approach to development founded on the philosophy of Gross National Happiness and more particularly the local values, culture and religious beliefs of coexistence with nature has helped in maintaining remarkably stable forest health and cover. Forest occupies 2,730,889 ha accounting for 71% of the total geographical area of the country with a tree density of 213 per hectare (FRMD, 2016). Forest in Bhutan is predominantly broad-leaved forest with 50% coverage (1.928 million ha) and 20% coniferous forest (Box 2). The estimated forest biomass of about 973 million tonnes serves as a significant terrestrial carbon sink amounting to 457 million tonnes of carbon (FRMD, 2020). The forests of Bhutan show a wide range of ecological variation and species diversity. To ensure sustainable conservation of rich biodiversity, Bhutan has designated 51.44% geographical area under protected area.

Box 2: Forest cover in Bhutan

Subtropical Forest	6%
Fir Forest	9%
Warm Broadleaved Forest	18%
Bluepine Forest	4%
Chirpine Forest	3%
Cool Broadleaved Forest	26%
Evergreen Oak Forest	1%
Spruce Forest	1%
Hemlock Forest	2%
Juniper-Rhododendron Scrub	1%

Forests provide a wide variety of social and economic benefits, ranging from easily quantifiable economic values associated with forest products, to less tangible services and contributions to society. Since 1963, forest management plans were developed to sustainably extract forest resources. The forest share of GDP was 16% in 1981 which decreased to 10% in 2000, and further plummeted to 2.6 in 2015 (Dhital 2009, NSB 2018). Though the direct revenue from forestry sector decreased drastically due to the policies of banning timber export, subsidized supply of timber to rural people, conservation priority, and rise of other sectors in generating revenue, the indirect contribution is immense. Hydro power and tourism industry, both of which are strongly correlated to the pristine natural environment are today, the top sources of revenue (NSB, 2018).

Community based Non-Wood Forest Products (NWFP) enterprises provide an alternative source of livelihood. NWFPs such as cane, bamboo, cordyceps, daphne paper, honey, incense, lemon grass oil, medicinal fruits and plants, mushrooms and spices were promoted in Bhutan under ‘one gewog three products plan’ in 10FYP and are one of the major commodities used for income generation in rural Bhutan. Livestock grazing and fodder collection is also an important aspect of NWFP. Traditional medicines are widely practiced and medicinal plants form an important source of income for the people. There are over 300 species of medicinal plants throughout Bhutan which are being used by National Institute of Traditional Medicines (NITM) and local healers. Sustainable harvesting of the medicinal plants forms an integral part of rural livelihood options. Today, close to 166 NWFP groups are formed engaging over 6106 households from 17 dzongkhags in benefit sharing from the diverse NWFPs. To promote community engagement and ensure sustainable management, 804 Community Forests covering 99,146 ha is managed by 33,281 households (FRMD, 2020).

Endowed with vast natural resources and only 7.3% of the forest area under commercial management, forest sector is often considered as underutilized sector of the economy (World Bank, 2019) with a negative growth of 1.01% in 2018 and dwindling contribution of only about 3% to GDP per year (NSB, 2018). Forests in Bhutan offer tremendous potential to be productive without jeopardizing the national commitment to conservation and ecological resilience. From the national perspectives, it is vital to formulate short, medium and long-term strategies to modernize the sector to harness multiple benefits it can offer.

Crop Production Systems

Bhutan was traditionally considered to be self-sufficient in cereals (5th FYP Document) with small surplus traded with Tibet for salt and wool (Kuensel, 2015). Food self-sufficiency discussion in Bhutanese development emerged as early as 2nd FYP (1966-70). Nonetheless, the RNR Sector has observed a significant transition in its national goal of achieving food self-sufficiency over the years, achieved through myriad interventions to aid production and productivity albeit the food and agriculture sector facing challenges in the recent past. Despite unprecedented evolution and progress in self-sufficiency policy over the decades, Kuensel (2015) reports food trade deficit of Nu 5.2B in 2013, as the deficit widened by 24% from 2012, mainly on account of increasing rice imports.¹² The 2007-08 food crisis that ‘brought higher and more volatile food prices’¹³ (FAO 2015-16, p. 1) had many countries expressing ‘increased interest in pursuing policies to bolster their levels of food self-sufficiency’ (ibid). Bhutan’s support to fulfil the national objective of food self-sufficiency received even utmost importance ensuing to crisis. At the same time, role of food imports needs to be recognized as they are as equally (if not less) important for enhancing the food and nutrition security. This is important especially for Bhutan with extreme geographical conditions and topography where agriculture land is limited coupled with other technical challenges for producing all the required food domestically. Role of imported foods need to be recognized to fill the gaps as BLSS (2017) reported that on average, households spend 20% of their food budget on dairy products, 13% on vegetables, 10% on rice, 10% on other cereals and pulses, and 10% on spices and seasonings.

Box 3: Opportunity for commercial farming

“We spend Nu. 8 billion annually to import food. To cite an example, we export potatoes and oranges, and then import potato chips and orange juice. From this, it is evident there are many opportunities for entrepreneurship and commercial farming in our country. In addition, our youth are educated, capable and enthusiastic. We must ask ourselves then, where we have gone wrong.”

His Majesty the King
(17th December 2016)

Dru-na-gu (rice, maize, wheat, barley, buckwheat, millets, pulses, oilseeds and amaranth) forms an important component of Bhutanese agriculture and food system which is still prevalent and recognized in the farming systems. Overall, the major production systems in Bhutan are pastoral production system, wetland production system, dry land production system, and orchard or plantation production system. Across these production systems, farmers have selected and

cultivated a wide array of crops and varieties that have adapted to the micro-climatic niches. Relative to its small size, Bhutan has considerable diversity of agricultural crops, varieties and agro-ecosystems. The land use, farming systems, crops cultivated, opportunities and challenges in agriculture are predominantly dictated by climate, topography and altitude. The major cropping systems of Bhutan are rice-based, maize-based and potato-based depending on the main crop and land type. Technology and innovation have had a major impact in agricultural transformation in Bhutan. In the last three decades (1988 to 2017), DoA has introduced, evaluated and released 89 improved fruit plants, 52 field crop varieties and more than 84 vegetable varieties to farming communities; and de-notified 28 vegetable varieties (ARED, 2018). For instance, improved rice technologies lead to an increase in national rice output by 5000 to 10000 tons per year (Shrestha, 2004). The productivity gain from 1981 to 2017 was 105%. Similarly, adoption of improved maize varieties by 60% of the surveyed households and planted to 49% of the total maize area (Katwal, 2006) helped in expanding maize production.

It is evident from the first plan, that the focus of horticulture development has been on few cash crops (apple and potato in the temperate region; citrus and cardamom in sub-tropical region; and the promotion of a small-scale vegetable cultivation across the country) and not on developing the whole sector (IHDP, 1992). The Integrated Horticulture Development Program (1994-2003) brought about a major development in horticulture. Building on IHDP initiatives, every subsequent plan has adequately funded horticulture development, resulting into attainment of higher vegetable self-sufficiency and export of fruits.

Over the years, crops and crop production has been constrained by socio-cultural (low level of literacy, subsistence nature of farming, land fragmentation/degradation, wildlife damage), technological (limited technology options, low technology uptake capacity) and institutional (access to credits, inputs and markets) factors. Although the agriculture sector directly employs 51.1% of the population (LFS 2019) and contributes to about 70% of the total food need, farming especially crop sector is confronted with acute shortage of farm labour. Shortage of farm labour is mainly attributed to out migration of rural population, which is prompted by drudgery and high risk involved in farming, better economic option provided by the growth of other sectors (service and manufacturing) and also the lack of modern facilities in rural areas.

Farm mechanization as labour saving technologies gained importance from the 5th Five Year Plan. Farm mechanization is broadly understood to encompass all levels of labour-saving technologies from basic hand tools to externally powered machines. Today, farm mechanization is generally accepted as the solution to many emerging issues such as unemployment and the growing farm labour constraint and the drudgery associated with it. Some of the most popular farm machines are power tiller, tractors, harvesters, threshers, transplanting machines and many hand tools. Many of these are established as rural based small-scale business enterprises.

In view of the slow technological uptake and inadequacy of technological innovation to enhance efficiency of agriculture production system, a definitive focus of aggressive innovation and dissemination is necessary. Additionally, necessary support to all stakeholders in agriculture sector will be crucial to achieve the goal of food self-reliance.

Livestock

Livestock plays an integral role in the lives of Bhutanese farmers and it forms an indispensable component of the agricultural production system in Bhutan. Livestock are raised in Bhutan for various reasons including milk, egg, meat, and manure production, draught power as a source of income and as assets. Livestock provide both tangible benefits such as milk, egg, meat and intangible benefits such as manure and draught power for farming. The tangible benefits in absolute value amounts to Nu 3.739 billion and intangible benefits was Nu: 4.634 Billion in 2017 (DOL, 2017). Livestock is vital to improve rural livelihood, secure household food and nutrition security and boost income. Livestock contributes 4% to the national GDP, and it has been estimated that about 22% of rural household income is produced from the rearing of livestock (MoAF, 2009).

The self-sufficiency in dairy products has increased from 68 to 84% during the 11thFYP. In egg production, the 100% self-sufficiency was maintained throughout the plan period. In chicken production, there is 15% increase in the production within the plan period. Although there is social stigma in the meat sector, there was a substantial increase in the pork production by 20%, in fish production by 9% and 34% in Chevon production.

In terms of volume, the domestic meat production is dominated by chicken and pork which accounts to 39.66% share and 29% share respectively. The boost in domestic livestock production during the past plan periods are mainly attributed to the introduction and uptake of improved livestock breeds and farming technologies with efficient animal health and nutrition delivery services. From 2011 to 2018, the sub-sector also pursued climate smart livestock farming and has promoted more than 6087 domestic bio-gas plants in fourteen Dzongkhags.

Though, the livestock sub-sector has made tremendous achievement, it is confronted with many challenges such as social stigma in meat sector and increasing pressure on the limited land for improved pasture development to ensure balanced livestock feeding. The encroachment of rangeland resources with highly un-palatable shrubs and species is quite evident and has led to degradation of most of the areas despite the effort from the department to restore them. However, it is yet to be quantified through scientific research. Another challenge faced is on free livestock grazing through extensive farming vis-à-vis on forest bio-diversity and environment concern. However, the impact of forest grazing through free range livestock farming system is not yet quantified. To overcome such challenges, high yielding and productive breeds of livestock are promoted under stall feeding practices and further upscaling production efficiency in the livestock sector through mechanization and automation.

Biodiversity Conservation and Sustainable utilization

Conservation has always played a pivotal role in Bhutan's development history and concern for the natural environment and biological diversity is deeply embedded in Bhutanese traditional beliefs, socio-cultural outlook and the overarching development philosophy of Gross National Happiness. However, there is a strong and urgent need to be cognizant of the fact that in the phase of increasing erosion of biodiversity in the neighboring countries due to constant struggle between conservation and development, ever-expanding population and the threat of changing climate, the value of Bhutan's biological resources will increase in terms of relative importance. This presents numerous opportunities for deriving benefits from sustainable utilization of rich biodiversity. Bhutan has one of the most rugged terrains with diverse altitudinal range and climatic conditions. Crop diversity and genetic diversity within species is important to adapt to this diverse and heterogenous agro-ecological zones of Bhutan. The importance of crop diversity and genetic

diversity is gaining more importance than ever before as part of climate change adaptation and mitigation measures. Given these considerations, it is imperative that due importance be accorded to strengthening national capacities particularly in developing a sound scientific knowledge base of the country's rich biological diversity and tapping the opportunities from biodiversity for effective conservation and utilization of our biological resources in a sustainable manner. Therefore, it has become of utmost importance that the country establishes and strengthens measures that will enable it to benefit from its rich biological resources and promote leadership of people at grass root level in conservation. Key interventions and initiatives include: tapping the potential of biodiversity resources through a strengthened bioprospecting and sustainable utilization program; Conserving genetic diversity of traditional crop varieties and animal breeds to harness it for food security, enhanced livelihoods and to build national resilience to climate change through both ex situ and in situ (on-farm) conservation programs; Preventing the increasing erosion and loss of traditional knowledge and culture associated with biological resources and harnessing it for sustainable utilization and conservation of biological resources; Strengthening biodiversity information and knowledge base and Improving public awareness on the value of biodiversity.

Biosecurity and Food Safety

With the global food supply chain becoming highly interconnected and logistically efficient, the vulnerability to emerging biosecurity challenges is escalating in countries where biosecurity system and Sanitary and Phytosanitary (SPS) measures are not well-established. The threats of foodborne illness and emerging disease and pandemics linked with zoonosis have prompted Bhutan to institute biosecurity and food safety response systems for the protection of plant, animal and human health, following the '*One Health*' approach. As our food system is import-dependent, securing our food systems against any risk of exposure to biosecurity and food safety threats is vital. Additionally, as Bhutan is endowed with rich biodiversity, its protection from such threats is within the premise of sustainable development. Biosecurity risks are also increasing due to increased global trade and travel, increased agricultural expansion and intensification, increased urbanization close to farmlands, and other factors such as climate change.

Bhutan has been witnessing increased trade of plants, animals and their products over the years. Such trade has associated risks as they may serve as a pathway for the introduction and spread of

exotic pests and diseases. Bhutan has recorded several outbreaks of transboundary diseases and emerging invasive species over the years, some of which may have been introduced and established through the imports. In addition, other consequences of under-resourced and neglected plant and animal biosecurity systems in the country is the introduction of *Cryptomeria*, *Poplar*, *Thuja* and *Eucalyptus*, Brucellosis, Avian Influenza, Rabies, etc., and its rippling effects to the environment and society which has been realized only very recently. Overall, the complexity of biosecurity issues makes it difficult to quantify and value the biosecurity and food safety services. Emerging biosecurity threats, further aggravated by the SPS and non-tariff barriers to trade, demands effective approaches across the entire Biosecurity Continuum; pre-border, border and post border to mitigate potentially adverse impacts.

Food safety is an area of high relevance to today's time when we are faced with increasing food safety threats leading to food poisoning/foodborne diseases. An unprecedented number of disease outbreaks have occurred both within the country and internationally due to both microbial pathogens and chemical contaminants. Similarly, application of novel technologies is also likely to present new and at times undiscovered risks to the food system. Other challenges include the emergence of new threats due to changing lifestyle and eating habits, food scares, change in the way food, plants and animals are produced, processed and distributed; and high dependence on imported food. These issues necessitate a robust national food control system to protect public health. Considering the complexity of food safety issues, continual improvement of this system is necessary through self-regulation and food safety culture, thereby ensuring collective coordination of a vast network of food safety services across the food system.

Under the aegis of Biosecurity Policy of the Kingdom of Bhutan 2010, the Bhutan Agriculture and Food Safety Authority (BAFRA) is mandated to protect public health, animal health, plant health and the environment by implementing biosecurity and food safety measures. Alongside, Bhutan's commitment to the International Plant Protection Convention (IPPC), Codex Alimentarius Commission (CAC), National Enquiry Point for World Trade Organization-Sanitary and Phytosanitary Agreement (WTO-SPS agreement), International Food Safety Authorities Network (INFOSAN), and the Cartagena Protocol on Biosafety (CPB) to the Convention on Biological Diversity (CBD) is served by BAFRA.

Biosecurity incidents and foodborne disease outbreaks continue to test public confidence and resilience of the national biosecurity and food safety system. Therefore, there is need to develop inclusive legislations; establish robust regulatory control; strengthen quarantine and testing infrastructure for inspection, testing and certification; and increase collaboration with the key stakeholders.

RNR Marketing

The commercialization of agriculture in Bhutan was a very gradual and government driven initiative. Farming sector characterized by small operational units, scattered over the inhospitable agriculture landscape and subsistence-based production pose a tremendous challenge to integrate into mainstream value-chain. With smallholder farmers, decision on production is not driven by market forces. Furthermore, agricultural produces are bulky, perishable, lack diversity of varieties, and seasonality which make marketing difficult. Since small farmers also operate as individual entity with multiple objectives, intermediaries have to put in efforts to network and connect them to market. Since production volumes are generally small, aggregation, grading, storage, transportation and distribution pose a logistical challenge. The marketing agency facilitates the transformation from subsistence to market-oriented farming to bring about improvements in rural economy. The major commodities traded in the market are potato, apple, mandarin, vegetables, dairy products, egg, meat, gravels and wood products. The major commodities exported from 2005 to 2018 include potato, mandarin, apple, cardamom, ginger, betel nuts, cabbage, carrot, peas, essential oils, matsutake mushroom, cordyceps and gravels/pebbles. In terms of volume traded, gravels/pebbles with 32% had the highest average growth rate while apple and mandarin had negative growth rate with record low of -6% and -2%. The declining growth rate for apple and mandarin is largely attributable to the reduction in production coupled with poor quality of fruits. Figure 2 shows the growth rates of the RNR commodities exported and figure 3 shows the trends in export of apples.

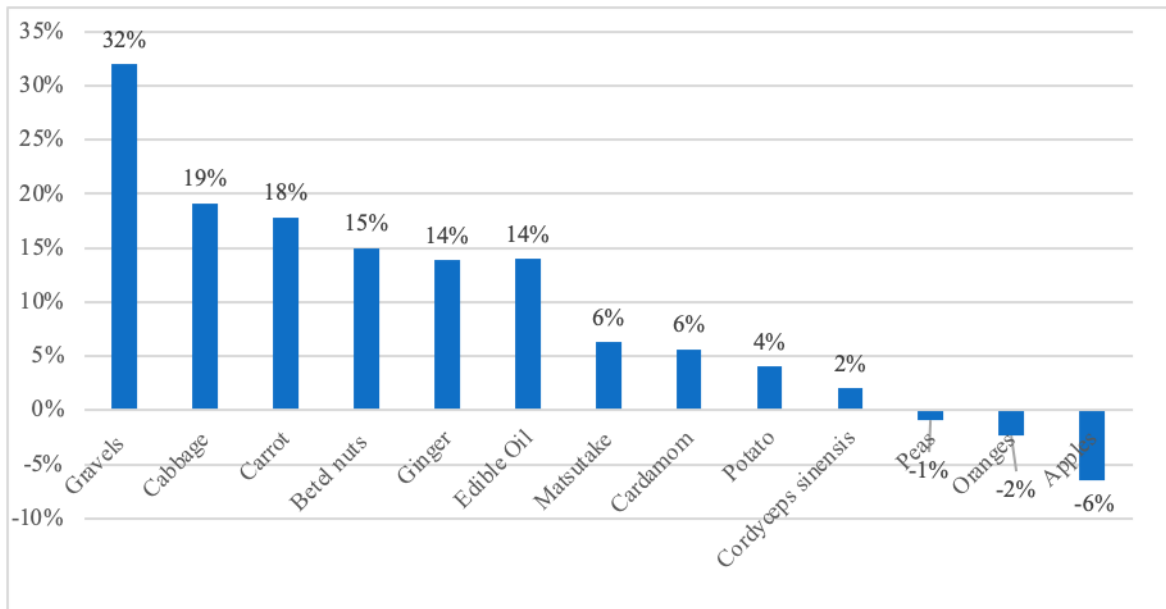


Figure 2: Average growth rate of RNR commodities exported from 2005 - 2018 (BTS, 2018)

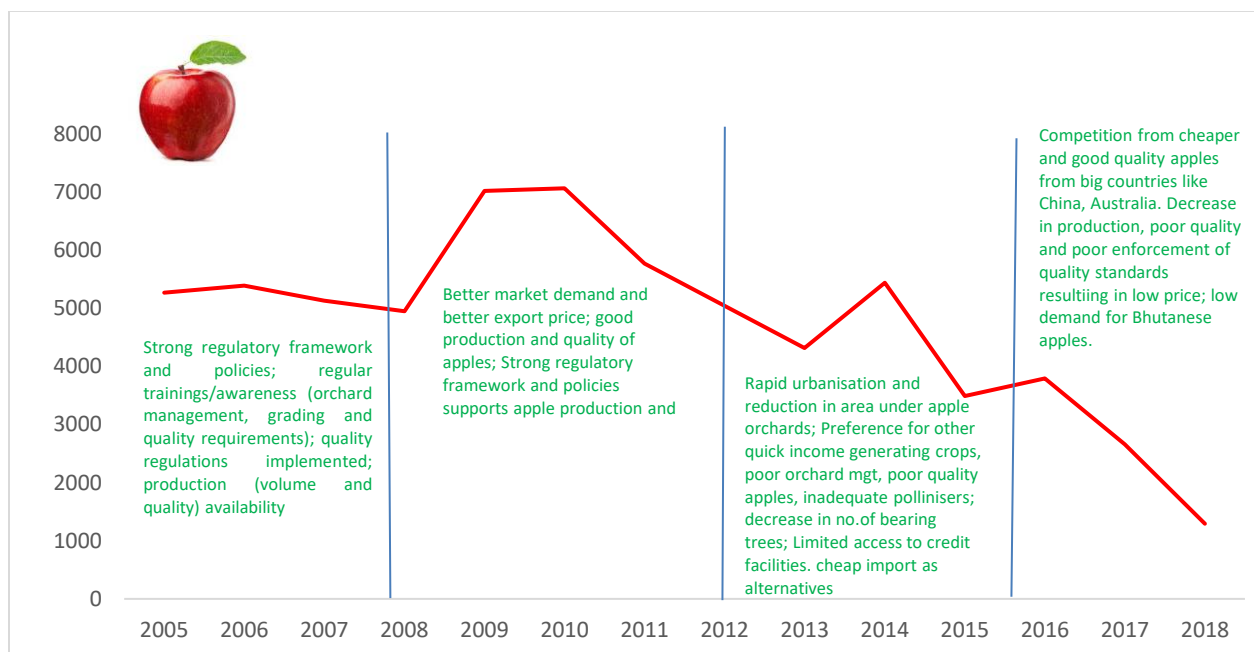


Figure 3: Trends in export of apples and influencing factors

In 2018, Bhutan exported Nu.1.004 billion worth of spice including cardamom. Other agricultural commodities exported during 2018 are potato worth over Nu.497.78 million, fruits worth over Nu. 122 million, betelnuts worth Nu. 122 million and vegetables³ worth over Nu.35 million, mainly to

³ Includes only 5 vegetables (cabbage, cauliflower, peas, beans and carrot) auctioned through FCBL

India and Bangladesh. Non-wood forest products exported during that year was over Nu.159 million (BTS, 2018).

During 2005-2018, Bhutan imported large quantities of rice, potato, tomato, cabbage, onion, chilli, milk, cheese, butter, pork, beef, chicken, dry fish, furniture, particle board, plywood, parquet and paper board. Forestry products have the highest import growth rate followed by livestock and agriculture products. The total annual import of agriculture, livestock and forestry products during 2018 was Nu.3.83 billion, Nu.1.94 billion and 0.362 billion respectively. (BTS, 2018).

Rice is the major commodity imported. In 2018, Bhutan imported 60,267 MT of rice worth Nu. 1.88 billion along with significant volume of edible oil worth 1.04 billion, dairy products worth Nu. 0.8 billion, livestock, meat and fish items worth Nu. 1.14 billion and vegetables worth Nu. 0.234 billion.

The main marketing challenges are inadequate real time information on commodity prices, knowledge gap on demand and supply conditions, market outlets, economy of scale both for export as well as domestic markets, inadequate mechanism for product standardisation, grading, packaging and labelling, lack of processing and value addition and infrastructures.

Vulnerability of the RNR Sector/Bhutanese Agricultural Systems

The rugged mountainous topography, diverse agro-ecological zones and rapid changes in environmental variabilities renders the country and in particular the RNR sector more vulnerable to impacts of climate change and natural disasters. Bhutan already witnessed severe crop loss due to unusual outbreaks of pests and diseases, erratic rainfall patterns, windstorms, hail storms, flash floods, landslides attributed to climate change. Further, being a landlocked country with high dependence on neighbouring countries for the vast majority of its imports and exports adds to the vulnerability.

Agriculture, food and nutrition came into limelight as a fallout of the pandemic and epidemic situations irrespective of whether such situations pertain to crops and livestock or to human health. These includes incidences of rice blast, the locust attack, armyworm and GALS outbreak in crops, and bird flu, African swine fever outbreaks in livestock. Similarly, SARS and COVID-19 pandemic in humans have indirectly exposed the vulnerability of the agriculture sector. The

COVID-19 pandemic for instance affected food trade, increased dependency with increasing number of laid-off employees from other affected sectors and aggravated the challenges with labour shortage following nationwide lockdown. The economic loss that stakeholders (from producers to consumers) involved in the value chain suffer from such epidemics could lead to poverty and hidden hunger, socio-economic disarray as well as reduce the momentum gained in the agricultural sector.

Vulnerability of Agriculture Value chain

Inputs: Production inputs are the backbone for successful farming. Input ranges from seeds, livestock parent stocks & imported breeds, feeds, fertilizer, crop protection chemicals, veterinary medicine & vaccines, machineries, irrigation, raw material for wood products, etc. Most of the inputs such as Day-Old Chicks (DOC), hybrid seeds, fertilizer, veterinary medicine and vaccines, etc. are imported and distributed to our farmers. Quite often, during any natural and biological (infestation, epidemic, pandemic) disasters, import and distribution of such inputs are disrupted owing to poor accessibility, import ban or unorganized distribution network on the ground. Generally, impact of such disasters disproportionately burdens small and marginal farmers practicing subsistence farming for livelihood with low resilient and recuperating capacity.

Production: Both natural and biological disasters hugely impact the production and management of farm activities. In Bhutan, natural disasters like storm, flashflood and extreme variation in climate and weather pattern are some of the major causes resulting in huge crop and livestock losses. Windstorms & hail storm causing crop damage is an annual threat for farmers all over the country. In 2013 about 100 acres of maize fields were damaged by windstorm. Flashflood is one of the major disasters causing large scale loss of crop, livestock and land. The flashflood/GLOF outburst of 1994 washed away 816 acres of dry land and made 965 acres of land unproductive due to sand and silt deposit (Yeshey Lotay, 2015). Similarly, the incessant rain in 2004 washed away 161 acres of wetland and 503 acres of dryland and damaged 39 irrigation channels in eastern Dzongkhags. Loss of agricultural field which is a primary production resource had caused long lasting production loss resulting in household food insecurity, malnutrition and economic loss to farmers and government. Cyclone Aila in 2009 caused an estimate loss of Nu. 719 million including crop, livestock and agricultural infrastructure which affected the livelihood options for many farm families. Further, it is reported that an estimated amount of Nu.29.2 million worth of

crops were lost to various natural calamities between 2013-15 (MOAF, 2016) which can be translated to annual loss to the tune of Nu.9.7 million.

Likewise, variation in climate and weather pattern which has become extreme and frequent event has greatly affected the crop production as nearly 50% of the agricultural fields depend on timely monsoon for irrigation. Extreme weather pattern also causes biological disaster like outbreak of pest/diseases in crop and livestock (army worm, rice blast, bird flu, H1N1 etc.). Health pandemic like the recent COVID-19 has disrupted all aspect of economic activities and livelihood of people across the world. Bhutan and RNR sector were not immune to it. The closure of border and import ban in an effort to contain COVID-19 spread created shortage of food items especially vegetables and meat products. The closure of international southern borders also impacted the export of agriculture produces resulting in huge economic loss to farmers. Similarly, the national lockdown imposed by the government to contain the spread of COVID-19 virus hampered day to day farm management such as irrigation, crop guarding against wild animal depredation, harvesting, weeding etc.

COVID-19 pandemic in particular has underscored the need to seriously relook into our Agriculture sector development and prioritize its importance for securing country's food self - reliance and reduce import dependency.

Harvesting and Processing: The economic use of all agricultural produce depends on its timely harvest and processing. Harvesting and processing of agricultural products must happen in aseptic environments to prevent spoilage as agricultural products are perishable if not preserved or value added immediately. Limited harvesting and processing facilities significantly impede the safe food harvest, diversification and shelf life. To mitigate the severity of emergency situations, food products must be diversified to add benefits of product choice and shelf life. To prevent damage of food products, there is a need to identify and implement relevant technologies and establish/strengthen harvesting and processing facilities to enhance safe food harvest, product diversification and enhance product shelf life.

Storage and transport: Food products require to be stored in ambient temperature and moisture to maintain food quality and safety in addition to proper handling. Some food products mainly livestock products such as meat, milk and dairy products require specialized storage and refrigerated transport facilities to maintain longer shelf life. Without safe storage and such

specialized transportation facilities products could easily be spoiled within 30 minutes of harvest, reducing the value, quality and safety of food products.

Distribution and handling: Experiences with the COVID-19 Nationwide lockdown showed that the food supply chain is very short, indicating the missing link between the producer, middleman and the consumers. The supply chain had to be bridged through involvement of the public sector to source and distribute food to the consumers. Establishing an End-to-End value chain ensures confidence in food production, traceability of products to farms, marketing and availability of food products. To enable a reliable food supply chain, the MoAF must develop a platform where producers and consumers meet over a reliable market (wholesale and/or retail) and institute mechanisms to trace products to farms for quality control.

Market: Ensuring a reliable market for food products entails creation of competitive markets that benefit both the producers and consumers. Further, during natural calamities, farmers often expect and keep a bigger profit margin, which was observed during the national lockdown in Bhutan. To prevent huge price fluctuation of food commodities, the need to institute pricing policy and facilitate fair price for food commodities produced in Bhutan is important.

Management: Weak coordination among sub-sectors under RNR and at all levels of government functionaries were noted during the COVID-19 nationwide lockdown. The need for one general guideline outlining agencies that will be involved in different situations for effective management of such national situations was opined along with required capacity enhancement. For instance, BAFRA and Forestry officials involved in combating COVID-19 as front-line workers were not prepared and assigned tasks beyond their mandates. Biosecurity and food safety protocols need to be strengthened, so that pests and diseases are controlled at the ports and this needs to be operated from “*One Health*” approach/concept.

The unorganized/weak value chain management of RNR produce resulted in huge wastage of food products or the quality of produce getting deteriorated in the process. As such it is important to design efficient, comprehensive and systematic value chain management protocols for important agricultural commodities by involving all the relevant stakeholders for better income generation, sustainable and environment friendly practices.

Policy: Considering vulnerability of the RNR sector throughout the value chain particularly in the event of disasters and emergencies, a holistic RNR contingency plan for such unforeseen events need to be developed through the experiences of handling such situations thus far. Such a contingency plan developed and implemented would address concerns of poor price setting, regulations imposed by the Government or even the adhoc changes in Government policies.

Drivers of Agriculture Changes in Bhutan

For centuries agriculture in Bhutan has been a way of life, majority living on farms subsisting with crops and livestock. Bhutanese consider agriculture as merit or blessing therefore it is termed as *soenam*. Associated to this belief, any area is considered blessed if the conditions are favourable for the cultivation of the nine basic crops or *dru-na-gu* (rice, maize, wheat, barley, buckwheat, millets, pulses, oilseeds and amaranthus). Bhutanese believe that only the fortunate and the blessed can be farmers (Choden, 2008). However, majority of Bhutanese lived under harsh conditions, toiling every day for livelihood. People entirely depended on land and forests, cultivating or collecting as much food as they required. They raised livestock, wove clothes and made their own pottery. Advent to the modernization in 1961 and joining the global community after years of self-imposed isolation, all sectors like health, education, agriculture, communication and governance were developed. All the while, Bhutan has adopted a “middle path” approach to sustainable development in order to achieve optimum economic development without compromising its environmental, socio-cultural and biological diversity.

Bhutan’s development path into the new millennium stresses on human development, culture and heritage, balanced equitable development, governance and environment conservation. Nested within these broad development strategies, agriculture in Bhutan has undergone a gradual transformation from a largely subsistence non market-oriented farming tradition, based on seasonally nomadic lifestyles, agriculture is changing, though at varying degrees, into a market-oriented entrepreneurial activity, encouraging year-round cultivation, using improved seed varieties (Mai Kobayashi *et al.* 2015), production technologies and mechanization.

Generally agricultural transformation is considered to have three phases (i) traditional agriculture - small labor intensive family operated farms which uses only crude form of capital, (ii) technologically dynamic agriculture-low capital technology involving the use of new inputs (fertilizers, pesticides, improved seeds and livestock breeds, and machines) with high marginal productivity, and (iii) technologically dynamic agriculture-high capital technology where heavy machinery will be used in agriculture and labor will be available for absorption in developing non-farm sector. Based on the three phases, the contemporary view recognizes the evolving role of

agriculture in development, roughly definable in four phases: (i) Beginning phase—agricultural labor productivity starts to increase; (ii) Agricultural surplus—agricultural productivity growth generates surplus towards the development of the non-agricultural sector; (iii) Integration—agriculture becomes increasingly linked to the rest of the economy through improved infrastructure and development of markets; (iv) Industrialized—integration is successful and the role of agriculture diminishes to just one of numerous major sectors of the economy. For instance, the rice productivity growth in Bhutan follow a similar trend growing from 2 t/ha in 1981 to 4.2t/ha in 2017. The role of technical inputs in accelerating rice productivity in Bhutan is evidently represented in Figure 4).

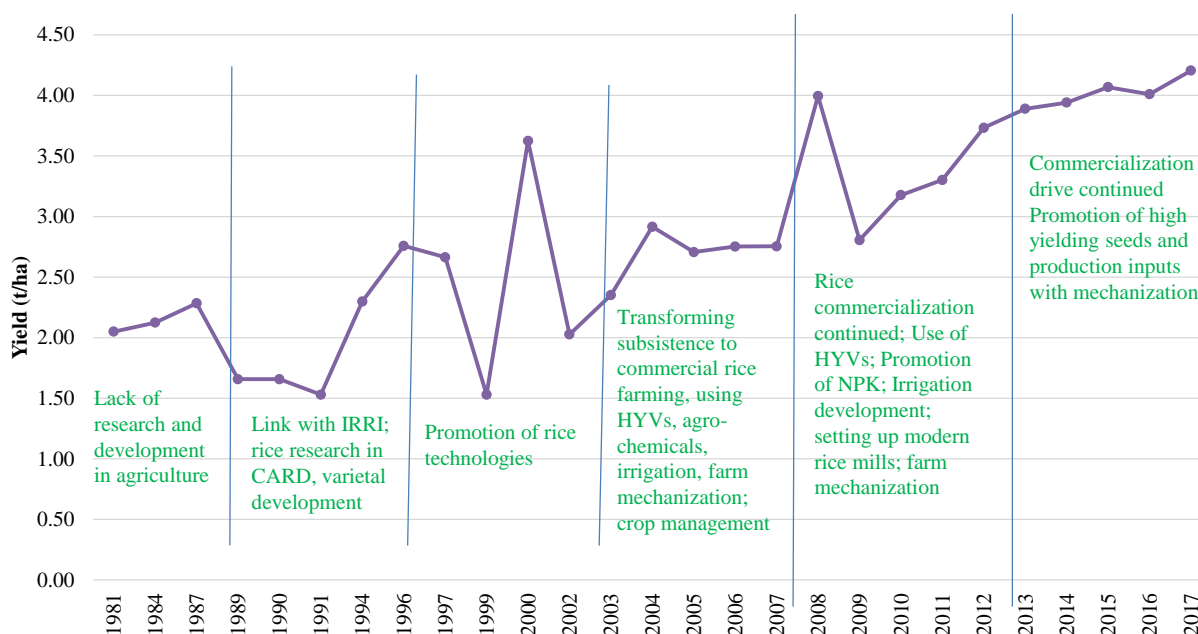


Figure 4: Rice productivity growth and growth drivers during 1981 to 2017

Boserup (1963) too opined that failure to achieve a technically progressive agriculture can dampen the whole process of economic growth. This projects agriculture as a sector to accelerate growth. Based on the above classification, Bhutanese agriculture can be considered to be largely traditional with gradual transformation into technologically dynamic agriculture (Phase 2). General observations on possible drivers of agricultural transformation in Bhutan are briefly explained below:

1. Public Sector investment

The principal driver of agricultural transformation and growth in Bhutan is the public sector investment. From the very first plan period (1961-66), government invested on agricultural research and development, irrigation & infrastructure (farm road, processing units, and marketing facilities). Besides, government also invested substantially on agricultural input supply, capacity development and agricultural credit. RNR sector GDP steadily declined from 38% in 1992 to 17% in 2018. According to Mehta (2012), this deceleration is associated to declining public investment in the sector. The strength of the investment of the state in the RNR sector can also be observed from the withdrawal of the state investment, where a 4% decrease in the state investment during the 9th five-year plan resulted in 65% decrease in GDP contribution from the RNR sector (PPD, 2020).

The last three decades remarkably show the declining trend in three parameters – public investment in RNR sector, farming population and RNR GDP which show a definitive relation among them (Figure 5). From 1961 to the beginning of the 7th plan, most agricultural inputs (seeds, fertilizers and chemicals) were provided free, thereafter subsidy was gradually withdrawn in phased manner making the farmers to fully bear the input cost. On the other hand, some of the critical livestock input like medicines, and vaccines are still subsidized by the Government. During the same period, construction of infrastructures was also modelled in cost-sharing, in the form of government providing the materials and community contributing the labour. Even the management of irrigation and roads were transferred to community. These changes in modalities of RNR sector interventions would have proportionately decelerated RNR contribution to national accounts.

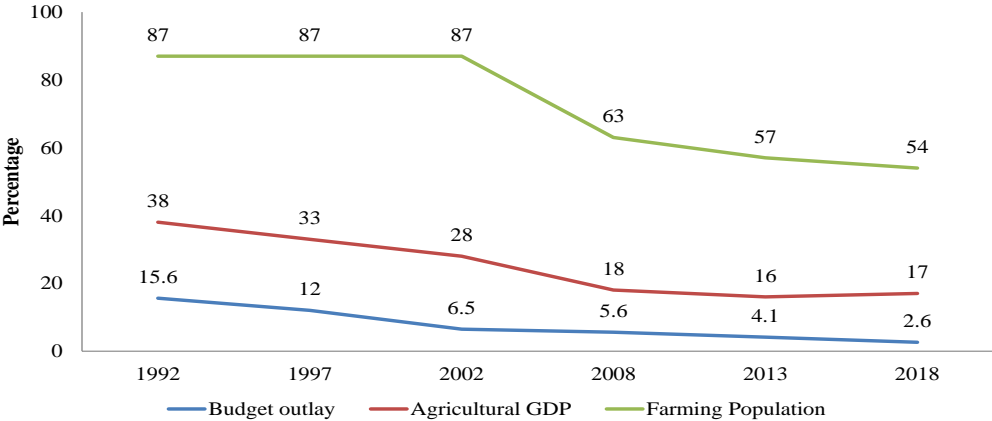


Figure 5: Farming population, RNR GDP, and budget outlay in RNR sector from 7th-12th FYP

2. Policies and Legal Frameworks

The transformation of agriculture from traditional to semi-commercial in Bhutan has been largely driven by farmer-friendly policies. For instance, during 1st to the 6th Plan, all the production inputs were subsidized and home delivered free. Other policies and legal frameworks that directly influenced agricultural transformation are Land Act of Bhutan 2007, National Forest Policy 2011, National Irrigation Policy 1992, Food and Nutrition Security (FNS) Policy of the Kingdom of Bhutan 2014, Biosecurity Policy 2010, Forest and Nature Conservation Act of Bhutan (FNCA) 1995, Environment Assessment Act 2000, The Livestock Act of Bhutan 2001, Water Act of Bhutan 2011, Food Act of Bhutan 2005, The Seeds Act of Bhutan 2000, Pesticide Act 2000, Biodiversity Act 2003, and Plant Quarantine Act 1993. Figure 6 illustrates the trends in timber production with the introduction and enforcement of policies such as the FNCA, 1995.

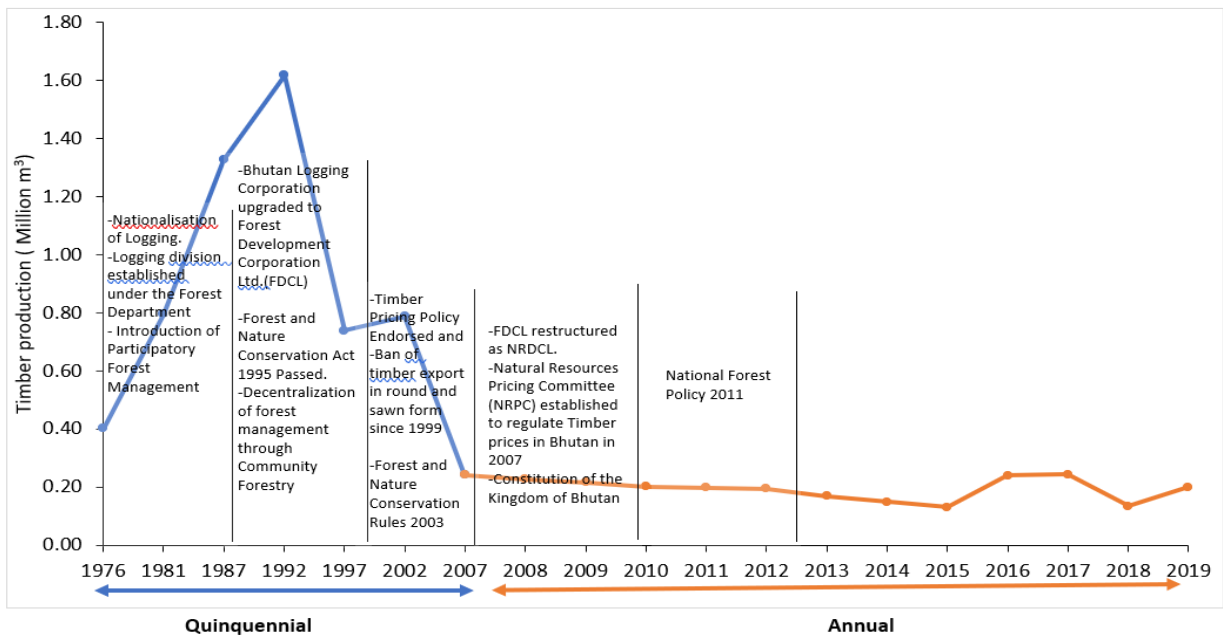


Figure 6: Trends in timber production from 1976 -2019

In view of small-holder farmers with average land holding of less than 1 ha, Land Act had a far-reaching influence in agricultural transformation. The changes in land cover and land use (Table 1) clearly indicate marked changes in last 26 years. The constitutional mandate to maintain 60% of area under forest cover (Constitution of Bhutan, 2008) prevail all the land use policies. Furthermore the protected area complex (national parks, wildlife sanctuary, biological corridors, and botanical parks) which covers 51.44% of land, make it inaccessible to other uses. While the Land Act 2007 has provision to protect wetlands (*chuzhing*), with the increasing human-wildlife conflict and decline of labour and water resources, high proportion of wetland is left fallow. This is evident from the decline of 8% of agriculture land over last 2 decades. The decline of agriculture land has direct implication on volume of agriculture production. In conjunction with the land use policies, the policy on pesticide and chemical fertilizer import and use has extremely influenced crop production potentials.

Table 1: Land use changes during 1990-2016 (Sq. Km)

Land use Type	1990	2000	2010	2016	Proportion (%)	Change
Forests	25558	26445	26732	27172	70.77	6%
Shrub land	4169	3401	3869	6679	17.40	60%
Grassland	3485	3418	2000	963	2.51	-72%
Agriculture	1144	1160	1200	1057	2.75	-8%
Built up area	67	66	68	75	0.19	11%
Others (water bodies)	3971	3904	4525	2449	6.38	-38%
Total	38394	38394	38394	38394		

Furthermore, the policy reforms on import of eggs following the outbreak of bird flu in 2008 resulted in a positive impact on increasing domestic egg production (figure 7).

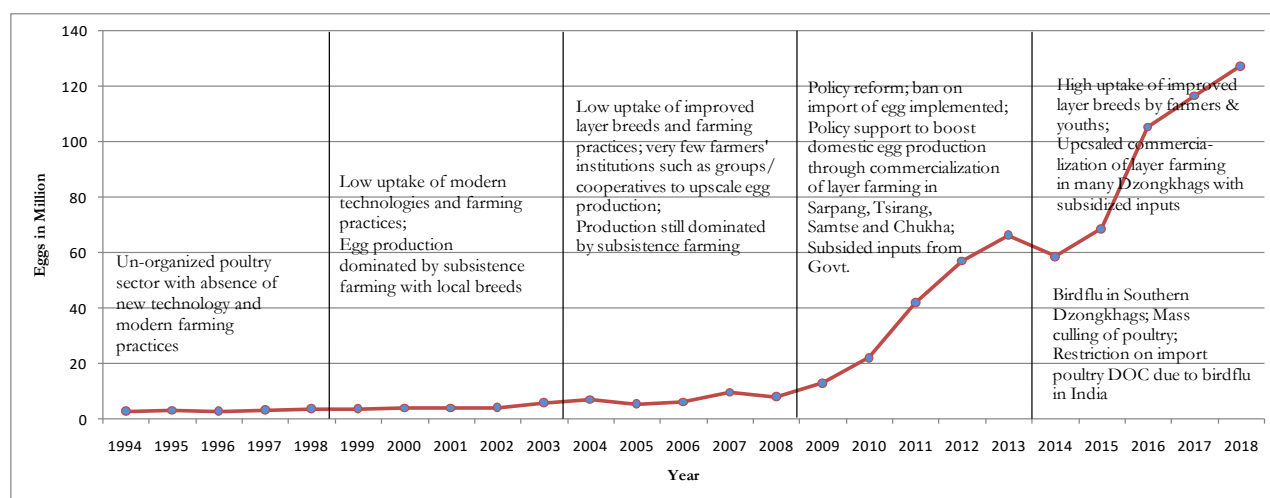


Figure 7 : Egg production growth and growth drivers from 1994-2018

3. Technologies

Technology has made a vast influence on Bhutanese agriculture. The launch of the first FYP (1961-66) coincided with the green revolution of 1960s, which provided access to high yielding crop varieties and production technologies. It was during the first plan period, that varieties of rice,

Box 4: Excerpt from 1st FYP File (GNHC)

- Department of Agriculture started model farms, seeds farms, research station, and extension work. Area under fruit and vegetable were expanded.
- Department of Animal Husbandry established many livestock and sheep breeding farms
- Department of Forest initiated sustainable conservation of forest resources

wheat, vegetables and fruits were introduced in Bhutan (Box 3). It was also during the first plan when apple (*Malus domestica* Borkh.) was introduced from India and planted in demonstrated farms in Thimphu and Paro. So far 23 varieties of rice, 4-maize, 5-other cereals, 5-mustard, 4-soybean, 84-vegetable, and 89 varieties of fruits have been released for general cultivation in Bhutan. Rice being the staple food and widely consumed, intensive research has been done on rice and its cultivation in the form of high-yielding rice varieties (including Bhutanese cross-bred variety-IR20913). Promotion of these improved varieties triggered rapid increase in productivity and total rice production. Simultaneously, the introduction of scientific land management approaches and irrigation systems helped in further expansion of rice cultivation. One of the tangible impacts in crop sector has been the increase of crop productivity almost by 95% in last 15 years (Figure 5). Similarly, the introduction of Brown Trout (fish) in 1930, Rhode Island Red and Australorp (poultry birds) in 1961, Jersey (cattle) in 1965, Brown Swiss (cattle) in 1972, Saddleback (pig) in 1981, Grass Carp (fish) in 1984, Nili-ravi (buffalo) in 2015, temperate and tropical fodder varieties in 1982 have immense impact in livestock sector development in Bhutan. Improved breeds and production technologies have helped in increasing production by manifold. For instance, milk production during 1994-2018 increased by 280% (Figure 8). Among the livestock products, Bhutan is self-sufficient in eggs.

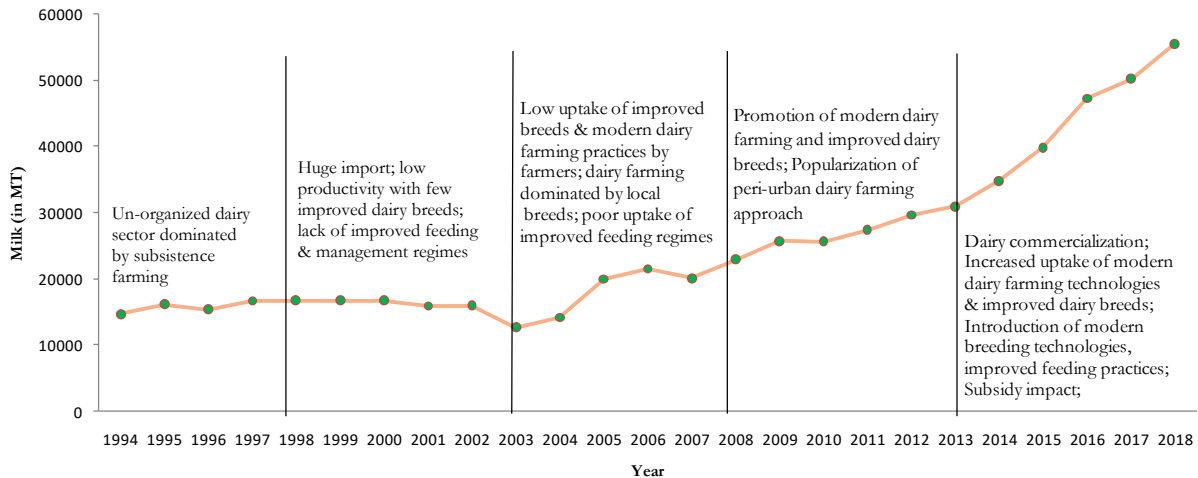


Figure 8: Milk production growth and growth drivers' trends from 2008 to 2017

Apart from improved genotypes and production technologies, introduction of appropriate farm machineries, processing technologies and chemicals have equally contributed in production enhancement. Similarly, climate resilient technologies also have helped farming adapt to the climate change impacts.

4. Population growth and demand - Diversified diet and consumer demand

The ever-increasing populations of Bhutan, 16% increase in the last twelve years (2005-2017) increasing at the rate of 1.3% per annum (NSB, 2017), pose tremendous pressure on food production from a small agriculture land (2.75%). Additionally, with the thriving rural-urban migration at the annual rate of 48.7%, the farms are either left unattended with absentee households or with elders only. This declining farming population has correspondingly resulted in reduced cultivation of land and ultimately reducing the domestic food production.

With the increasing urban population and also awareness on health and food safety, the demand for diverse food types and quality has increased. Demand for diverse cereals, fruits, meats and vegetables have led to increased production of short season crops and farming intensity.

5. Institutional credits - Fiscal incentives for agricultural-based enterprises

Considering the subsistence farming, coupled with small land holding and crop production challenges, the profitability from farming in Bhutan is very low. In order to enhance the profitability from the farming and make it more attractive, government is encouraging financial

institutes to increase the credit portfolio for RNR sector and lower the interest rate. Agriculture credit has increased from Nu. 562.2 million in 2008 to Nu. 5069.5 million in 2017 (RMA, 2017) accelerating the growth of agri-business. Credit to agriculture sector is low compared to other sectors. For instance, in 2017, agriculture sector credit accounted only 5.33% of the total credits provided by the financial institutions (RMA, 2017). The Priority Sector Lending (PSL) initiative launched since 2018 has a provision of low interest (8%) loan of maximum of Nu.0.500 million for farmers and Nu. 10 million for cooperatives and companies, is expected to boost the agriculture sector development. The PSL scheme also include the provision for mandatory crops and livestock insurance decreasing the risks to farmers from crop and livestock losses. As of June, 2020, about 1292 projects were approved under the PSL of which 78% were agri-related projects amounting to Nu. 332 million. The approved PSL projects included provisions of 157 policies under Livestock insurance and 43 policies under crop insurance.

6. Agri-business and trade

Bhutan has relatively been successful as an agriculture exporter. Agricultural commodities such as apples, mandarins, potatoes, cardamom, ginger, betelnuts and vegetables have established export markets in Bangladesh and India. The value of agriculture exports has grown at an annual rate of 15% since 2005 (BTS 2005-2018). The demand in general for Bhutanese agriculture produce outside are high on account of commodities being natural and cultivated in a clean environment. This demand is likely to grow with people increasingly becoming more health conscious and aware of food safety. Provided quality parameters (standards) including volume requirements, consistency and packaging of produces are improved, the demand for Bhutanese agricultural produces are bound to increase in export markets.

Similarly, existing agro-processing factories within the country present market opportunities for local agriculture (agricultural) commodities as currently most of their raw material requirements are imported from the region. As RNR sector increasingly moves towards commercialization, enabling environment to link RNR output to various value chains through intermediaries such as agro-industries are important. This include provision of, but not limited to market information, market research, market explorations, product promotion and market infrastructures.

Strategic Issues

The performance of RNR sector was analysed using three participatory approaches (i) retrospective review of past plans, (ii) questionnaire-based survey, and (iii) SWOT analysis. It was evident from the past and on-going five year plans that sector has fulfilled its strategic objectives of conservation of forest, increase in food production, and enhanced rural income and livelihood. The limited impact of the sector is conversely constrained by frequent organizational review, policy conflict, ad-hoc derailment of plans (including SoEs), lack of cascading plans, and absence of objective monitoring and evaluation. Additionally, the lack of accounting intangible ecosystem services provided by agriculture, livestock and forest, projects decreasing sector contribution to GDP. Review of stimulus and contingency plans revealed lack of inclusive planning approach. RNR sector also encounters the challenge of informal value chains, which are often shielded by deceptive practices. Although the sector has cadre of skilled and qualified manpower, absence of planned and targeted human resource planning and deployment has incapacitated the sector to deliver to its full potential. Disparagingly, excessive focus on smallholder farmers and exclusion of private sector has restrained innovation, mechanization, promotion of smart technologies and expeditious expansion of scale of production. Aligning SWOT analysis result to four perspectives (stakeholder, internal processes, research and innovation, and resources) of MoAF provides a clear bifurcation of enabling and impending factors to the RNR sector development (Table 2).

Table 2: Aligning SWOT analysis result to four perspectives of MoAF

Perspectives	Strength	Weakness	Opportunities	Threat
Stakeholder	<ul style="list-style-type: none"> - Big clientele base (farmers, hoteliers, business entities, public) 	<ul style="list-style-type: none"> - Too much emphasis on small holder farmers and neglect of other clients - Exclusive planning process and conflicting policies - Weak Monitoring and Evaluation/ Impact assessment 	<ul style="list-style-type: none"> - 63% of farmers do not use agro-chemicals - Majority of farmers use traditional technologies - Scope to improve and organize RNR value chain 	<ul style="list-style-type: none"> - Social taboos especially on the production of meat in livestock sector - Aging rural population
Internal Processes	<ul style="list-style-type: none"> - Relevant legal and regulatory frameworks - Well distributed establishments and infrastructures across the country (Outreach throughout the country) 	<ul style="list-style-type: none"> - Weak institutional linkages and coordination - Frequent organizational (OD) reviews and during the plan period - Weak decision making and competing priorities - Declining emphasis on research, innovation and dissemination - Cumbersome process to access services, Ad-hoc & short-term plans 		<ul style="list-style-type: none"> - Intellectual property – misuse of brand ‘Bhutan’
Technology and Innovation	<ul style="list-style-type: none"> - Highly integrated farming systems 	<ul style="list-style-type: none"> - High cost of production - Poor uptake of improved technologies - Limited ownership of program/project interventions 	<ul style="list-style-type: none"> - 70% food self sufficiency - 66,120 ac of fallow arable land - Product development and Value addition - High market demand for Bhutanese produce - Ever expanding tourism industry 	<ul style="list-style-type: none"> - Vulnerability to climate change, disasters and bio-security threats - Competition from cheap imports - Increasing pressure to land - Dietary changes and unsustainable consumption
Resources	<ul style="list-style-type: none"> - Qualified and skilled manpower - High donor interest and investment in RNR sector - Endowed with rich and abundant natural resource base 	<ul style="list-style-type: none"> - Absence of comprehensive HR plan (development and deployment) - Declining public investment - Weak Monitoring and Evaluation/ Impact assessment 	<ul style="list-style-type: none"> - Sustainable utilization of high value resources for food security and livelihood - Green accounting 	<ul style="list-style-type: none"> - Brain drain (loss of critical qualified HR pool) - Rampant illegal harvesting/exploitation of natural resources - Increasing human wildlife conflicts

As the enabling and challenging factors of the RNR sector are very pertinent, they were aligned to the four perspectives of stakeholders, internal processes of MoAF, technology and innovation, and resources to locate them accurately to the concerned area of the sector (Table 2). The grouping is also expected to facilitate clarity in defining strategic issue of the sector.

Enablers

SWOT analysis of RNR sector gave a comprehensive analysis of the factors that enables and restricts the sector in achieving its goal and mandates. These enablers provide tangible visibility of the sectoral initiatives and also pave potential pathways. Table 3 presents set of internal and external enablers of the RNR sector.

Table 3: Internal and external enablers of the RNR sector

Internal	External
- Endowed with rich and abundant natural resource base	- 70% food self-sufficiency. Opportunity to expand production of essential commodities and substitute imports
- Big clientele base (farmers, business entities, producers, processors, aggregators, entrepreneurs, processors, marketers, consumers)	- 66,120 ac of fallow arable land
- Relevant legal and regulatory frameworks	- 63% of farmers do not use agro-chemicals
- Well distributed establishments and infrastructures across the country (Outreach throughout the country)	- High market demand for Bhutanese produce
- Qualified and skilled manpower	- 71.4% literacy rate (BLSS, 2017)
- Predominantly an agrarian society	- 50.9% skilled agricultural and forestry worker (LFSR, 2019)
- Highly integrated farming systems and diversified crop and livestock varieties/breeds	- Limited product development and value addition
- High donor interest and investment in RNR sector	- Majority (63%) of farmers use traditional farming technologies
	- Sustainable utilization of high value resources for food security and livelihood
	- Very weak and unorganized value chain
	- Ever expanding tourism industry

Challenges

The agricultural sector growth of 4.36% in 2018, generally considered lower rate of sector growth is often associated to poor performance in the forestry sub-sector (NSB, 2018). A broad-based consultation revealed that the plummeting sectoral GDP is linked to other factors in addition to absence of accounting forestry services. The most critical challenges are the declining public sector investment, frequent institutional reorganization (during the plan period), and increasing vulnerability to climate change impacts. The general challenges that have impacted agricultural sector are presented in Table 4.

Table 4: Internal and external challenges of RNR sector

Internal	External
- Declining public investment	- Vulnerability to climate change, disasters (natural and human induced) and bio-security threats
- Weak institutional linkages and coordination	- Rampant illegal harvesting/exploitation of natural resources
- Exclusive planning process and conflicting policies and legislations	- Competition from cheap imports (free trade agreements)
- Frequent organizational (OD) reviews and restructuring during the plan period	- Increasing pressure to arable land from urbanization and other infrastructure development
- Weak monitoring and evaluation/ Impact assessment	- Increasing human wildlife conflicts
- Adhoc and short-term plans	- Social stigma/taboo especially on the production of meat in livestock sector
- Weak /unstructured decision making and competing priorities	- Aging rural population
- Absence of comprehensive HR plan (development and deployment)	- Brain drain (loss of critical qualified HR pool)
- Too much emphasis on small-holder farmers and neglect of other clients (traders, business entities, consumers)	- Intellectual property – misuse of brand ‘Bhutan’
- Weak emphasis on postproduction and processing	
- Declining emphasis on research, innovation and dissemination	- Dietary changes and unsustainable consumption
- Cumbersome process to access services	- SoEs in RNR Sector
- High cost of production	
- Poor uptake of improved technologies	
- Limited ownership of program/project interventions	

Additionally, a qualitative questionnaire-based survey using open ended questions was conducted via email to study RNR sector's strengths, achievements, opportunities and failures to identify strategic issues impeding its growth. Convenience sampling, a non-probability type of sampling method was adopted and a total of 62 respondents from DoA, DoL, DoFPS, DAMC, BAFRA, PPD DoS and ex-MoAF officials participated in the survey. The findings and analysis show that most respondents considered RNR sector successful in conserving biodiversity (38.7%) and natural resources, promoting food security (40.3%) and establishing a pool of competent human resources (21%).

From the consultative process, it was logical to use the enabling and challenges, alongside the survey finding to define strategic issues. Correctly defining them can facilitate formulation of coherent mission, vision and strategies. These issues are considered as unresolved needing a decision or potentially impeding future course of direction. Broadly the strategic issues can be grouped into four categories (i) Policy, (ii) Internal processes, (iii) Innovation and dissemination, and (iv) Human resource.

- (i) **Policy:** There are more than 16 legal and policy frameworks that govern the implementation of RNR sector. Amidst these policies, one of the major concerns is incoherence of policies like agriculture intensification and conservation. Similarly, organic farming and use of agro-chemicals are two opposing production approaches, which cannot technically co-exist. This incoherence is further aggravated by lack of evidence-based planning and absence of cascading strategies, which implies that most plans across different levels neither converge nor complement, posing compartmental operations. The sector also lacks some critical policy instruments to protect agriculture land, regulate agriculture prices, import regulations and limited accounting of ecosystem services.

Absence of all-encompassing policy for the RNR sector, led to '*constant integration and disintegration of RNR concept*' and creation, dissolution or frequent reorganisation of agencies without much objectivity. Further, the sector lacks important policies driving RNR sectors growth such as: land use policy, policy to monetise intangible benefits from the ecosystem, policy on promotion of organic agriculture, field-oriented policies and fiscal incentives to make farming attractive, insurance policy to offset the socio-economic losses

of farmers and pricing policy. Besides the Fiscal Incentive policy, the cost sharing mechanism need to be revisited favourably to support the growth and development of RNR sector. Also, non-inclusive policies resulting in conflicting, inconsistent and overlapping policies driven by short-term priorities often compromise the approach towards ensuring '*stable, safe food and fair price*'. While '*everyone expects clearer Rules and Regulations and its implementations uniformly*', most of the RNR policies do not cascade down to sub-sector level as implementable strategies and client-friendly interventions, which are further aggravated due to limited awareness by the beneficiaries and weak monitoring system and impact assessment.

- (ii) **Internal processes:** MoAF being one of the biggest ministries with four departments and two non-departmental agencies with presence in all the Dzongkhags and gewogs, confronted with frequent organizational reviews and restructurings could never settle operationally. Such organizational disruptions have seriously impacted on some of the critical functions of the sector. Failure of the sector to organize supply chain; diversify products and value add; diversify food basket; domestically produce essential inputs, absence of marketing strategy; availability of cheap imports; lack of assured market for RNR produce; low Total Factor Productivity; subsistence and semi-commercial scale of production discourages engagement of private and public sector in pursuing farming as a business. Further, poor marketing information and weak agriculture marketing system has resulted in the inability to promote demand driven production and marketing opportunities for RNR produce.

Most prominently, limited awareness amongst the clients on the services provided by RNR sector and lack of client-friendly service environment to access '*faster, better and quality service delivery*' prolongs the turnaround time, prompting the clients to resort to deceptive and unlawful practices. Further, lack of client-beneficiary oriented inputs and services to produce and market food and agricultural produces discourages the clients to avail RNR services. The turnaround time is also affected if the service providers are not motivated, competent and diligent in delivering the mandates of RNR sector.

- (iii) **Innovation and dissemination:** Associated to the organizational reorganization, the juggling of research mandate has completely displaced the relevance of research and innovation to

the technical sector. With the lack of science-based approach to development, several initiatives are unproven and myopic, leading to no definitive outcomes. Within a weak research foundation, the following strategic issues widely prevail restricting the accomplishment of sectorial strength and opportunities:

- High cost of domestic production
- Lack of dietary advocacy
- Lack of rural revitalization
- Inadequate development of diversified RNR products
- Low adoption of technologies

With the dissolution of CoRRB, the research component of RNR sector has been disintegrated and diffused into individual sectors, the investment in research is decreasing, inadequate multi-disciplinary research approach for generating scientific knowledge and innovative technologies for increasing productivity and adapting to emerging threats. The poor research-extension linkage impedes the adoption of innovative technologies by the farming communities.

- (iv) **Human resource:** The RNR sector has one of the largest human resource comprising of 3421 regular and 1134 contract/ESP/GSP employee (HRD, 2019). Despite this large pool of human resource, inequitable distribution of workforce aligned to the timely implementation of OD recommendations, ineffective delivery of services, and specialist deployment seems to be major bottleneck in the sector (HRD, 2019). Weak human resource management has resulted into professionals leaving the service (brain drain), absence of ownership of sectoral initiatives (scheme managers), and inefficient delivery of technical and regulatory services (enforcement of rules).

There are limited initiatives to optimally utilize potential human resource and modern technology to strengthen the system for making evidence-based decisions. RNR sector also lack strategic and evidence-based HR planning processes often leading to frequent review of plan and programs that derails the implementation of the existing sectoral plans and leads to prioritization of *ad hoc* programs driven by short-term goals.

Foundation of RNR Sector Strategies

Sustainable agriculture in Bhutan is an important factor for socio-economic development and growth. Although agricultural GDP is declining⁴, it provides employment and livelihood to more than 54% of the population. Additionally, it provides more than 70% of the domestic food requirement and raw materials for agro-based industries. As an agrarian country, RNR Sector is considered as one of the five⁵ important drivers of economic development in terms of its potential to ensure self-reliance (EDP, 2016).

Bhutanese agriculture and social customs are seamlessly entrenched in the pristine natural environment, without which local farming may not thrive. As an integrated system, communities have evolved basic ecological equilibrium among agriculture, livestock and forest which has ensured sustainable growth, without upsetting the harmony. The need to preserve the pristine natural environment, the Constitution of the Kingdom of Bhutan mandates the Government to maintain a minimum of 60% of Bhutan’s total land under forest cover for all time in order to conserve the country’s natural resources and to prevent degradation of the ecosystem. Constitution is explicit in decreeing to secure safe and healthy environment, and ecologically balanced sustainable development while promoting justifiable economic and social development. Correspondingly, Article 9 articulates the mission of economic self-reliance, private sector engagement, and adequate livelihood.

Box 5: Article 5/Clause 3: Constitutional mandate of 60% Forest cover

གཞུང་གིས་ རྒྱལ་ཁབ་ཀྱི་རང་བཞིན་ཐོན་ལུང་ས་ཚུགས་ལྡན་པའི་སྤོངས་ སྤོངས་བརྒྱུད་ཀྱི་གནས་ ལུགས་དེ་ལུ་ཉམས་ཆགས་ཚུ་ སྤོངས་འགོག་འབད་ནི་འོ་ན་ལུ་ འབྲུག་གིས་ཆའི་ཕྱོད་བསྐྱོམས་ ལས་ཉུང་ཤོས་བརྒྱུད་ཐུག་ཅུ་ཐམས་པ་ རུས་དང་རྣམ་པ་ཀུན་ཏུ་ནགས་ཚལ་གྱི་ཁྱབ་བརྒྱུ་ལོག་ ལུ་འཛིན་སྐྱོང་ལུ་འཕམ་དགོ།

The core development philosophy of Bhutan - the Gross National Happiness (GNH), encapsulates unequivocally that Bhutanese development takes a holistic approach towards notion of progress and gives equal importance to non-economic aspects of wellbeing. The four pillars of GNH (good

⁴ The decline is in proportion to other sectors with rapid developments in energy, industrial and service sectors. In absolute terms, the agriculture GDP is actually increasing
⁵ Five Jewels-Hydropower, Agriculture, Tourism, Small and medium enterprises and Mining

governance, sustainable socio-economic development, preservation and promotion of culture, and environmental conservation) form the guiding principles in directing the development. The successful initiatives of all eleven past five-year plans (FYP) in transforming the agriculture to the present day farming is a resounding demonstration of commitment of past programs and institution. The vast experiences and lessons learned by the sector and its development partners from 59 years of services to the agriculture in the country provides profound basis for strategizing the future prospects of RNR sector.

The visionary wisdoms of His Majesty the Kings, the Constitution of the Kingdom of Bhutan, GNH principles and 59 years of sectoral evolution provides a rationale foundation for the MoAF to offer its service in fulfilling the aspirations of the Nation State. These well-grounded foundations accentuate the RNR sector's vision, mission, core values and strategies.

Transpiring from the above foundation, the RNR mission, vision and strategies are based on the following broad principles:

- Self-reliant food system;
- Competitive RNR value chain and socio-economic well-being
- Ecologically balanced sustainable management of the pristine environment and biodiversity;
- Intergenerational equity in access and benefit sharing from natural resources and biodiversity; and
- Landscape management approach to agricultural innovation and intensification.

Vision

Sustainable natural resources and self-reliant food systems contributing to inclusive socio-economic well-being of Bhutanese.

Mission

To create enabling policy, technology, and value-chain to ensure sustainable environment and food security.

Core Values

Integrity, Efficiency, Innovation, Participatory and integrated approach, Reliability, Sustainability.

Strategic Framework

The RNR Strategic Framework comprehensively reinforces and builds on the strategic thrust and outcomes of the past plans (1st to the 11th: 1961 to 2018) and the current plan (12th: 2018-23). It also firmly aligns to the overall political economy of Bhutan and to the dynamically evolving regional and global agricultural environment. Grounded by the constitutional mandate of environmental conservation and livelihood security, the framework provides logical progression on transforming the RNR sector. The RNR Strategic Framework thus serves as an overarching policy guideline to provide definitive impact pathway through which RNR sector will attain the sectoral vision in next 20 years (2020-2040). The framework has following objectives:

- To articulate and orient RNR sector's strategic contribution to national building
- To define RNR sector's vision, strategic thrust, objectives and thematic focus.
- To align objectively the initiatives and their corresponding outputs temporally (short/medium/long term)
- To provide overall institutional processes (framework) as an enabler to accelerate sector's operations effectively.

This framework is articulated against the backdrop of Gross National Happiness that embodies holistic and multidimensional development approach structured on four pillars of (i) Sustainable and equitable socio-economic development, (ii) Environmental protection, (iii) Promotion and preservation of culture, and (iv) Good governance. The framework also aptly presents the national commitment to global agenda and conventions, most importantly the 2030 Agenda for Sustainable Development, which prescribes 17 SDGs among which majority concerns the RNR sector.

The past as well as the future of RNR sector is challenging, under the perils of abiotic and biotic stresses vis-à-vis the conflicting pressure from other sectors. However, considering the success of the sector, the optimism of fulfilling the sectoral vision will undeniably triumph to make the sector an engine of growth.

Figure 9 presents a schematic representation of the RNR strategic framework, where main building blocks are the institutional components and processes which has curtailed the past growth. The basic refurbishing in critical areas will facilitate the delivery process thereby enhancing the effectiveness and efficiencies of sectoral services. Additionally, the strategic map (Figure 10) provides a snapshot of the RNR Strategy 2040 and the cause-effect relationships of eleven strategic objectives and their hierarchy in fulfilling the overall objectives and the vision.

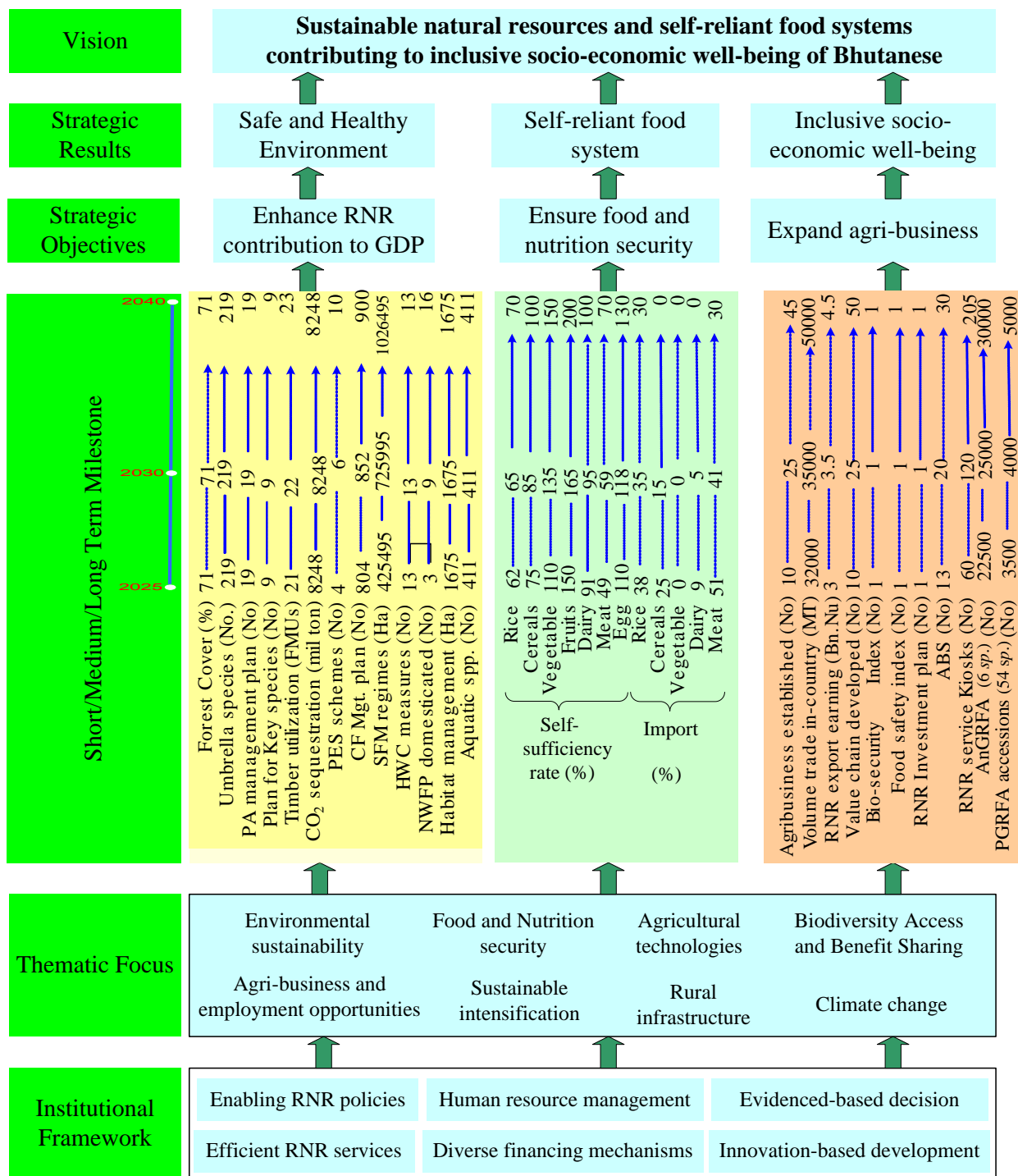


Figure 9: Strategic Framework for RNR Sector

Vision	Sustainable natural resources and self-reliant food systems, contributing to inclusive socio-economic well-being of Bhutanese.					
Mission	To create enabling policy, technology and value chain to ensure sustainable environment and food security					
Strategic priorities	Enhance production and quality of RNR commodities	Enhance contribution of RNR sector to National economy	Accelerate agri-business development and expansion	Develop enabling policies for RNR sector	Strengthen research, innovation and dissemination	
	Institute efficient RNR service delivery	Enhance production efficiency of RNR commodities	Promote Research and Innovation	Diversify sustainable financing for RNR sector development	Sustainable management of natural resources (Forest, land and water)	Enhance and promote resilience to climate change impacts
Strategic Results	<i>Self-reliant food system</i>		<i>Safe and Healthy Environment</i>		<i>Inclusive socio-economic well-being</i>	
Perspectives	Strategic Objectives		KPI	Targets	Interventions/Projects	
Stakeholder			Food and Nutrition Security Index	1 FNS Index	Establish the FNS Index for Bhutan	
			Self-sufficiency ratio, Import substitution	Rice-70%, Vegetable (100%), Rice-30% by 2040, Dairy products (100%), Meat (70%), Egg (130%)	Develop and promote improved climate resilient technologies (crops and livestock)	
			Food security reserve functional	Food reserve in all Dzongkhag	National food security reserve	
			Biosecurity measures strengthened	1 Biosecurity index	Establish Plant and Animal Biosecurity Index	
			National food control systems strengthened	Food quality and safety index by 2022	Establish Food Quality and Safety Index	
			RNR Sector contribution to GDP increased (17.37%)	RNR Sector contribution to GDP 30%	Establish mechanisms/proper accounting systems to monetize contribution of NR (sand, timber, ecotourism)	
Internal Processes			Operational Agri-business	Total 45 new enterprises	Support and establish Agri-businesses	
			Enabling RNR policies and legislations in place	6-Agriculture land use, Sector Support, Pricing, FNSP, insurance, Organic, Extension	Review, analyze and develop relevant policies	
			Research and extension strengthened	13 AEZ based research institutions	Strengthen research institutions	
			Professional capacity enhanced	1 strategic HR plan	Review the existing HR master plan	
			Enhanced efficiency service delivery	205 (Integrated RNR service Kiosks) by 2040	Integrated RNR service Kiosks	
				5 sub-sectoral SOPs	Develop clear SOPs for RNR service delivery	
Technology and Innovation			Advocacy on RNR plans and policies enhanced	Behavior change	Advocacy on RNR plans and policies to the stakeholders	
			Number of innovative technologies developed and promoted	15 technologies (2025); 30 Technologies (2030)	Develop innovative and gender responsive technologies for smart climate resilient farming	
			Number of research collaboration established	20 collaborations (2040)	Develop and promote use of modern technologies through digital platforms (Agri. 4.0);	
Resources			Resilience Index/Score established	Stability of all production factors over time	Strengthen collaboration with academic institution; private sector funding; access to production inputs	
			Innovative and sustainable RNR Sector investment plan developed	1 RNR Sector investment plan by end of 12th FYP	Develop Innovative RNR Sector investment plan	
			Protected and Conservation Area management strengthened	Management effectiveness of Protected areas maintained at 66.1 %	Implementation of METT + for PAs	
			Area brought under SFM regimes(FMUS, CFs, LFMPs, CBNRM)	425495 Ha of total forest area by 2023, + 5000 Ha from CF 2040 +596000 Ha from LFMPs)	Enhance Sustainable Management and Utilization of Forests	
			Watershed and Wetlands Management enhanced	All 186 Watershed Assessed by 2023,	Develop and Implement effective interventions to improve watershed and wetland conditions	
			Sustainable management and utilization of timber enhanced	23 FMUs by 2040,	Creation of two new FMUs and Develop 2 Sustainable Forest Management Plans	
			Agroforestry Program Strengthened	Agroforestry Strategy developed by 2023	Develop and strengthen Agroforestry Programs and interventions	
			Bio-prospecting and ABS initiatives	13 nos by 2023, 20 nos by 2030, 30 nos by 2040	Bio prospecting initiative for access & benefit sharing Strengthened	
			ANGR and PGRFA accessions	22500nos & 3500 nos by 2025;25000 &4000nos by 2030; 30000nos & 5000nos by 2045	Sustainable conservation and utilization of native crop and animal genetic resources	
			Circular economy model developed for Forest based Products	Number of smart wood based enterprises	Promotion of Smart wood based enterprises	
Core Values: Integrity, Efficiency, Innovative, Participatory and Integrated Approach, Reliability, Sustainability						

Figure 10: Strategy Map

RNR Strategies

The vision “*Sustainable natural resources and self-reliant food systems, contributing to inclusive socio-economic well-being of Bhutanese*” is the solemn pledge of RNR sector to strengthen the sovereign ecosystem of Bhutan for all time. It is truly the reflection of national aspirations to ensure “sustainable natural resource”, “self-reliant food system” and “inclusive socio-economic development” which the RNR sector commits to achieve by 2040. Correspondingly, the RNR strategic thrust areas are formulated to deliver the four strategic results (i) Self-reliant food system, (ii) Safe and healthy environment, (iii) Inclusive socio-economic well-being and (iv) Competitive agriculture value-chain. In view of the RNR sector oriented to sustainable rural development, poverty alleviation and regulation it was critical to deconstruct the vision and strategic results into strategies from the perspectives of outcome and delivery of RNR mandates. The four perspectives identified for the RNR sector are stakeholders, internal process, technology and innovation, and resources (similar to four perspectives in Balanced Scorecard - Kaplan and Norton, 1992). This helped in translating the vision into strategies and objectives specific to the four areas which is associated with RNR sector. The four perspectives for building strategies were identified as follows:

Stakeholders: The clientele base of RNR sector is very extensive – ranging from farmers, traders, processors, consumers, youths, public sector, private sector, and development partners.

Internal process: RNR sector has a large network of functional agencies, spread across all the Dzongkhags and gewogs. Sector also has wide range of legal and policy instruments to facilitate its services. Often, lapses in internal processes become a hurdle in reaching out and effectively delivering the intended services. Here internal processes imply the RNR sector organization and management procedures.

Technology and innovation: As a technical sector, one of primary tool is the smart and modern technological interventions that push the growth of the sector. Technology and innovation includes research, innovation and dissemination.

Resources: Considering the rural development focus of the RNR sector, the sector needs resources (physical, financial and human) to effectively deliver the services and bring about desired outcomes.

On the basis of the strategic issues identified earlier and the RNR sector vision, eleven strategies were defined in view of the four perspectives that influence the sector's input and outputs. The eleven strategies are as follows:

Strategy 1: Enhance production and quality of RNR commodities

Strategy 2: Enhance contribution of RNR sector to National economy

Strategy 3: Accelerate agri-business development and expansion

Strategy 4: Develop Enabling policies for RNR sector

Strategy 5: Strengthen research, innovation and dissemination

Strategy 6: Institute efficient RNR service delivery

Strategy 7: Enhance production efficiency of RNR commodities

Strategy 8: Promote research and innovation

Strategy 9: Diversify sustainable financing for RNR sector development

Strategy 10: Mainstream sustainable management of Natural resources

Strategy 11: Enhance and promote resilience to climate change impacts & Low emission development

Strategy 1: Enhance production and quality of RNR commodities

The major RNR commodities include cereals (rice, maize, wheat, millets, buckwheat), vegetables and fruits, pulses, oilseed, egg, dairy products, meat and natural resources or NWFPs collected from the forests. Beset with numerous challenges, the production of these commodities is limited and insufficient to meet increasing demand. The quality parameters of most of the commodities are also ill-defined and disregarded. It is only logical that any enhancement in production will lead to a higher level of food self-sufficiency and reduced dependency on imports, which is the long-cherished goal of the MoAF. Adequate food production, based on a combination of self-sufficiency and self-reliance principles, will necessarily translate into food and nutrition security of the nation.

Approximately 66,120 acres of land remain fallow (RSD, 2020) for reasons ranging from scarcity of farm labour, irrigation inadequacy and predation by wild animals. Given the difficult geographical terrain, land consolidation and development is required to facilitate farm mechanization leading to higher production and quality of RNR commodities. Critical production inputs are essential for increasing production and quality of RNR commodities and these inputs are superior livestock breeds, feed and fodder, medicines, vaccines, high yielding seeds and

seedlings, fertilizers (both organic and inorganic) and irrigation water. To enhance the quality of the produce there is need to develop and disseminate improved production packages (GAP, GMP, GHP) for all the important commodities, which are easy to follow and adopt by the producers. In order to avoid loss of good agricultural land to other land uses, there is an urgent need to designate Agro-Ecological Zones (AEZ) for major RNR commodities production. Further, to sustain continued flow of ecosystem services, strategic interventions to sustainably manage and utilize natural resources are required. The following are priority initiatives:

- Enhance development and utilization of fallow lands
- Increase and intensify access to production inputs
- Develop and disseminate Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP)
- Designate AEZ for major RNR commodities
- Enhance sustainable management and utilization of natural resources

Strategy 2: Enhance contribution of RNR sector to National economy

The RNR sector as one of the Five Jewels plays a major strategic role in the economic development of Bhutan. It has made considerable contributions to the economic prosperity of the country with 17.4% contribution to national GDP (NSB 2018) and employment of about 51.1% (LFS, 2017) of the total employed population. Furthermore, 71% of our country's total geographical area is maintained under forest cover with rich biodiversity and natural resources. The population by large is agrarian and rural based (62.2% of the total population in 2017); therefore, the RNR sector in Bhutan has the potential to contribute much more significantly to food security, poverty alleviation, economic diversification, wealth creation, employment generation and to the overall national economy. With more than half of the population engaged in farming, RNR sector has significant role in ensuring sustained stable economic growth.

However, to build this economic foundation, a greater thrust in enhancement of RNR sector productivity and fiscal disciplines are a prerequisite. There is thus a need for structural transformation of the RNR Sector thereby giving necessary momentum to agribusiness, agro-based industries, increase in productivity, transformation of subsistence to commercial farming, climate smart agriculture, transformation of current farming to Agriculture 4.0, and most importantly private sector engagement in RNR sector development. Increase in RNR production and rise in per capita income of the rural population together with industrialization and

urbanization lead to an increased demand in industrial production which further helps promote economic growth of a country.

Investment is the fundamental driver of the RNR sector. For the RNR sector, the agricultural capital stock formation is only 0.05% of the National Capital Stock Formation (PPD, 2020). This shows the meagre capital stock share of the RNR sector for a huge policy responsibility of FNS. The growth in the labour productivity and Total Factor Productivity in Bhutan has also been low. In addition; the development of agro-based industries is seen as a necessary driver for RNR Sector growth. Direct and indirect contributions from the RNR sector have not been adequately accounted for despite the actual contribution. There is a need to institute a green accounting system to indicate the monetary contribution to the national economy. The following are priority initiatives:

- Increase investment in RNR sector
- Create capital stock formation
- Enhance labour productivity and technology
- Expand Agro-based industries
- Institute green accounting system (Monetization of Ecosystem Services)

Strategy 3: Accelerate RNR enterprise development and expansion

Driven by small-holder farmer, subsistence and semi-commercial production, some of the strategic issues in agri-business in Bhutan are limited market opportunities, low uptake of farming as a business by private entities, limited private sector investment, weak and unorganized value chain and cheap imports. Agri-business has a vital role as a multiplier of agricultural development. While at the upstream it stimulates production and consumption, in the downstream it accelerates the pace of economic development. The network of domestic-regional-international markets can widen the product destination thereby increasing the demand, concurrently the expansion of production, processing and income. An increased impetus and focus on market driven production on potential and high value products with value addition and enterprise development will be a priority so that RNR sector contributes towards import substitution and national economy.

Major challenges encountered in marketing fresh produce are transportation, aggregation facilities, storage, low volume, and price competition with imported products. To accelerate demand for Bhutanese products there is a need to explore and identify niche markets and establish market linkages at national, regional and international levels. Lack of market information on price,

supply and demand situation and forecasts are also some of the major issues that need to be addressed. Strong market intelligence system that ensures timely dissemination of accurate and reliable agricultural marketing information is crucial for farmers, traders and policymakers to make appropriate decisions. Some of the other strategic issues are lack of PPP & FDI in RNR businesses and weak product quality management with regional and global standards and certification systems such as GAP and Organic standards. To address these issues there is a need to develop guidelines and strategies, engage the private sector in streamlining the supply chain process and expanding economic opportunities. Alongside, there is the need to strengthen the post-harvest facilities (processing industries, cold chain facilities) to expand and accelerate agribusiness in the country. The following are priority initiatives:

- Encourage PPP and FDI in RNR businesses
- Develop and promote the supply chain
- Enhance market price management
- Enhance MIS and promote RNR market network
- Develop market infrastructure
- Adopt and implement regional and global production and quality management standards

Strategy 4: Develop enabling policies for RNR sector

The National Forest Policy, 2011 and National Food and Nutrition Security Policy 2014 are the two umbrella policies of the RNR Sector to fulfil its core mandates of sustainably managing natural resource base and food self-reliance. Equally important, many contributory public policies and legislations are in place to support the operations of the sector. In view of the multiple drivers of the RNR sector growth, the legal and policy frameworks have not adequately catalysed the sector development. For instance, the review of agriculture policy and strategies by the Natural Resources and Environment Committee (National Council, 2013) presented compelling interpretations of the inadequacies of the Food and Nutrition Security (FNS) policy, the absence of a comprehensive pricing policy, subsidy policy and crop and livestock insurance mechanisms that limit achievements of the sector. Similarly, the case policy incoherence is often mentioned in research paper, for instance the Rice commodity chain analysis (FAO, 2006) picks on the policy on environment and conservation of wild life directly affecting farmers who suffer crop losses because of rampage by wild animals. Some of the existing policy and legal instruments are also perceived to be inconsistent or even contradictory leading to unstructured decision making and competing priorities resulting in poor strategic direction.

Structural transformation in the RNR sector through enabling policy and legal interventions is therefore critical and the way forward in diversifying the economic base of the country. Although there are numerous RNR policies and legislation there is low level of advocacy and awareness amongst the stakeholders. Harmonization of policies through amendment of existing policies, development of new policy, strategies, regulations or guidelines that clarify and resolve apparent contradictions are critical to achieve cohesiveness, synergy and collaboration within the sub-sector and between the central and local administration. The absence of required policies (Agriculture land use policy, RNR Sector Development support policy, Pricing policy for RNR commodities, National Organic Policy, Extension policy) impede the realization of the expected impact at the grassroots level. Further, in the absence of structured policy implementation mechanisms, challenges with interpretation and implementation often impede the development interventions. Therefore, there is need to develop implementation mechanism/framework.

The following are priority initiatives:

- Aggressively advocate RNR sector policies and legislations;
- Review existing policies for coherence and harmonization;
- Develop/formulate new policies and legislations as deemed necessary
- Develop policy implementation mechanism/framework
- Sustain operationalization of the National Food Security Reserve (NFSR).

Strategy 5: Strengthen research, innovation and dissemination

The RNR sector development started with establishment of research, demonstration and training units in Yusipang, Bhur and Khangma for agriculture; Taba for forestry and Wangchutaba for livestock during first plan period (1961-66). Ever since, research and extension became a crucial arm of the sector, contributing significantly in terms of promoting modern technologies for RNR sector growth. In early 2000, RNR research gained momentum resulting in a new Council for RNR Research of Bhutan (CoRRB) responsible for Ministry-wide coordination, screening, prioritizing and evaluation of research. Further, to provide policy guidance on the conduct and management of RNR research in the country, RNR Research Policy was approved by the Cabinet in 2012. However, under the pressure of series of organizational reviews and changes over the years within the sector, CoRRB succumbed delegating the research mandates to respective agencies. Thereafter, the thrust on RNR research gradually diminished to the point that erstwhile research centres became entangled in development activities.

As a technical agency RNR sector has to be backed by science and sustained research. A systematic research, transformational innovation, and timely dissemination have to drive the RNR sector development. Currently, there are sectoral research strategies which are implemented in silos. Therefore, there is a need for an overarching RNR research strategy to be developed. Furthermore, in view of the sub-sectoral integration at the grassroots level, there is a need for strengthening institutional collaboration amongst local, regional and international institutions. An ideal and enduring research institution as explained in the Annexure 2 will facilitate growth of RNR research and innovation. As we move forth to the 21st century and plan to achieve accelerated socio-economic development, there is a need to enhance the capacity of research training institutes, attract funding and engage the private sector, as well as develop collaboration with academic institutions. Instituting integrated RNR-Kiosks for technology dissemination and service delivery is also seen as equally important. The following are priority initiatives:

- Develop and implement comprehensive RNR research strategy
- Enhance capacity of research centres, training institutions and extension
- Attract funding and engagement in research and innovation
- Expand collaboration with academic institutions for research
- Institute integrated RNR-Kiosks for technology dissemination and service delivery

Strategy 6: Institute efficient RNR service delivery

Extension forms the frontline professionals of RNR and an indispensable link between the RNR sector and its large clientele base (producers, aggregators, entrepreneurs, food processors, marketers and consumers). Fundamentally they play a crucial role in conservation of natural resources, boosting systems productivity, increasing food security, improving rural livelihoods, and dissemination of policies and smart technologies as an engine of economic growth. Apart from technology transfer and agents of change, they also serve as an essential conduit to feedback field concerns and issues. Ever since the start of planned development in 1961, MoAF instituted a technical cadre and placed technical officials in all gewogs and dzongkhags building an extension network for service delivery. Some of the prominent institutions spread across the country are RNR centres, veterinary hospitals, research centres, production farms, quarantine facilities, forest offices, and training centres. With the rapid socio-economic development, farming in Bhutan is fast transforming into a technology-based commercial operation attracting youth and private sector. This transformation demands strengthened linkages and collaboration with local governments and communities for more proactive, resilient and efficient service

delivery to match the aspirations of clients and at the same time ensuring sustainable conservation and utilization of renewal natural resources for present and future use.

New farming technologies and practices are frequently updated and innovated to improve the farm productivity. There is a need to regularly train and expose our farmers, youths and relevant clients on improved technologies and practices for which five regional training and technology demonstration centre are proposed to be established. In order to facilitate reliable support services for food production, integrated RNR laboratories will be strengthened to provide testing and diagnostic services. RNR sector provides numerous services but it has always been a challenge to make it easily accessible. Review of existing and development of new Standard Operating Procedures (SOP) in line with policy reforms and changing needs of clients is important. To enhance access and efficient delivery of services an integrated RNR service kiosk will be established in all gewogs. Various policies, plans and programs provided by MoAF are not widely known to the clients as such the desired impact is not realized by targeted beneficiaries. Therefore, there is a need for regular advocacy and awareness programs. The following are priority initiatives:

- Strengthen training and extension institutions
- Strengthen laboratory services:
- Institute Integrated RNR Service Kiosk
- Develop/review and disseminate SOP for RNR Services
- Advocate RNR policies, plans, programmes and services

Strategy 7: Enhance production efficiency of RNR commodities

RNR sector comprising of close interwoven system of crops-livestock-forest, represents a multifunctional entity producing diverse outputs and services. Agricultural production system as a multifunctional structure has to efficiently strike a balance among social, ecological and financial objectives to guarantee a sustainable production system. The efficiency of production system is directly proportionate to how natural resources, human resources, and capital goods – the three main factors of production are innovatively used to produce goods and services. Bhutan is endowed with bountiful natural resources, however, small farming population and scarce capital resources tends to influence how these factors of production are used. The enhancement on production efficiency of RNR commodities is crucial to ensure conservation of natural resource, food and nutrition security and self-reliance. Though several attempts have been made by the

Ministry in the past plans to address this concern, it has still remained as a grey area requiring due attention. A paradigm shift is required to accelerate RNR sector development.

Farm labour shortage has been identified as one of the major constraints to farming population resulting in high cost of production. To address this concern, farm mechanization is seen as one of the vehicles to achieve production efficiency. To counteract the adverse effects of climate change there is a need to develop innovative and resilient farming technologies. Additionally, enhanced improvement in production efficiency of RNR commodities will necessitate access to quality production inputs. Incentivizing farming communities through provisions of Cost-Sharing Mechanisms, Minimum Support Price, access to credit facilities, etc., will bring about the desired impetus in the prioritized commodities. Promoting integrating agricultural landscapes will enhance scale and efficiency of production. To diversify the traditional food sources, alternative protein sources and cultured meat will be explored. The following are priority initiatives:

- Promote mechanization technologies to improve farm efficiency
- Develop innovative and resilient technologies to enhance food production
- Enhance access to quality production inputs
- Incentivize production of prioritized RNR commodities
- Develop integrated agriculture landscape production systems

Strategy 8: Promote Research and Innovation

Research and innovation is one of the vital interventions in solving new challenges and to pursue opportunities in development of RNR sector in times to come. With certain level of adoption of research output, we have seen the clear impact in poverty reduction in Bhutan mainly due to productivity improvements and food diversity through development of improved agriculture inputs. As such it is crucial and important to promote research and innovation in RNR sector in enhancing livelihood, food security and to strengthen national economy. Investment in research and innovation need to be given priority and advocated to further enhance the agriculture productivity and sustainability of agriculture system to ever growing demand for nutritious and safe food. Due to population growth, with very limited arable land, challenge posed by global climate change and other threats, research and innovation would be one of the responses in overcoming these challenges.

Due to population drift and increasing feminization of farming, the need for gender sensitive technologies is increasingly becoming pertinent. Gender responsive technologies would help in

minimizing drudgery in farming and achieve enhanced production efficiency. The use of ICT in generation and dissemination of relevant technology for increasing productivity and adapting to emerging threats is urgently needed. Thus, potential ICT applications need to be identified and applied in the Bhutanese farming systems for increased productivity and efficiency. Considering the limited expertise and resources in the RNR sector, strong collaboration with regional and global centres of excellence (example: CGIAR) is must to introduce new technologies and adapt to the Bhutanese conditions.

Given the limited resources in generating research technologies by the sector, the need for the private sector to engage and contribute in research and innovation is important. Providing an enabling environment for researchers is crucial to foster innovation in research. To this end, appropriate reward mechanisms must be instituted to foster and encourage excellence in research and innovation. The following are priority initiatives:

- Develop innovative and gender responsive technologies
- Develop and promote use of modern technologies through digital platforms (Agri. 4.0),
- Develop and strengthen collaboration with regional and global centres of excellence
- Encourage private sector funding and engagement in Research and Innovation.
- Institute reward system for excellence in research and innovation
- Institute assured and stable research funding system

Strategy 9: Diversify sustainable financing for RNR sector development

Bhutan's global commitment to the Sustainable Development Goals and other international conventions related to the RNR sector are challenging from the financing point of view. As the country graduates to a middle-income country by 2023, the pressure to fund the development activities will escalate. Based on the concept of development finance, it is important to diversify financing of the RNR sector development. In view of the diverse strategic objectives of RNR sector which are local, regional and global in outcome benefit sharing, the investment needs to be aligned to the prospective beneficiaries. Additionally, if the outcome is to be created and sustained, benefits have to be equitably distributed through the financing lifecycle. In view of the RNR 2040 vision and strategic initiatives (MoAF, 2020) such as securing food self-reliance, accelerating agri-business, efficient service delivery, innovation in the sector, ensuring resilient production system and suitable resource management, the sector will have to secure/generate commensurate funding through an innovative RNR sector investment plan.

The Economic Development Policy, 2016 clearly provides opportunity for FDI in agri-business. With the expansion of agribusiness opportunities like organic farming, wood-based industries, agro/eco-tourism, adventure tourism, the scope to attract and engage FDI will be expanded. The sector investment analysis (in terms of total Budget outlay) and the RNR sector growth (GDP Contribution from the RNR sector) from the 5th five year plan to the 11th five year plan, indicates the correlation at 0.927 (Perfect correlation value =1) signifying high correlation, establishing the phenomenon that should growth be produced in the RNR sector it should fundamentally be driven by the state investment. Thus, RNR sector growth is fundamentally driven directly by Government investment. Therefore, the Government needs to prioritise investment in the RNR sector. As the sector accelerates commercialization and agribusiness, the prospect to attract private sector, PPP and RNR Cooperatives/enterprises besides enhancing access to global funds would propel the economy further. Improving the affordability and accessibility to rural/agriculture credit facilities is seen as important too since this can help secure funding sources for start-ups as well as expansion of existing agri-businesses. The following are priority initiatives:

- Encourage and involve FDIs in RNR Sector development
- Reprioritize public investment in RNR Sector
- Encourage private sector, PPP and RNR cooperatives
- Enhance access to micro-finance and credits for agri-business
- Enhance resource mobilization through global funds for food and agriculture, climate change and conservation

Strategy 10: Mainstream sustainable management (conservation and utilization) of natural resources

The guiding principles of environment conservation and sustainability in Bhutan emanates from the Article 5 Clause 2 of the Constitution, which mandates the Government to (a) Protect, conserve and improve the pristine environment and safeguard the biodiversity of the country; (b) Prevent pollution and ecological degradation; (c) Secure ecologically balanced sustainable development while promoting justifiable economic and social development; and (d) Ensure a safe and healthy environment. Bhutan's global leadership in conservation is exemplified by the award of "Champion of the Earth" in 2005 and "J. Paul Getty Conservation Leadership Award in 2006" bestowed on His Majesty Drukgyal Zhipa. Bhutan's natural resource endowment of 1001 million m³ stock of rich forests and natural vegetation, 7434 floral and faunal biodiversity and rich water bodies form a major source of livelihood security. Apart from food, water and shelter that it provides, forests also offer numerous intangible provisions and benefits. Among the Five Jewels

of the Bhutanese economy, the three most important ones (Hydropower, agriculture and tourism) are directly dependent on the natural resource base of the country. DoFPS aims to appropriately protect and conserve the floral and faunal diversity and other natural resources of the country through appropriate scientific management planning to ensure social, economic and sustainable natural resources. Consequently, judicious management of natural resources is a key strategy of environmental conservation, strengthening rural livelihoods and eradicating poverty.

In order to ensure environmental well-being of the present and future generations of Bhutan mainstreaming sustainable utilization of Natural resources including genetic resources are important. These measures will enable us to fulfil the Constitutional mandate of maintaining 60% of forest cover for eternity. Forests contain unique gene resources underpinning agriculture and animal husbandry as well. Physically and spiritually forests have defined the cultural and religious values of Bhutanese communities throughout time. Besides, provision for direct and tangible benefits, other intangible benefits of enhancing socioeconomic wellbeing are yet to be accounted for. Thus, to comprehensively account for all the ecosystem services, the institution of a green accounting system is imperative. Considering the rich natural resource base and the immense potential to sustain livelihood, there is a need to strengthen bio-prospecting initiatives to ensure access & benefit sharing. To facilitate efficient and sustainable utilization of natural resources, principles of Circular Economy should be applied. Owing to vast pristine habitats harbouring diverse wildlife, wildlife is increasingly coming in conflicts with the farming communities. In order to address this, there is a need to develop innovative mechanisms to mitigate human wildlife conflicts. The following are priority initiatives:

- Mainstream sustainable utilization of NR including genetic resources
- Develop and institute green accounting for natural resources
- Strengthen bio prospecting initiative for access & benefit sharing
- Promote circular economy for natural resource utilization
- Develop innovative mechanisms to mitigate HWC

Strategy 11: Enhance and promote resilience to climate change impacts & Low emission development

Bhutan is in the forefront of the regional and international commitment to remain carbon neutral and has been a champion in securing pristine natural environment for all times to come. With limited industrialization, sequestering three times more carbon than national greenhouse gas

emissions and with zero contribution to global climate change, Bhutan has to face the perils of climate change-related threats.

Although numerous climate smart initiatives to build climate resilience and low emission initiatives are implemented, Bhutan still remains vulnerable to the effects of climate change. Like many other nations, Bhutan experiences increasing challenges of climate change causing intense yet sporadic agricultural damages impacting rural livelihood. In addition, Climate change causes damage to infrastructure leading to disruption in essential services such as roads and communication facilities and causes marketing challenges for RNR products. Bhutan must devise and adopt appropriate plans to secure the future. To mitigate the perils of climate change, Bhutan has to implement more versatile climate resilient technologies and adapt wisely to climate change in order to ensure livelihoods of Bhutanese people.

Due to fragile mountainous landscapes, Bhutan is more vulnerable to the adverse impacts of climate change especially the RNR sector. The impacts of climate change are likely to add to the challenge of food production in Bhutan. The farming communities have already been experiencing the climate related hazards and impacting their livelihood. Therefore, an increased impetus to develop climate smart and resilient farming technologies is a priority. With a forest cover of 71 % and an ambitious goal of staying carbon neutral, knowledge on future risks of the forests and landscapes is important. This will aid in maintaining carbon sequestration capacities of forest ecosystems. Capacity to conduct R&D in climate change science is still limited and further attenuated by low investments. This has to change in order to enhance resilience to climate change impacts. Thus, there is a need for increased investments in climate change research and development. The ability to cope and adapt to the adverse impacts of climate change differs among rural communities. Promotion of integrated production landscapes is known to minimize the severity of the adverse impacts. Green infrastructures and technologies increase climate change resilience. For Bhutan, environment friendly road construction, climate proofing of irrigation infrastructure, plantations, renewable energy are the main priorities. The following are priority initiatives:

- Develop climate smart and resilient farming technologies
- Maintain carbon sequestration capacity of forest ecosystem
- Increase capacity and investment in climate change research
- Develop integrated agriculture landscape systems
- Promote green technologies (Biogas, Green infrastructure, Organic inputs etc.)
- Strengthen agrometeorological information and data management

Key Performance Indicators

The alignment of programming, implementation and the process within the RNR sector is critical to assure attainment to strategic results and the vision which is far-reaching and all-embracing in its scope. The sector will require set of verifiable measurement metrics to gauge and demonstrate the progress in achieving strategic objectives. Taking into account the enduring purpose transcending beyond the set timeline, RNR Strategies are attributed with credible measurement metrics in the form of Key Performance Indicators (KPIs) with specific indicators (Table 5).

Table 5: Key performance Indicators of Eleven RNR Strategies

Measurements (KPIs)	Indicators
Strategy 1: Enhance production and quality of RNR commodities	
1.1 Food and Nutrition Security Index of Bhutan	<ul style="list-style-type: none"> - 1 FNS Index - Self-sufficiency ratio (Rice-70%), Cereals (Wheat, Millet, Maize-100%), Vegetable (100% by 2025 and 150% by 2040), Fruits (200%), Dairy products (100%), Meat (70%), Egg (130% ~ equivalent to the recommended dietary allowances as per FAO standards); - import substitution Rice-30% by 2040; Wheat/maize-100%, Vegetable-100% substituted by 2025, Dairy products- 12.4% import substituted by 2040, Meat-33% (2040) - 1 Biosecurity Index developed, quarantine stations strengthened, biosecurity emergency risk management plan developed and implemented, 80% of farms implement farm biosecurity measures, GMOs, LMOs entry prevented - 1 Food Quality and Safety Index, commercial RNR inputs regulated, food business operators licensed for food safety, food import control system operationalized, food safety emergency management enhanced, foodborne disease surveillance systems operationalized, National Food Testing Laboratory strengthened and satellite labs in biosecurity sensitive areas established, food product certification promoted, food safety culture advocated for behavioral change
1.2 Self-sufficiency ratio (Rice (Baseline: 47%), Cereals (Wheat, Millet, Maize: 85%), Vegetable (baseline:80%), Fruits (Baseline: 132%), Dairy products (87.6%), Meat (37%), Egg (100%);	
1.3 Import substitution (Rice, Cereals, Vegetable, dairy products, meat)	
1.4 Plant and animal Biosecurity measures strengthened	
1.5 National food control systems strengthened	
Strategy 2: Enhance contribution of RNR sector to National economy	
2.1 RNR Sector contribution to GDP increased (17.37%) - Crops (10.64%), Livestock (4.29%), Forest (2.44%)	<ul style="list-style-type: none"> - 30% RNR Sub-Sector contribution to GDP- Crops (14%), Livestock (7%), Forest (9%) - 25 value chain in 3 sub-sectors
2.2 Develop formal value chain for priority commodities (Crops, livestock, NWFP)	

Measurements (KPIs)	Indicators
Strategy 3: Accelerate agri-business development and expansion	
3.1 Number of operational Agri-business/enterprises established (20)	- 45 new enterprises (2040) – 10 enterprises (2025); 25 enterprises (2030) and 45 enterprises (2040)
3.2 Increased volume of RNR products traded domestically	- 32,000MT(2025) ; 35,000MT (2030); 50,000MT(2040)
3.3 Export earnings of RNR products increased	- 3 bn(2025); 3.5bn (2030); 4.5 bn (2040)
3.4 Value chain developed	- 10 nos (2025); 25 nos (2030); 50 nos (2040)
3.5 Quality assurance and certification systems in place	- 5 systems-GAP/GMP (2022), HACCP (13 FYP), GAP (2022), Organic (2022), food product certification systems (2022)
Strategy 4: Develop enabling policies for RNR sector	
4.1 Enabling RNR policies and legislations in place	- 6 policies-Agriculture land use Policy (13th FYP), RNR Sector Development Support Policy (2023), Pricing Policy (2021), Revised FNSP (2021), Crop and livestock insurance scheme (2022), National Organic Policy (2023), RNR extension policy;
4.2 Operationalization of policies and legislations	- 4 Acts-Food Act (2022), Livestock Act (2022), FNCA (2023), Cooperative Act (2020) - Advocacy and implementation of policies and legislations
Strategy 5: Strengthen research, innovation and dissemination	
5.1 Comprehensive RNR research strategy in place	- Comprehensive RNR research strategy developed
5.2 Research and extension capacity strengthened	- 13 Agro-ecological zone-based research institutions (4 each DoA, DoFPS, DoL, DAMC-1), 4 - 12 FYP
5.3 Professional capacity enhanced	9- 13 FYP;
Strategy 6: Institute efficient RNR service delivery	
6.1 Enhanced efficiency of RNR service delivery	- 5 RNR Integrated Farmers' Training Centers; 5 strategic locations - Integrated laboratory services (soil, seed, feed, animal health & wildlife), Animal welfare indicator developed
6.2 Advocacy on RNR plans and policies enhanced	- 205 (Integrated RNR service Kiosks) by 2040 - 5 sub-sectoral SOPs (DoFPs, DAMC, DoL, DoA, BAFRA) by 2021; 1 strategic HR plan (competency based, succession planning) by each plan - Behaviour change (increase in the number of clients availing services and decline in number of defaulters) Improve service delivery by reducing TAT
Strategy 7: Enhance production efficiency of RNR commodities	
7.1 Number of innovative technologies developed and promoted	- 30 Technologies (2030); 15 technologies (2025)
7.2 Number of research collaboration established	- 20 collaborations (2040)
7.3 Outreach of mechanization services enhanced	
Strategy 8: Promote Research and Innovation	
8.1 Resilience Index/Score established	- Stability of all this factors over time (Income and access to food; Social safety nets such as food assistance and

Measurements (KPIs)	Indicators
	social security; Assets such as land and livestock; access to basic services; households' adaptive capacity)
Strategy 9: Diversify sustainable financing for RNR sector development	
9.1 Innovative and sustainable RNR Sector investment plan developed	- 1 RNR Sector investment plan by end of 12th FYP
Strategy 10: Sustainable management (conservation and utilization) of natural resources (Forest, land and water)	
<p>10.1 State of forest and carbon stock assessment of Bhutan completed</p> <p>10.2 Aquatic Ecosystems Maintained</p> <p>10.3 Population estimates of Umbrella Species</p> <p>10.4 Protected and Conservation Area management strengthened</p> <p>10.5 Forestry and wildlife offences/conflicts management strengthened</p> <p>10.6 Nature based Eco-tourism strengthened</p> <p>10.7 Community based forest management and conservation enhanced</p> <p>10.8 Professional Capacity of Foresters enhanced</p> <p>10.9 High Value NWFPs domesticated</p> <p>10.10 Area brought under SFM regimes (FMUS, CFs, LFMPS, CBNRM)</p> <p>10.11 Sustainable management and utilization of timber enhanced</p> <p>10.12 Agroforestry Program Strengthened</p> <p>10.13 Watershed and Wetlands Management enhanced</p> <p>10.14 PES Schemes Established</p> <p>10.15 Native crop and livestock genetic resources commercialized</p> <p>10.16 Bio-prospecting and ABS initiatives</p> <p>10.17 Biosecurity measures enhanced</p> <p>10.18 Circular economy model developed for Forest based Products</p> <p>10.19 Area (grassland, rangeland and sokshing) brought under sustainable management for feed, fodder and manure</p> <p>10.20 Climate smart and Disaster resilient preparedness enhanced</p>	<ul style="list-style-type: none"> - National Forest Inventory conducted once every five years, (2023, 2028, 2033, 2038, 2043); State of National Forest report 2023, 2028, 2033, 2038, 2043); Forest Carbon stock of Bhutan (2023, 2028, 2033, 2038, 2043) - No of Aquatic macro-invertebrates species maintained at 411 by 2040 - Maintain sustainable population of umbrella species (123 tigers, 96 snow leopards) - Management effectiveness of Protected areas maintained at 66.1 %, 19 Protected area management plans, 1675 ha brought under habitat management, Conservation action plans for 9 key species developed, Bhutan wildlife health strategy developed by - All 28 Field Offices Adopts Zero Poaching Strategy Innovative and effective HWC mitigation measures up-scaled (13 nos.) by 2023; 6 Wildlife Rescue and Rehabilitation Centers established by 2023. - 30 by 2023, 45 by 2028, 60 by 2033, 75 by 2038, 81 nos. by 2040; 8 Nature Recreational Areas developed by 2023 - 804 CFs & Management Plans by 2023, 900 CFs by 2040, 13 CF Network Group by 2023, 30 CF Networks by 2040; 180 NFWP groups by 2023, 200 groups by 2040 - 1291 foresters by 2040 - 16 NWPS domesticated (including 10 MAPs) - 425495 Ha of total forest area by 2023, + 5000 Ha from CF 2040 +596000 Ha from LFMPS) - 23 FMUs by 2040, 8000 Ha (one FMU) by 2030, 8000 Ha (one FMU by 2040; 205 LFMPS by 2040; Forest Management Code of Bhutan 2020 developed - Agroforestry Strategy developed by 2023 - All 186 Watershed Assessed by 2023, 10 degraded watershed improved through interventions by 2023, 5 wetland Management Interventions developed by 2023, National Wetland Inventory conducted by 2023; 19095 Ha of plantation areas by 25895 Ha by 2040 - 4 PES schemes by 2023, 6 PES by 2028, 8 by 2033, 10 by 2040 - No of native crop and livestock genetic resources commercialized, 4 Native livestock (dairy, poultry, piggery and small ruminant/ honey), 5 Nos. of native crops/varieties commercialized - 13 nos. by 2023, 20 nos. by 2030, 30 nos. by 2040

Measurements (KPIs)	Indicators
	<ul style="list-style-type: none"> - Biosecurity management interventions (AIS) developed by 2022 - Number of smart wood-based enterprises - Maize + Soybean as feed ingredient = 128715 acres Grassland + Rangeland = 705825 acres Improved pasture = 75258 acres; 5% of <i>sokshing</i> area brought under improved management - Forests capacity for carbon sequestration maintained at 8.248 mill. tons Co2 Equivalent; National REDD+ Strategy & Action Plan by 2020, Spatial Decision Support Systems Tool Developed, NFMS and MRV Established, Forest fire prone area assessed (10 Dzongkhags) 20 Assessment 2023; 2040 Complete Nationwide Assessment; 72 Forest Fire management groups; Forest fire prone area assessed (10 Dzongkhags)by 2023; 2040 Complete all assessments - 240 Ha of Area effectively managed and fire hazard reduced
Strategy 11: Enhance and promote resilience to climate change impacts and low emission development	
11.1 Enhance resilience to climate change	<ul style="list-style-type: none"> - 50 climate resilient crop varieties and breeds - 25 Climate smart and gender responsive technologies - 19095 Ha of plantation areas by 2023, 21095 Ha by 2028, 23095 Ha by 2033, 25095 Ha by 2038, 25895 Ha by 2040 - National REDD+ Strategy & Action Plan by 2020, Spatial Decision Support Systems Tool Developed, NFMS and MRV Established, Forest fire prone area assessed (10 Dzongkhags) 20 Assessment 2023, 2040 Complete Nationwide Assessment - Forests capacity for carbon sequestration maintained at 8.248 mill. tons Co2 Equivalent

Strategic Initiatives

Commensurate to the dynamic and progressive vision, strategies and stimulating KPIs, RNR sector identified 114 strategic initiatives that will set the sectoral strategies in action to generate strategic results. These initiatives assigned to respective agencies of the RNR sector not only mandate a particular functional unit, rather it also creates possible synergies between the initiatives and the functional units. Using a simple prioritization matrix, the 114 initiatives were mapped in four quadrants (short term, medium term, long term, and ignore) based on two criteria of (i) ease of implementation and (ii) value to stakeholder. Based on the prioritization, 35% of the initiatives were identified for the short-term intervention, followed by 33% and 32% intervention slotted for medium-term and long-term respectively (Figure 11 and 12).

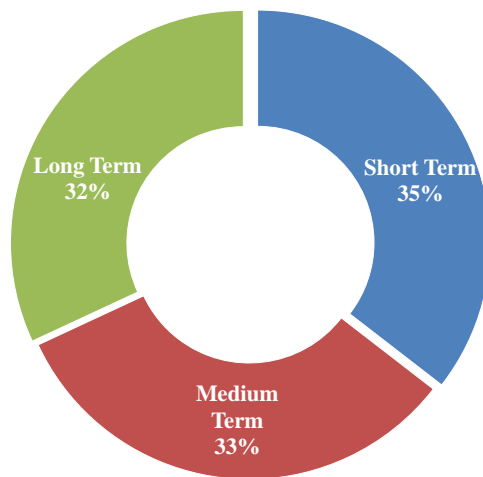


Figure 11: Designation of 114 interventions as short-medium-long term (based on implementation)

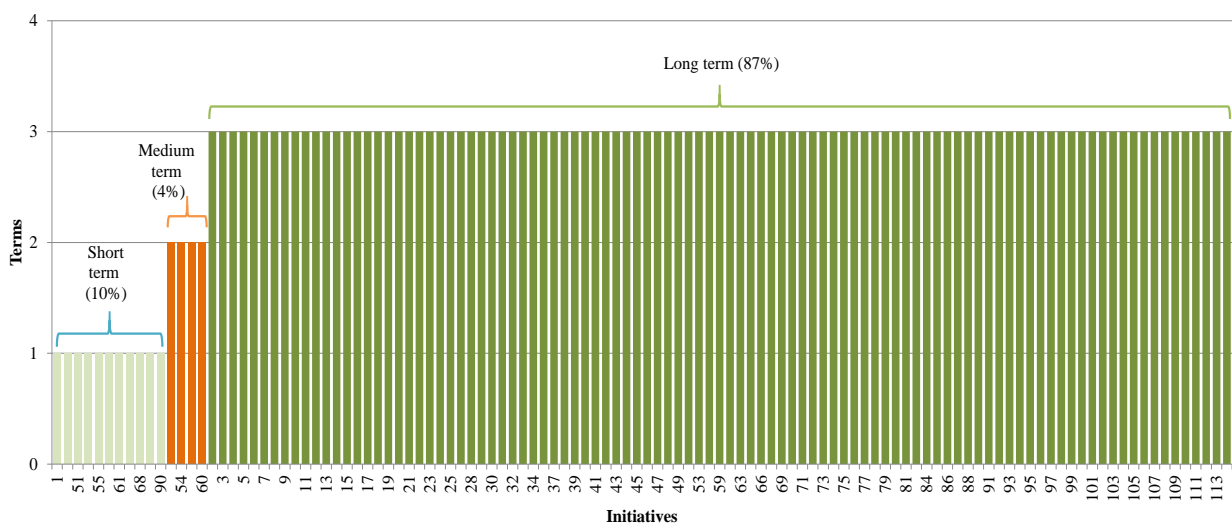


Figure 12: Designation of 114 interventions as short-medium-long term (based on completion)

Maximum interventions are associated to Strategy 1 (Enhance production and quality of RNR commodities) accounting 26.9% of the total interventions. Interventions related to Strategy 10 (Sustainable management of natural resources) accounts 22.5% followed by S3: Accelerate agri-business development and expansion taking up 8.7%. The share of interventions addressing the above three strategies actually demonstrates the strategic thrust area of the RNR sector. One of the area which is often raised as strategic issue is the RNR service delivery, fittingly so Strategy 6 (Institute efficient RNR service delivery) comprise of 8.7% interventions. All the remaining 5 strategies include 4-5% intervention, while Strategy 9 (Diversify sustainable financing for RNR sector development) has only 1.7% intervention (Figure 13).

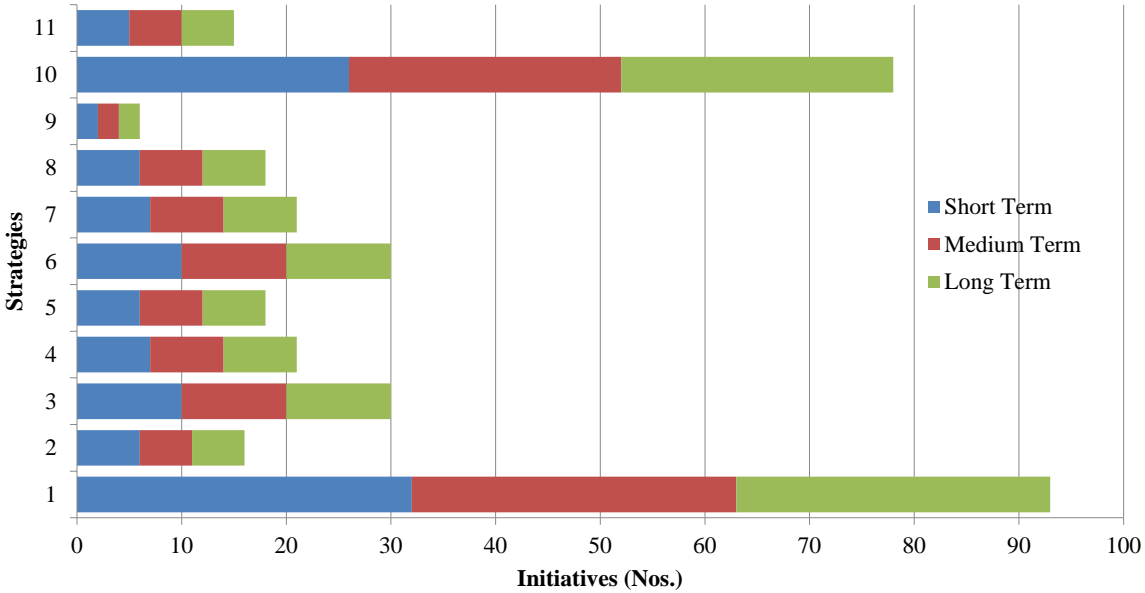


Figure 13: Interventions associated to eleven RNR strategies

From among the RNR sub-sectors, the Department of Forests and Park Services have maximum initiatives of 26.6% which is warranted for the mandate it holds to sustainably conserve 71% pristine forest cover that provides enormous ecosystem services. The other two functional agencies, livestock and agriculture commit to 17.8% and 17.6% of the initiatives respectively. BAFRA and DAMC foresee a major role in regulating biosecurity and facilitating agri-business in RNR sector, thus proposes 12.9% and 11.7% initiatives respectively. To offer enabling environment, legal and policy frameworks and financial and human resources are critical, accordingly PPD and DoS has 5.6% and 4.9% interventions respectively. Finally, 2.9% of the initiatives are related to biodiversity and genetic resources (Figure 14).

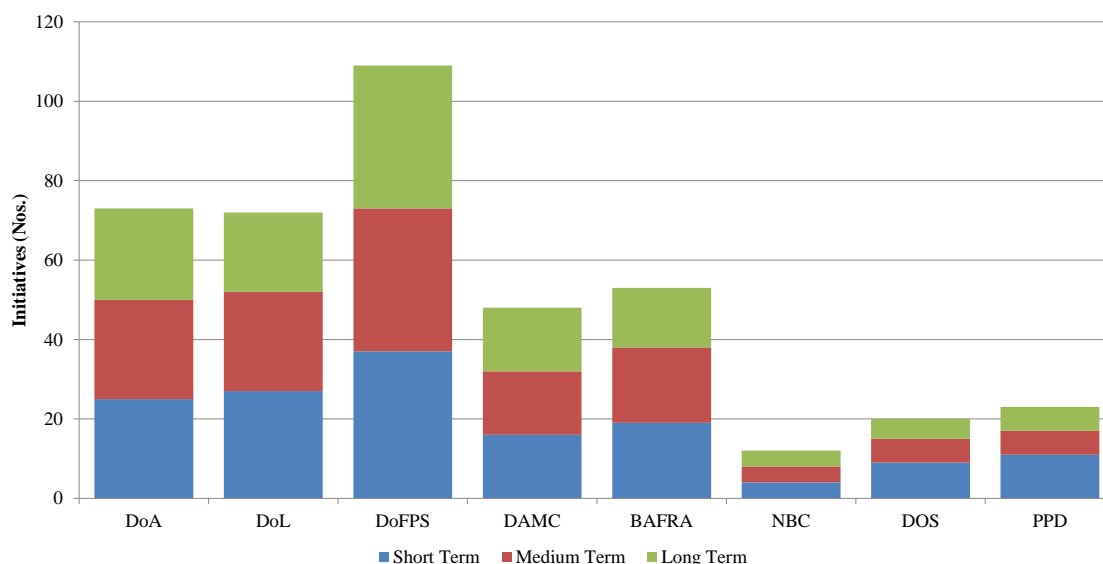


Figure 14: Short-Medium-Long term initiatives of different agencies of MoAF

For the purpose of clear understanding and appropriate alignment to the sectoral planning process, the initiatives are segregated into short, medium and long term as follows:

A. Short-term Strategies and Initiatives

Owing to the gravity of environmental and food security agenda, ever since planned development was launched in Bhutan, interventions over the years have been consciously planned as connected and progressive to build on succeeding plans. Consequently, to maintain the continuum of past initiatives, 86 initiatives aligned to 11 strategies have short-term objectives and arising from the 11th and 12th Plan. From the short term perspective, sustainable management of natural resources (29%), enhancement of production and quality of RNR commodities (23%), acceleration of agri-business development and expansion (12%), and institutionalization of efficient RNR service delivery (9%) are the top priority strategies. In terms of the sub-sectoral engagement, DoFPs has 31% of the intervention in the short-term category followed by BAFRA (14%), DAMC (13%) and the rest below 9% of the total interventions. The full list of interventions against each strategy and respective lead agency is presented in Table 6.

Table 6: Interventions under each Strategy proposed for the short-term

Strategies and Initiatives	Agency
<i>Strategy 1: Enhance production and quality of RNR commodities</i>	
1. Establish the FNS Index for Bhutan and determine the ideal FNS Index	PPD
2. Improve irrigation infrastructure	DoA
3. Fallow land cultivation and land consolidation	DoA

Strategies and Initiatives	Agency
4. Maintain nucleus genetic pool	DoL
5. Strengthen cluster approaches and livestock commercialization	DoL
6. Improve nutrition and animal health services	DoL
7. Strengthen laboratory diagnostic services (health and nutrition)	DoL
8. Enhance risk-based disease prevention and control measures	DoL
9. Strengthen One Health and veterinary public services	DoL
10. Establish Plant and Animal Biosecurity Index	BAFRA
11. Strengthen quarantine and laboratory capacity, Implement Pest Risk Analysis	BAFRA
12. Strengthen biosecurity emergency risk management through biosecurity continuum and sanitary and phyto-sanitary capacity	BAFRA
13. Strengthen farm biosecurity	BAFRA
14. Strengthen biosafety measures	BAFRA
15. Establish Food Quality and Safety Index	BAFRA
16. Regulate RNR inputs	BAFRA
17. License agri-food businesses for food safety	BAFRA
18. Enhanced food safety emergency management	BAFRA
19. Establish satellite laboratories	BAFRA
20. Promote food product certification	BAFRA
<i>Strategy 2: Enhance contribution of RNR sector to National economy</i>	
1. Establish mechanisms/proper accounting systems to monetize contribution of NR	DoFPs
2. Sustainable intensification & commercialization	DoL/DoA
3. Establish valuation of draught power and manure to GDP	DoL
4. Mainstream valuation of forest eco-system services	DoFPs
5. Streamline and strengthen value chain for domestic and international market	DAMC
6. Develop and establish formal value chain for priority RNR commodities	DAMC
<i>Strategy 3: Accelerate agri-business development and expansion</i>	
1. Support and establish agri-businesses	DAMC
2. Strengthen & support farmer institutions (FGs/Coops, etc.,)	DAMC
3. Establish market infrastructure and strengthen distribution networks (enhancing access, strengthening role of traders and aggregators)	DAMC
4. Specialize (quality and scale) focused cash crop/commodities targeted for export	DAMC
5. Explore and establish domestic and export markets	DAMC
6. Establish user-friendly real-time market information system	DAMC
7. Facilitate trade	DAMC
8. Support commodity price guarantee to farmers	DAMC
9. Support product enhancement and promotion	DAMC
10. Establish and implement quality assurance and certification system for both domestic and export markets	BAFRA
<i>Strategy 4: Develop enabling policies for RNR sector</i>	
1. Develop RNR Sector development support Policy (fiscal Incentives to RNR Sector dev.)	PPD
2. Review, analyse and revise FNSP	PPD
3. Develop crop and livestock insurance Scheme	PPD
<i>Strategy 5: Strengthen research, innovation and dissemination</i>	

Strategies and Initiatives	Agency
1. Review RNR Research Policy 2012 and Develop RNR Research Strategy	PPD
2. Strengthen research institutions (technical capacity of researchers, facilities, laboratories)	All6
3. Strengthen training and extension institutions	All6
4. Strengthen the laboratory facilities for testing soil, seed, feed, animal health, wildlife genetics, strengthen regulation of animal welfare	All6
5. Review the existing HR master plan, HR Gap analysis, strategic HR planning and deployment	DoS
<i>Strategy 6: Institute efficient RNR service delivery</i>	
1. Develop forest research clearance, Online Forestry Clearance-SDSS, G2C Rural timber	DoS
2. Strengthen Interactive Voice Response (IVR), Bhutan Agricultural Market Information (AMIS)	DoS
3. Develop 5 Animal health, nutrition, production, extension	DoS
4. Upscale Agromet (Agriculture and Livestock) advisory	DoS
5. Develop permit and clearances systems (biosecurity, inspection, testing and certification)	DoS
6. Develop system to issue clearance for RNR Enterprises, integrated system for RNR sector (Disaster)	DoS
7. Develop clear SoPs for RNR service delivery and disseminate in public domain	DoS
8. Advocacy on RNR plans and policies to the stakeholders	PPD
<i>Strategy 7: Enhance production efficiency of RNR commodities</i>	
1. Incentivize production of prioritized agriculture and livestock commodities	All3
2. Diversify food sources;	All3
3. Assess adoption and impact of technologies	All3
<i>Strategy 8: Promote Research and Innovation</i>	
1. Develop innovative and gender responsive technologies for smart climate resilient farming	All3
2. Develop and promote use of modern technologies through digital platforms (Agri. 4.0)	All3
3. Conserve and utilize agro-biodiversity and genetic resources	NBC
4. Implement agromet advisory system	All3
<i>Strategy 9: Diversify sustainable financing for RNR sector development</i>	
1. Develop Innovative RNR Sector investment plan	PPD
<i>Strategy 10: Mainstream sustainable management (conservation and utilization) of natural resources</i>	
1. Strengthen National forests resources and forest carbon stock assessment strengthened	DoFPs
2. Conduct aquatic biodiversity assessments and monitoring	DoFPs
3. Conduct National tiger and snow leopard survey in 2021, and once every five years, Habitat Management	DoFPs
4. Implement METT + for PAs	DoFPs
5. Revise and develop PA management plans for 10 PAs and 9 other conservation Area management	DoFPs
6. Strengthen habitat management interventions	DoFPs
7. Strengthen conservation of key species	DoFPs
8. Develop wildlife strategy	DoFPs
9. Strengthen anti-poaching, human wildlife conflict management and wildlife conservation	DoFPs

Strategies and Initiatives	Agency
10. Support /facilitate establishment of nature-based enterprises and hand over to the communities/private sector	DoFPs
11. Strengthen new CFs and network groups	DoFPs
12. Strengthen NWPF management groups	DoFPs
13. Train foresters (Certificate program) at UWICER	DoFPs
14. Develop and promote domestication of high value NWFPs	DoFPs
15. Enhance Sustainable Management and Utilization of Forests	DoFPs
16. Establishment of new LFMP Areas and Develop Local Forest management plans	DoFPs
17. Review of FMCB 2004 and development of FMCB 2020	DoFPs
18. Develop and strengthen agroforestry programs and interventions	DoFPs
19. Strengthen watershed management	DoFPs
20. Develop and implement effective interventions to improve watershed and wetland conditions	DoFPs
21. Implement innovative financing mechanism	DoFPs
22. Develop and implement biosecurity management interventions	BAFRA
23. Strengthen forest fire management	DoFPs

Strategy 11: Enhance and promote resilience to climate change impacts and low emission development

1. Promote clean energy production through promotion of biogas	All3
2. Carry out climate restoration through plantations	DoFPs
3. Strengthen National REDD plus program and benefits	DoFPs
4. Develop and promote climate smart resilient farming technologies	All3
5. Promote green technologies	All6

B. Medium-term Strategies and Initiatives

There are 104 initiatives proposed for achievement by medium-term (10 years). Coinciding with SDG 2030, Bhutan commits to achieve SDG 1: No poverty and SDG 2: Zero hunger, as such majority (29%) of the initiatives are associated to Strategy 1(Enhance production and quality of RNR commodities). Strategy 10 and 3 have 25% and 12% of initiatives respectively, while Strategies 4 and 9 have less than 2% initiatives. As the accountable agency for strategy 1, DoA and DoL have highest number of initiatives. The proposed list of interventions against each strategy and respective lead agency is presented in Table 7.

Table 7: Interventions under each Strategy proposed for the medium-term

Strategy	Initiatives	Agency
<i>Strategy 1: Enhance production and quality of RNR commodities</i>		
1	Improve irrigation infrastructure	
2	Enhance mechanization;	DoA
3	Intensify Fallow land cultivation and land consolidation;	DoA
4	Develop and disseminate GAP; GMP	DoA
5	Innovate appropriate crop protection technologies;	DoA

Strategy	Initiatives	Agency
6	Develop Land and Nutrient management technologies; Agriculture landscape management (Organic agriculture)	DoA
7	Develop and promote post-harvest technologies to prevent post-harvest losses,	DoA
8	Sustain the maintenance of NFSR	DOA
9	Maintain nucleus genetic pool	DoL
10	Breed and supply of high yielding commercial livestock breeds and fodder varieties	DoL
11	Strengthen cluster approaches and livestock commercialization	DoL
12	Promote improved farming technologies and farm mechanization	DoL
13	Improve nutrition and animal health services	DoL
14	Strengthen laboratory diagnostic services (health and nutrition)	DoL
15	Institute cost recovery scheme for sustainable animal health services	DoL
16	Enhance risk-based disease prevention and control measures	DoL
17	Strengthen one health and veterinary public services	DoL
18	Establish Plant and Animal Biosecurity Index	BAFRA
19	Strengthen quarantine and laboratory capacity, implement Pest Risk Analysis	BAFRA
20	Strengthen biosecurity emergency risk management through biosecurity continuum and sanitary and phyto-sanitary capacity	BAFRA
21	Strengthen farm biosecurity	BAFRA
22	Strengthen biosafety Measures	BAFRA
23	Establish Food Quality and Safety Index	BAFRA
24	Regulate RNR inputs	BAFRA
25	License agri-food business for food safety	BAFRA
26	Enhanced food safety emergency management & operationalize foodborne disease surveillance systems	BAFRA
27	Establish satellite laboratories	BAFRA
28	Promote food product certification	BAFRA
29	Operationalize food import control system	BAFRA
30	Strengthen National Food Testing laboratory	BAFRA
31	Promote food safety culture/self-regulation	BAFRA

Strategy 2: Enhance contribution of RNR sector to National economy

1	Establish mechanisms/proper accounting systems to monetize contribution of NR (sand, timber, ecotourism)	DAMC
2	Promote sustainable intensification & commercialization of Agriculture and Livestock (including highland)	DOA/DOL
3	Establish valuation of draught power and manure to GDP, commercialization of livestock initiatives	DOA/DOL
4	Mainstream valuation of forest eco-system services	DOFPS
5	Streamline and strengthen value chain for domestic and international market	DAMC
6	Develop and establish formal value chain for priority RNR commodities	DAMC

Strategy 3: Accelerate agri-business development and expansion

1	Support, establish and accelerate agribusinesses	DAMC
2	Strengthen & support farmer institutions (FGs/Coops, etc.,)	DAMC
3	Encourage/engage PPP and FDI in RNR businesses	DAMC
4	Establish market infrastructure and strengthen distribution networks (enhancing access, strengthening role of traders and aggregators)	DAMC
5	Specialize (quality and scale) focused cash crop/commodities targeted for export	DAMC

Strategy	Initiatives	Agency
6	Explore and establish domestic and export markets	DAMC
7	Establish user-friendly real-time market information system	DAMC
8	Establish market intelligence & forecasting (Price, markets and production)	DAMC
9	Facilitate Trade	DAMC
10	Support commodity price guarantee to farmers (Buy Back)	DAMC
11	Support product enhancement and promotion	DAMC
12	Establish and implement quality assurance and certification system for both domestic and export markets	DAMC
<i>Strategy 4: Develop enabling policies for RNR sector</i>		
1	Review, analyze and revise the Acts related to RNR Sector	PPD
2	Review, analyze and develop Agriculture Land use Policy	PPD
<i>Strategy 5: Strengthen research, innovation and dissemination</i>		
1	Strengthen research institutions (technical capacity of researchers, facilities, laboratories)	DoA/DoL/DoFPs
2	Strengthen training and extension institutions	DoA/DoL/DoFPs
3	Strengthen the laboratory facilities for testing soil, seed, , feed, animal health, wildlife genetics), Strengthen regulation of Animal welfare	DoA/DoL/DoFPs /BAFRA
<i>Strategy 6: Institute efficient RNR service delivery</i>		
1	Develop integrated RNR service Kiosks (built on concept of CCs and single window service)	DS
2	Strengthen Interactive Voice Response (IVR), Bhutan Agricultural Market Information (AMIS)	DS/DAMC
3	Upscale Agromet (Agriculture and Livestock), input apps	DS/DoA
4	Strengthen permit and clearance system for biosecurity, inspection, testing and certification	DS/BAFRA
5	Develop clearance system for RNR Enterprises, integrated system for RNR sector (Disaster)	DS/DAMC
6	Develop clear SoPs for RNR service delivery and disseminate in public domain	DS
7	Advocacy on RNR plans and policies to the stakeholders	DS/PPD
<i>Strategy 7: Enhance production efficiency of RNR commodities</i>		
1	Develop and promote use of modern technologies through digital platforms (Agri. 4.0);	DoA/DoL/DoFPs
2	Assess adoption and impact of technologies	DoA/DoL/DoFPs
3	Upscale clean energy production through promotion of biogas	DoL
4	Strengthen collaboration with academic institution for research;	DoA/DoL/DoFPs
5	Promote protect cultivation technologies	DoA
6	Encourage private sector funding and engagement in Research and Innovation	DoA/DoL/DoFPs
<i>Strategy 8: Promote Research and Innovation</i>		
1	Increase and intensify access to production inputs;	DoA/DoL/DoFPs
2	Incentivize production of prioritized agriculture and livestock commodities;	DoA/DoL
3	Diversify food sources and social safety;	NBC
4	Implement agromet advisory system	DoA/DOL
<i>Strategy 9: Diversify sustainable financing for RNR sector development</i>		
1	Develop Innovative RNR Sector investment plan	PPD
<i>Strategy 10: Sustainable management (conservation and utilization) of natural resources</i>		
1	Strengthen National forests resources and Forest Carbon Stock Assessment Strengthened	DoFPs

Strategy	Initiatives	Agency
2	Conduct aquatic biodiversity assessments and monitoring	DoFPs
3	Conduct National tiger and snow leopard survey in 2021, and once every five years, Habitat Management	DoFPs
4	Implement METT + for PAs	DoFPs
5	Revise and develop PA management Plans for 10 PAs and 9 other conservation area management	DoFPs
6	Strengthen habitat management interventions	DoFPs
7	Strengthen conservation of Key species	DoFPs
8	Strengthen anti-poaching, human wildlife conflict management and wildlife conservation	DoFPs
9	Support /facilitate establishment of nature-based enterprises and hand over to the communities/private sector	DoFPs
10	Strengthen new CFs and network groups	DoFPs
11	Strengthen NWPF Management Groups	DoFPs
12	Train foresters(Certificate program) at UWICER	DoFPs
13	Develop and promote domestication of high value NWFPs	DoFPs
14	Enhance sustainable management and Utilization of Forests	DoFPs
15	Create two new FMUs and develop 2 Sustainable Forest Management Plans	DoFPs
16	Establish new LFMA's and Develop Local Forest management plans (8 LFMPs per year)	DoFPs
17	Review of FMCB 2004 and development of FMCB 2020	DoFPs
18	Develop and strengthen Agroforestry Programs and interventions	DoFPs
19	Strengthen Watershed Management	DoFPs
20	Develop and Implement effective interventions to improve watershed and wetland conditions	DoFPs
21	Implement innovative financing mechanism	DoFPs
22	Strengthen bio prospecting initiative for access & benefit sharing Strengthened	NBC
23	Develop and implement biosecurity management interventions	BAFRA
24	Promote smart wood-based enterprises	DoFPs
25	Identify and allocate land for sustainable use for feed, fodder and manure	DoFPs
26	Strengthen Forest Fire Management	DoFPs
<i>Strategy 11: : Enhance and promote resilience to climate change impacts and low emission development</i>		
1	Develop and promote improved climate resilient varieties and breeds;	DoA/DOL
2	Develop innovative and gender responsive technologies for smart climate resilient farming	DoA/DoL/DoFPs
3	Carry out climate restoration plantations (Every Year 400 Ha target)	DoFPs
4	Strengthen National REDD Plus Program and benefits	DoFPs
5	Maintain forests capacity for carbon sequestration at 8.248 mill. tons Co ₂ Equivalent Improve agro-met for climate information and data management DOA/DoS	DoFPs

C. Long-term Strategies and Initiatives

The initiatives proposed for long term strategies comprise of 104 broad initiatives (Table 8). In view of the investment and benefits, these initiatives demand substantial resources and may take time for generating desired outputs. In the longer term, RNR sector will focus on self-reliance on

food supported by smart technologies, ICT, functional food reserve, and circular economy. Major focus will continue to be on Sustainable management (conservation and utilization) of natural resources and Enhance production and quality of RNR commodities.

Table 8: Interventions under each Strategy proposed for the Long-term

Strategy	Initiatives	Agency
<i>Strategy 1: Enhance production and quality of RNR commodities</i>		
1	Improve irrigation infrastructure	DoA
2	Enhance mechanization	DoA
3	Intensify Fallow land cultivation and land consolidation	DoA
4	Develop and disseminate GAP; GMP	DoA
5	Innovate appropriate crop protection technologies	DoA
6	Promote Land and Nutrient management technologies; Agriculture landscape management (Organic Agriculture)	DoA
7	Develop and promote post-harvest technologies to prevent post-harvest losses	DoA
8	Sustain maintenance of NFSR	DoA
9	Maintain nucleus genetic pool	DoL
10	Breed and supply of high yielding commercial livestock breeds and fodder varieties	DoL
11	Strengthen cluster approaches and livestock commercialization	DoL
12	Promote improved farming technologies and farm mechanization	DoL
13	Improve nutrition and animal health services	DoL
14	Strengthen laboratory diagnostic services (health and nutrition)	DoL
15	Institute cost recovery scheme for sustainable animal health services	DoL
16	Enhance risk-based disease prevention and control measures	DoL
17	Strengthen One Health and veterinary public services	DoL
18	Establish Plant and Animal Biosecurity Index	BAFRA
19	Strengthen quarantine and laboratory capacity, implement Pest Risk Analysis	BAFRA
20	Strengthen biosecurity emergency risk management through biosecurity continuum and sanitary and phyto-sanitary capacity	BAFRA
21	Strengthen farm biosecurity	BAFRA
22	Strengthen biosafety Measures	BAFRA
23	Establish Food Quality and Safety Index	BAFRA
24	Regulate RNR inputs	BAFRA
25	License agri-food business for food safety	BAFRA
26	Establish satellite laboratories	BAFRA
27	Promote food product certification	BAFRA
28	Operationalize food import control system	BAFRA
29	Strengthen National Food Testing laboratory	BAFRA
30	Promote food safety culture/self-regulation	BAFRA

Strategy	Initiatives	Agency
<i>Strategy 2: Enhance contribution of RNR sector to National economy</i>		
1	Establish mechanisms/proper accounting systems to monetize contribution of NR (sand, timber, ecotourism)	DoFPs
2	Promote sustainable Intensification & commercialization of Agriculture and Livestock (including highland)	DoA/DoL
3	Mainstream valuation of forest eco-system services	DoFPs
4	Streamline and strengthen value chain for domestic and international market	DAMC
5	Develop and establish formal value chain for priority RNR commodities	DAMC
<i>Strategy 3: Accelerate agri-business development and expansion</i>		
1	Support, establish and accelerate agribusinesses	DAMC
2	Strengthen & support farmer institutions (FGs/Coops, etc.,)	DAMC
3	Encourage/engage PPP and FDI in RNR businesses	DAMC
4	Establish market infrastructure and strengthen distribution networks (enhancing access, strengthening role of traders and aggregators)	DAMC
5	Specialize (quality and scale) focused cash crop/commodities targeted for export	DAMC
6	Explore and establish domestic and export markets	DAMC
7	Establish user-friendly real-time market information system	DAMC
8	Establish market intelligence & forecasting (Price, markets and production)	DAMC
9	Facilitate trade	DAMC
10	Support commodity price guarantee to farmers (Buy Back)	DAMC
11	Support product enhancement and promotion	DAMC
12	Establish and implement quality assurance and certification system for both domestic and export markets	DAMC
13	Streamline and strengthen value chain for domestic and international market	DAMC
14	Develop and establish formal value chain for priority RNR commodities	DAMC
<i>Strategy 4: Develop enabling policies for RNR sector</i>		
1	Establish mechanism for monitoring and revising RNR Commodity pricing	DAMC
<i>Strategy 5: Strengthen research, innovation and dissemination</i>		
1	Strengthen research institutions (technical capacity of researchers, facilities, laboratories)	DoA/DoL
2	Strengthen training and extension institutions	DoA/DoL
<i>Strategy 6: Institute efficient RNR service delivery</i>		
1	Establish integrated RNR service Kiosks (built on concept of CCs and single window service)	DS
2	Develop forest research clearance, Online Forestry Clearance-SDSS,	DS/DoFPs

Strategy	Initiatives	Agency
3	Strengthen Interactive Voice Response (IVR), Bhutan Agricultural Market Information (AMIS),	DS/BAFRA
4	Develop 5 Animal health, nutrition, production, extension apps	DS/DoL
5	Develop Agromet (Agriculture and Livestock), input apps	DS/DoA
6	Strengthen permit and clearance system for biosecurity, inspection, testing and certification	DS/BAFRA
7	Develop clearance system for RNR Enterprises, integrated system for RNR sector (Disaster)	DS/DAMC
8	Develop clear SoPs for RNR service delivery and disseminate in public domain	DS
9	Advocate on RNR plans and policies to the stakeholders	DS/PPD
<i>Strategy 7: Enhance production efficiency of RNR commodities</i>		
1	Develop and promote use of modern technologies through digital platforms (Agri. 4.0)	DoA
2	Assess adoption and impact of technologies	DoA/DoL
3	Upscale clean energy production through promotion of biogas	DoL
4	Strengthen collaboration with academic institution for research;	DoA/DoL/DoFPs
5	Promote protected cultivation technologies	DoA
<i>Strategy 8: Promote Research and Innovation</i>		
1	Increase and intensify access to production inputs;	DoA/DoL
2	Incentivize production of prioritized agriculture and livestock commodities;	DoA/DoL
3	Diversify food sources and social safety;	DoA/DoL
4	Conserve and utilize agro-biodiversity and genetic resources	NBC
5	Implement agromet advisory system	DoA
6	Encourage private sector funding and engagement in Research and Innovation	DoA/DoL/DoFPs
<i>Strategy 9: Diversify sustainable financing for RNR sector development</i>		
0		
<i>Strategy 10: Mainstream sustainable management (conservation and utilization) of natural resources</i>		
1	Strengthen assessment of National forests resources and forest carbon stock assessment	DoFPs
2	Conduct aquatic biodiversity assessments and monitoring	DoFPs
3	Conduct National tiger and snow leopard survey in 2021, and once every five years, Habitat Management	DoFPs
4	Implement METT + for PAs	DoFPs
5	Revise and develop PA management Plans for 10 PAs and 9 other conservation Area management	DoFPs
6	Strengthen habitat management interventions	DoFPs
7	Strengthen conservation of Key species	DoFPs
8	Develop Wildlife Strategy	DoFPs

Strategy	Initiatives	Agency
9	Strengthen anti-poaching, human wildlife conflict management and wildlife conservation	DoFPs
10	Support /facilitate establishment of nature-based enterprises and hand over to the communities/private sector	DoFPs
11	Strengthen new CFs and network groups	DoFPs
12	Strengthen NWPF Management Groups	DoFPs
13	Train foresters (Certificate program) at UWICER	DoFPs
14	Develop and promote domestication of high value NWFPs	DoFPs
15	Enhance sustainable management and utilization of forests	DoFPs
16	Create two new FMUs and develop 2 sustainable forest Management Plans	DoFPs
17	Establish new LFMA and develop local forest management plans (8 LFMPS per year)	DoFPs
18	Review of FMCB 2004 and development of FMCB 2020	DoFPs
19	Develop and strengthen agroforestry programs and interventions	DoFPs
20	Strengthen watershed management	DoFPs
21	Develop and implement effective interventions to improve watershed and wetland conditions	DoFPs
22	Implement innovative financing mechanism	DoFPs
23	Strengthen bioprospecting initiative for access & benefit sharing	NBC
24	Develop and implement biosecurity management interventions	BAFRA
25	Promote smart wood-based enterprises	DoFPs
26	Identify and allocate land for sustainable use for feed, fodder and manure	DoFPs
27	Strengthen forest fire management	DoFPs
<i>Strategy 11: Enhance and promote resilience to climate change impacts and low emission development</i>		
1	Develop and promote improved climate resilient varieties;	DoA
2	Develop innovative and gender responsive technologies for smart climate resilient farming	DoA/DoL
3	Carry out climate restoration plantations (Every Year 400 Ha target)	DoFPS
4	Strengthen National REDD Plus program and benefits	DoFPs

Financing the RNR Strategy

The clientele base of the RNR sector is largely small holder farmers who are slowly transforming into commercial operation with much push from the government. Considering the resource-poor farmers, majority of the RNR sector interventions have been pro-poor and welfare oriented, implying the RNR services do not generate revenue as a plough back to sponsor sector development. So far, the sector received generous funding from national exchequer and more abundantly from development partners. For instance, in last 30 years (7th to the 12th plan) RNR sector's public investment increased by 29% in absolute term. As mentioned earlier, RNR sector has been very fortunate from the very first plan (1961-66) to receive magnanimous support from all the development partners associated with Bhutan's development. For instance, from 1990 to 2002 RNR sector received grant assistance of US\$ 119.5 million accounting 16.9% of the total grant assistance offered to the country, making RNR sector the highest recipient among all the sectors in Bhutan (RMA-AR, 2001-02. Page-141). Over the years, input and infrastructure related services have been progressively withdrawn from subsidy program, resulting in clients sharing the cost of development. While the proportions of cost sharing may not be substantial, it has definitely helped in enhancing the sustainability of development initiatives through increase participation and ownership.

As recommended in this document, with the scope of RNR sector amplified from mere domestic production to international competitive trade, the sector need to have a comprehensive sector investment plan, Furthermore, the assured and premeditated investment plan is essential when the sector has two critical national mandates (60% forest cover for all time to come and self-reliant food systems) to service.

The RNR Strategy 2040 which inspires to take the RNR sector forward to the fourth level of sectoral transformation into industrialized sector with complete integration into the national economy will need assured investment. Sector missioned with “*ensuring sustainable social and economic well-being through adequate access to food and natural resources*” is optimistic to attain the well-founded forward looking vision “*Sustainable natural resources and self-reliant food systems contributing to inclusive socio-economic well-being of Bhutanese*” and make Bhutan sovereign in natural environment and food system. The 114 initiatives proposed by different sub-sectors and agencies are seamlessly aligned to accomplish the strategic objectives there by the strategic thrust within stipulated schedule. The total financing requirement to implement the

initiatives is projected at Nu. 21641 Million. The details of the financing requirement are provided below:

Financing of different strategies

Among the eleven strategies, budget share of 28.29% is required for Strategy 1 (Enhance production and quality of RNR commodities) followed by Strategy 10 (Sustainable management of natural resources) and Strategy 8 (Promote Research and Innovation) taking up 23.14% and 12.5% respectively. Technically these three strategies encompass majorities of initiatives that have longer term impact and sustenance of the RNR sector programs. Other two strategies related to internal processes (institutional) which has been a concern area for service delivery, strategy 5 (Strengthen research, innovation and dissemination) and strategy 7 (Enhance production efficiency of RNR commodities) are allocated with 9.5% and 3.67% of the estimated budget respectively (Table 9). The budget is also rationally spread over short, medium and long term with 34.8%, 36.3%, and 28.8% respectively.

Table 9: Estimated budget for 11 strategies (Nu. Million)

Strategy	Term			Total
	Short (2025)	Medium (2030)	Long (2040)	
1. Enhance production and quality of RNR commodities	2228.00	2233.00	1663.00	6124.00
2. Enhance contribution of RNR sector to National economy	728.00	719.00	622.00	2069.00
3. Accelerate agri-business development and expansion	435.00	419.00	468.00	1322.00
4. Develop enabling policies for RNR sector	3.00	20.00	2.00	25.00
5. Strengthen research, innovation and dissemination	966.50	836.00	255.00	2057.50
6. Institute efficient RNR service delivery	53.00	29.00	40.00	122.00
7. Enhance production efficiency of RNR commodities	295.00	296.00	205.00	796.00
8. Promote Research and Innovation	971.00	965.00	785.00	2721.00
9. Diversify sustainable financing for RNR sector development	1.50	0.00	0.00	1.50
10. Mainstream sustainable management (conservation and utilization) of natural resources	1519.00	1743.00	1746.00	5008.00
11. Enhance and promote resilience to climate change impacts and low emission development	345.00	595.00	455.00	1395.00
Total	7545.00	7855.00	6241.00	21641.00

Sub-sector Budget

The budget distribution among the sub-sectors and agencies is directly proportional to the scope of the proposed initiatives. For instance, a total of Nu. 7096 Million (32.7% of the total budget) is assigned to the Department of Agriculture in view of the major rural infrastructures (irrigation, land development, and processing units) and cost-sharing mechanisms the department implements. Subsequently budget for the Department of Forests and Park Services account 27.4% followed by the Department of Livestock which has a share of 24.5% of the total budget. The remaining 15.3% is distributed to the remaining five agencies (Table 10). Roughly the departmental budget is allocated to short, medium and long term at 35%, 36% and 29% respectively.

Table 10: Distribution of budget strategy by sub-sector and agencies of MoAF (Nu. Million)

Strategy	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	Total
S1	2950.00	1775.00	0.00	0.00	1094.00	0.00	0.00	305.00	6124.00
S2	1200.00	805.00	14.00	50.00	0.00	0.00	0.00	0.00	2069.00
S3	0.00	0.00	0.00	1272.00	50.00	0.00	0.00	0.00	1322.00
S4	0.00	0.00	0.00	0.00	0.00	0.00	18.00	7.00	25.00
S5	875.00	950.00	230.00	0.00	0.00	0.00	1.00	1.50	2057.50
S6	30.00	0.00	20.00	0.00	0.00	0.00	42.00	30.00	122.00
S7	366.00	302.00	65.00	12.00	30.00	10.00	0.00	11.00	796.00
S8	1355.00	1156.00	0.00	0.00	10.00	200.00	0.00	0.00	2721.00
S9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	1.50
S10	0.00	175.00	4673.00	0.00	30.00	130.00	0.00	0.00	5008.00
S11	320.00	150.00	925.00	0.00	0.00	0.00	0.00	0.00	1395.00
Total	7096.00	5313.00	5927.00	1334.00	1214.00	340.00	61.00	356.00	21641.00

Table 11: Distribution of sub-sectoral budget across three terms (Nu. Million)

Term	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	Total
Short	2694.00	2220.00	1629.00	446.00	278.00	129.00	24.00	125.00	7545.00
Medium	2507.00	1984.00	2157.00	418.00	518.00	128.00	27.00	116.00	7855.00
Long	1895.00	1109.00	2141.00	470.00	418.00	83.00	10.00	115.00	6241.00
Total	7096.00	5313.00	5927.00	1334.00	1214.00	340.00	61.00	356.00	21641.00

Prospects of financing

Conforming to the trend of public investment during the last six FYPs (7th to the 12th plan), during which investment increased by 29% in absolute term, it is definite that the future plans are expected to be sizably funded. Using the least square method (Linear Trend) of public investment

in RNR sector from 1st to the 12th FYPs, a straight line equation $Y = 820.86x - 2211.1$ with $R^2=0.84$ was derived and used for extrapolation . Kubiszewski et al. (2012) deploying benefit transfer methodology estimated that natural resources in Bhutan contribute roughly Nu. 700 billion/year. The benefit of which is accrued largely by people outside Bhutan (53%) and only 47% of ecosystem services is benefitted by Bhutan. If these benefits are accurately valued and integrated into the national economy, RNR sector will have access to larger share of public investment.

Taking a cue from the support received from the development partner in 11th plan, RNR sector can possibly garner larger support in view of the global common benefits our environmental conservation efforts contribute to. Furthermore, with the easing of investment in Bhutan, one can expect rush of FDI and PPPs in RNR enterprises. Broadly, the following financing sources can be explored for taking forward the ambitious plans the RNR sector is championing and dedicating to the nation (Table 12).

Table 12: Financing sources

Financing Sources	Investment areas	Proportion (Remarks)
1. Public investment	Current and Capital	100% current and 30% capital expenditure
2. Grant assistance	Capital–irrigation, access, market systems, ICT, technologies, mechanization, TAs, conservation activities, research	70% capital investment based on 11 th plan financing.
3. Soft loan (Domestic)	Land development, market infrastructure, social safety mechanisms, social capital	
4. Soft loan (Regional/International banks)	Capital-plantations, conservation activities, collective farming, poverty alleviation, access, irrigation, watershed management, biosecurity	
5. Private sector investment	Research, enterprise development, organic agriculture	
6. Foreign Direct Investment	Commercial plantations, farm input production, organic agriculture	

Conclusion

Bhutan has made remarkable progress in RNR sector from the clichéd image of nomadic shifting cultivation of the 1960s to a global leader in environmental management, the only organic country in the world, and achieving self-sufficiency in vegetable, fruits and eggs. RNR sector is indisputably the largest livelihood provider in Bhutan, with more than 51% population engaged in the sector. The sector has undergone rapid transformation from a traditional to semi-commercial in operations in last five decades. As the custodian of the natural environment, sector had unwaveringly played its role in delicately maintaining the balance among social, economic and environmental priorities of development. Over a century as Nation State, Bhutan has judiciously maintained 71% pristine forest, creating it as the foundation of the overall development of the country.

The initiation of planned RNR sector development from the very first plan period following a path of smooth and measured modernization is attributed to the institution of Monarchy which spearheaded and propelled the growth. As a developmental state with very strong foundation of paternalistic welfare state, all the development initiatives in RNR sector and others were fully state-sponsored until 6th Plan. The steady investments in technology development, irrigation infrastructure, emphasis on modern agricultural practices and provision of agricultural credit and subsidies were the major factors that contributed to RNR sector development. With the decentralization in 1987, development interventions increasingly became people centric with active community engagement. The transformation of Bhutanese agriculture therefore was essentially through public investment. Although three phases of agricultural transformation has been identified, there is very thin line between them. Despite all the efforts and investments, Bhutanese agriculture is largely in second phase (semi-commercial farming). The deceleration of RNR GDP has been linked to this slow transformation of the sector, which is generally associated to the declining public investment.

RNR sector is overwhelmed with challenges ranging from global phenomena - climate change perils to a local issue of human-wildlife conflicts. Furthermore, with the pressure of increasing population on food, expansion of other sectors into agriculture landscape, rural-urban migration has progressively made farming less attractive and inefficient. While these challenges can be addressed, the sectoral review brought some urgent strategic issues related to policies, internal processes, innovation and dissemination, and human resources. Agricultural growth has been

primarily rooted in productivity improvements of crop and livestock commodities, driven by policy reforms and strategic investments. The rapid expansion of irrigation schemes, modern technology (seed and fertilizer), mechanization, rural access, value addition, and markets, have triggered sustainable intensification of agriculture.

Recognizing the strength and opportunity of the sector built on the strong foundation of prosperous eleven five year plans (1961-2018), the sector should contribute to national economy and be the engine to the economic growth. It has already demonstrated its ability to significantly contribute to sustainable management of pristine forest ecosystems, food security and poverty alleviation. As the country moves to the new phase of development, the RNR sector's vision of "Sustainable natural resources and self-reliant food systems, contributing to inclusive socio-economic well-being of Bhutanese" is ambitious yet not unattainable.

Recounting the strategic issues weakening the sector, it is critical to identify logical strategies that invigorate the sector to internally adjust the processes, policies and enhance service delivery efficiencies. The 11 strategic objectives proposed are logical and hierarchical, implying the relevance of each objective to the overall higher level objectives. As these strategic objectives are identified from the four sectoral perspectives of resources, technology & innovation, internal processes, and stakeholders they present a holistic approach to sectoral development. However, to ensure coherence of sectoral strategies to the national goal of sovereign and self-reliant economy, the five broad principles of (i) holistic sustainable socio-economic well-being and self-reliant food system; (ii) safe and healthy environment free of pollution and ecological degradation; (iii) ecologically balanced sustainable management of the pristine environment and biodiversity; (iv) intergenerational equity in access and benefit sharing from natural resources and biodiversity; and (v) landscape management approach to agricultural innovation and intensification, has to be adhered to. Under the aegis of above five principles, RNR sector need to also consider:

- Sustainable exploitation of the comparative advantage of specific commodities vis-à-vis technologies.
- Productive engagement of private sector in RNR sector development (R4D).
- Balanced incentives across RNR commodities to ensure uniform development of commodities and desirable integration in domestic economy.
- Responsiveness and resilience to climate change and market perils.
- Research and innovation for sector development (R4D)
- Food quality and safety measures.

Securing the required fund to implement the proposed 114 initiatives under 11 strategies will be fundamental. However, building on the past performance and popularity of the sector, the mission of obtaining funding commitments from the government and our development partners appears forthright.

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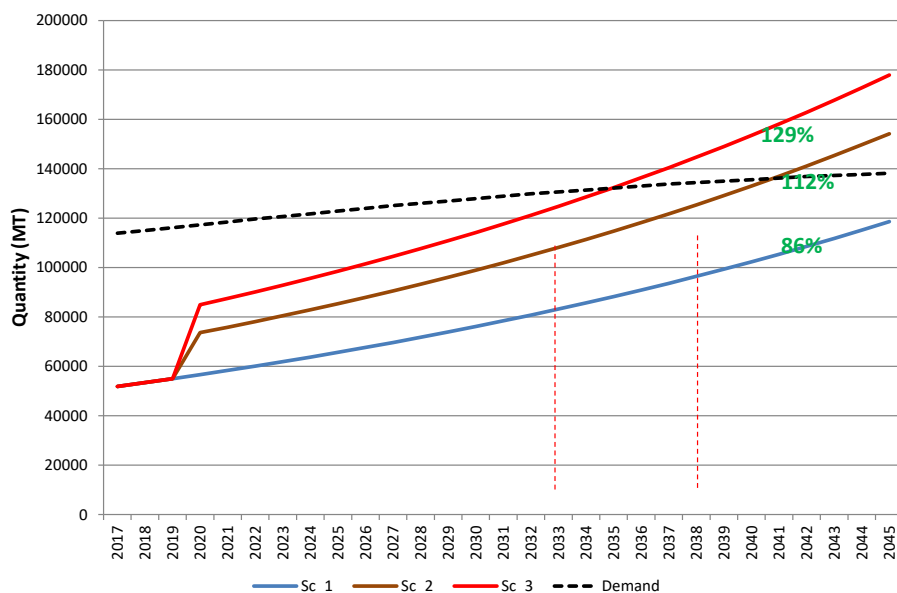
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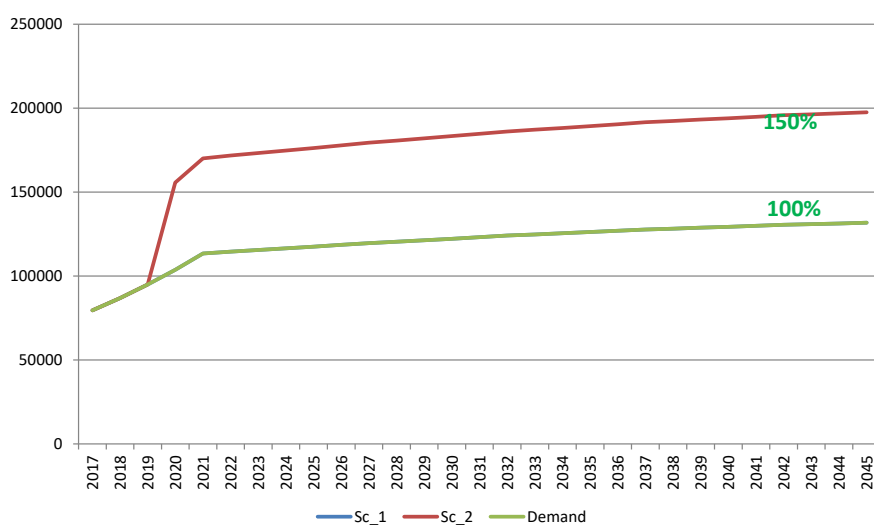
Annexure 1: Production projections and rice import substitution by domestic production

a) Rice



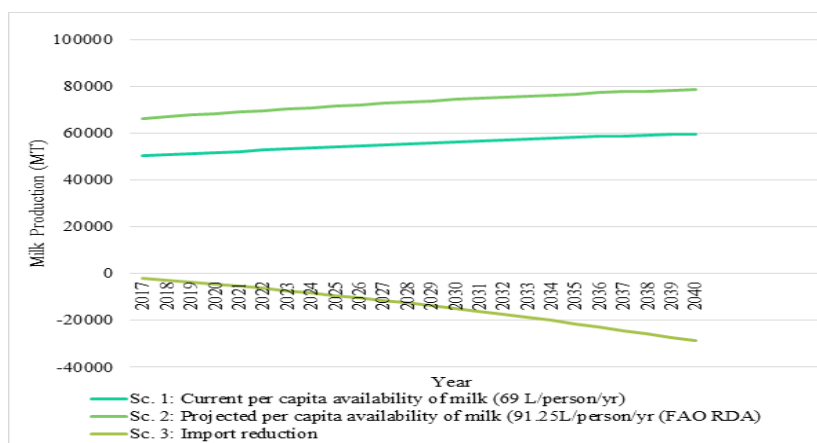
Scenarios
Sc 1: Yld. GR = 3%, Area = 20568 Ha
Sc 2: Yld. GR = 3%, Area = 20568 Ha + 30% Rice Fallow
Sc 3: Yld. GR = 3%, Area = 20568 Ha + 30% Rice Fallow + 20% new rice area

b) Vegetable

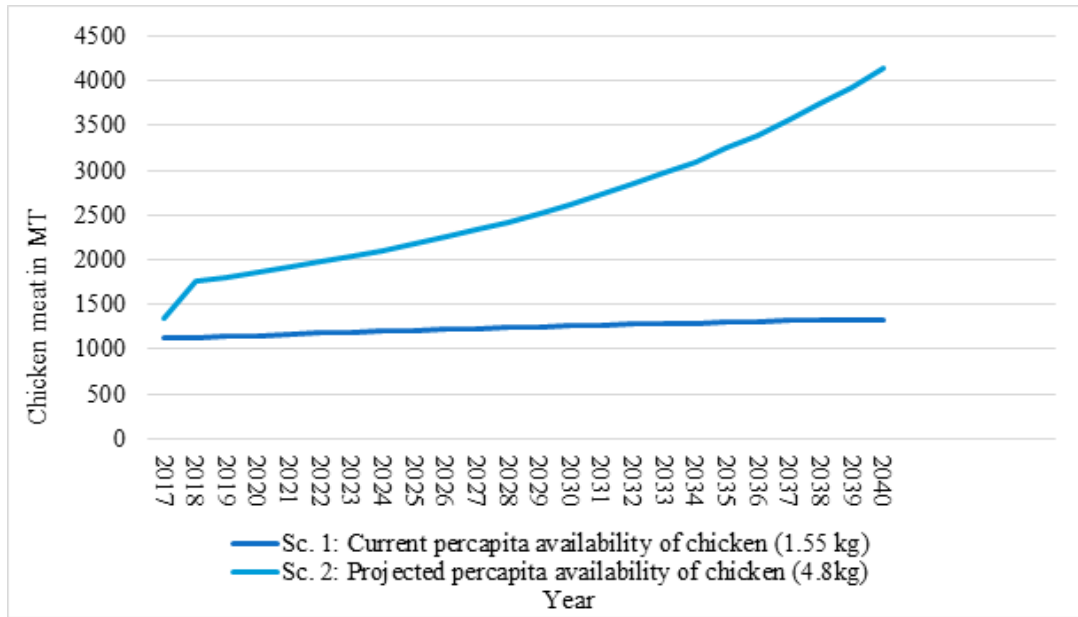


Scenarios
Sc 1: Yld. GR = 1.2%, Area = 12457 Ha, Per capita cons = 400gm
Sc 2: Yld. GR = 1.2%, Area = 12457 Ha + 50% new area, Per capita cons = 400gm

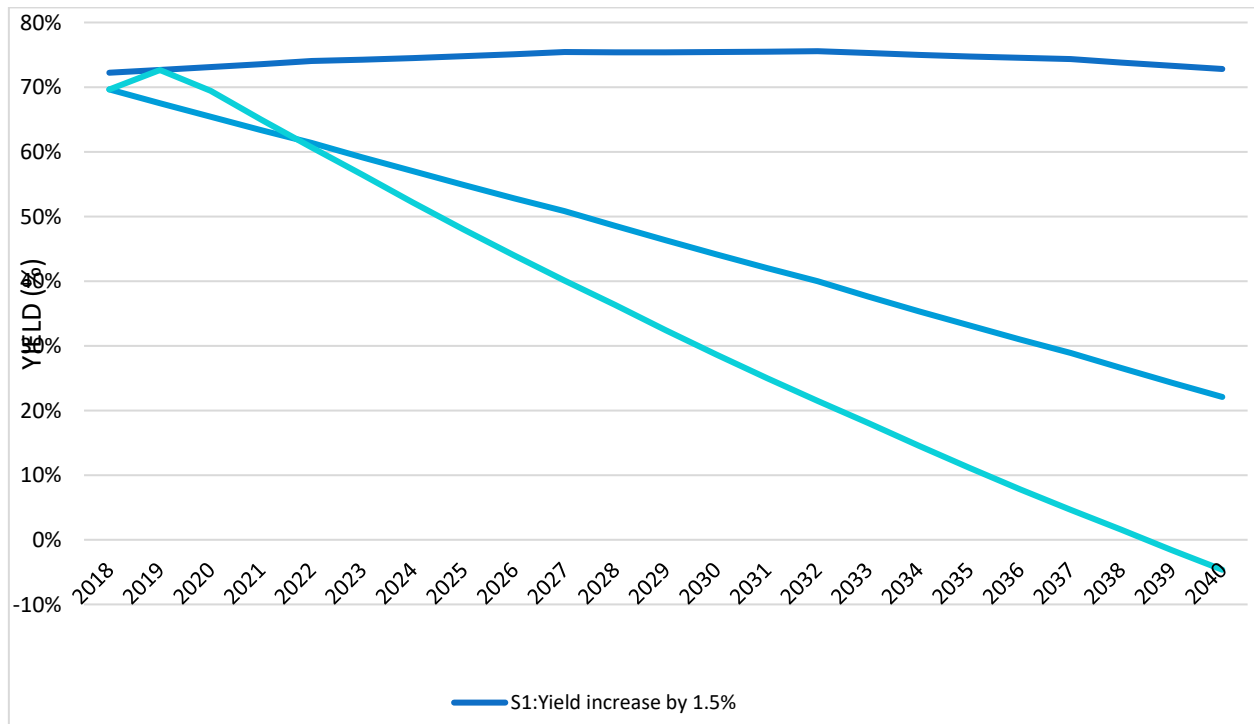
c) Milk



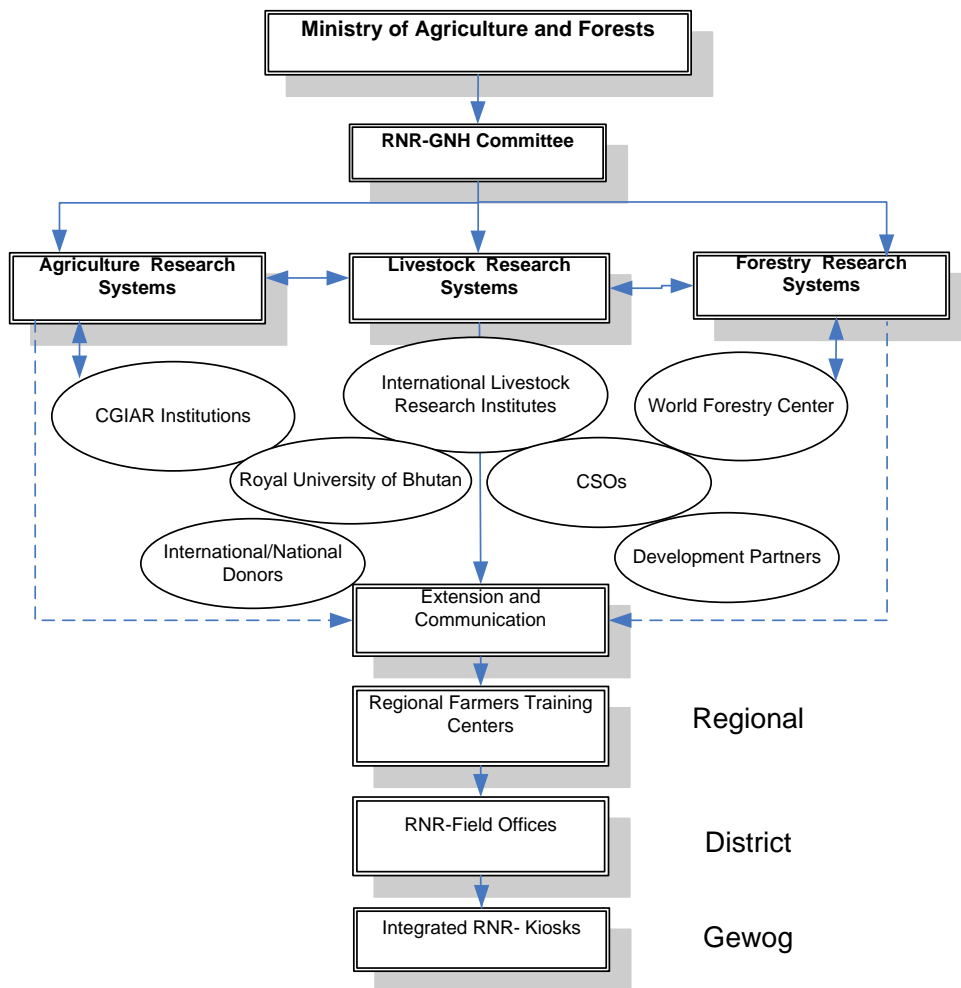
d) Chicken



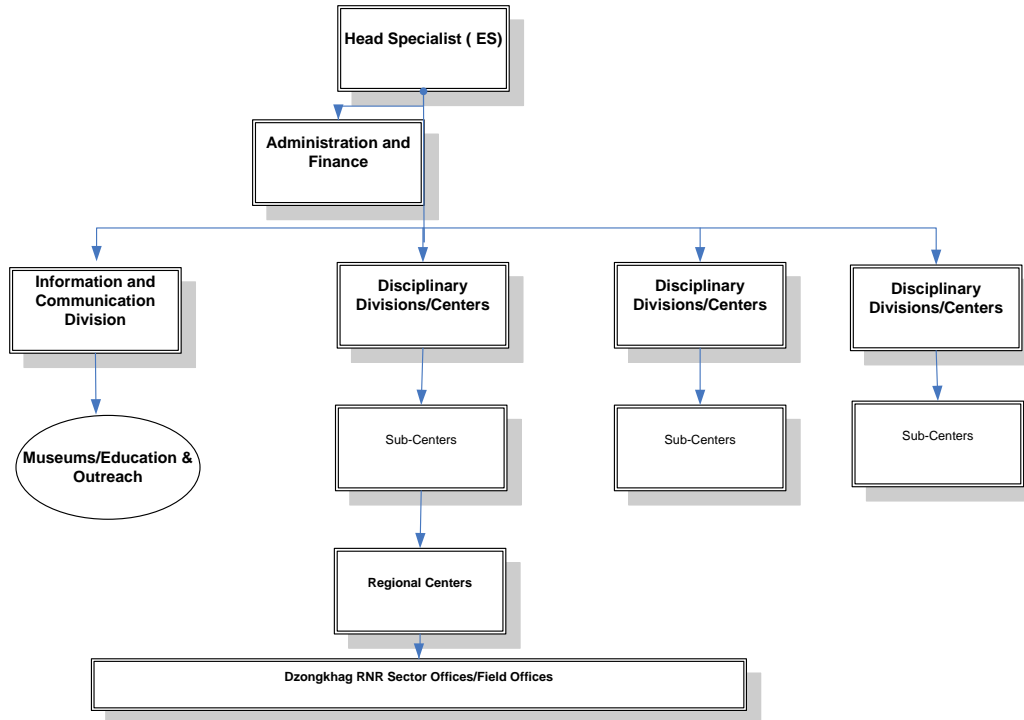
Rice import substitution by domestic production



Annexure 2: Strategic Framework of RNR Research and Dissemination



Annexure 3: Proposed structure for RNR research, training and dissemination



Annexure 4: Prioritization Matrix

Value to stakeholders	High Value	10			47	42, 111	99	20,39, 61, 97	29,46, 48, 84, 53, 80	85,86, 87, 88, 89,90, 102, 55, 83, 13	5, 40, 59, 98, 100, 101	41, 45, 49, 50, 82
		9					110,112	113, 114, 25, 109, 64,65, 66,67, 68,69	94,95	58	75, 91,92, 93,105, 106	43, 44, 96, 103, 104
		8			7		10, 63	31,34, 36, 37, 38, 59,	1, 22,24	3, 21, 62, 71	70	23, 56, 11
		7					6, 108	51, 81	32		26,27	15, 16, 19, 35, 60, 79,
		6					9, 54	73, 74				18, 72,
	Low Values	5						30, 78, 107	28, 52,76	2,4, 8, 57		77
		4							33			12, 14
		3										
		2										17
		1										

Annexure 5: Estimated budget for each initiative by respective agencies of MoAF (Million Nu.)

Strategy	Initiatives	Short Term							Medium Term							Long Term							Initiative Total	Strategy Total			
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA			NBC	DOS	PPD
1	Establish the FNS Index for Bhutan	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.00	6124.00
1	Improve irrigation infrastructure	400	0	0	0	0	0	0	0	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1000.00	
1	Enhance mechanization;	125	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	325.00	
1	Intensify fallow land cultivation	150	0	0	0	0	0	0	0	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	400.00	
1	Develop and disseminate GAP; GMP	25	15	0	0	0	0	0	0	25	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110.00	
1	Innovate appropriate crop protection technologies	75	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	225.00	
1	Land and nutrient management technologies; Agriculture landscape management (Organic agriculture)	250	0	0	0	0	0	0	0	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	700.00	
1	Develop and promote post-harvest technologies to prevent post- harvest losses,	100	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	225.00	

Strategy	Initiatives	Short Term							Medium Term							Long Term							Initiative Total	Strategy Total			
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA			NBC	DOS	PPD
1	Sustain the maintenance of NFSR	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	100	300.00	
1	Maintain nucleus genetic pool	0	200	0	0	0	0	0	0	0	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500.00	
1	Breed and supply of high yielding commercial livestock breeds and fodder varieties	0	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300.00	
1	Strengthen cluster approaches and commercial livestock	0	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250.00	
1	Promote improved farming technologies and farm mechanization	0	75	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	125.00	
1	Improve nutrition and animal health services	0	50	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150.00	
1	Strengthen laboratory diagnostic services (health and nutrition)	0	75	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	175.00	

Strategy	Initiatives	Short Term								Medium Term								Long Term								Initiative Total	Strategy Total
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD		
1	Institute cost recovery scheme for sustainable animal health services	0	20	0	0	0	0	0	0	20	0	0	0	0	0	0	0	10	0	0	0	0	0	0	50.00	500.00	
1	Enhance risk based disease prevention and control measures	0	50	0	0	0	0	0	0	10	0	0	0	0	0	0	0	10	0	0	0	0	0	0	70.00		
1	Strengthen One Health and veterinary public services	0	75	0	0	0	0	0	0	25	0	0	0	0	0	0	0	20	0	0	0	0	0	0	120.00		
1	Establish Plant and Animal Biosecurity Index	0	0	0	0	4	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0	12.00		
1	Strengthen quarantine and laboratory capacity, implement Pest Risk Analysis	0	0	0	0	30	0	0	0	0	0	0	60	0	0	0	0	0	0	0	60	0	0	0	150.00		
1	Strengthen biosecurity emergency risk management through biosecurity continuum and sanitary and phytosanitary capacity	0	0	0	0	40	0	0	0	0	0	0	40	0	0	0	0	0	0	0	40	0	0	0	120.00		
1	Strengthen farm biosecurity	0	0	0	0	10	0	0	0	0	0	0	20	0	0	0	0	0	0	0	20	0	0	0	50.00		
1	Strengthen biosafety Measures	0	0	0	0	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5	0	0	0	15.00		

Strategy	Initiatives	Short Term								Medium Term								Long Term								Initiative Total	Strategy Total
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD		
1	Establish Food Quality and Safety Index	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0	12.00	
1	Regulate RNR inputs	0	0	0	0	5	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5	0	0	0	15.00	
1	License agri-food business for food safety	0	0	0	0	10	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	20	0	0	0	50.00	
1	Enhanced food safety emergency management & Operationalize foodborne disease surveillance systems	0	0	0	0	10	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	30.00	
1	Establish satellite laboratories	0	0	0	0	30	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	50	0	0	0	130.00	
1	Promote food product certification	0	0	0	0	10	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	20	0	0	0	50.00	
1	Operationalize food import control system	0	0	0	0	20	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	30	0	0	0	90.00	
1	Strengthen National Food Testing laboratory	0	0	0	0	50	0	0	0	0	0	0	0	150	0	0	0	0	0	0	0	100	0	0	0	300.00	
1	Promote food safety culture/self-regulation	0	0	0	0	10	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	70.00	

Strategy	Initiatives	Short Term							Medium Term							Long Term							Initiative Total	Strategy Total			
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA			NBC	DOS	PPD
2	Establish mechanisms/proper accounting systems to monetize contribution of NR (sand, timber, ecotourism)	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	5.00	2069.00
2	Promote sustainable Intensification & Commercialization of Agriculture and Livestock (including highland)	400	300	0	0	0	0	0	0	400	300	0	0	0	0	0	0	0	0	400	200	0	0	0	0	2000.00	
2	Establish valuation of draught power and manure to GDP, commercialization of livestock initiatives	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.00	
2	Mainstream valuation of forest eco-system services	0	0	3	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3	0	0	0	0	0	0	9.00	
2	Streamline and strengthen value chain for domestic and international market	0	0	0	7	0	0	0	0	0	0	0	5	0	0	0	0	0	0	8	0	0	0	0	0	20.00	
2	Develop and establish formal value chain for priority RNR commodities	0	0	0	10	0	0	0	0	0	0	0	10	0	0	0	0	0	0	10	0	0	0	0	0	30.00	
3	Support, establish and accelerate agribusinesses	0	0	0	75	0	0	0	0	0	0	0	75	0	0	0	0	0	0	75	0	0	0	0	0	225.00	1322.00

Strategy	Initiatives	Short Term								Medium Term								Long Term								Initiative Total	Strategy Total
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD		
3	Strengthen & support farmer institutions (FGs/Coops, etc.,)	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75.00	
3	Encourage/engage PPP and FDI in RNR businesses	0	0	0	10	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	20	0	0	0	0	50.00	
3	Establish market infrastructure and strengthen distribution networks (enhancing access, strengthening role of traders and aggregators)	0	0	0	50	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	100	0	0	0	0	200.00	
3	Specialize (quality and scale) focused cash crop/commodities targeted for export	0	0	0	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	5	0	0	0	0	15.00	
3	Explore and establish domestic and export markets	0	0	0	10	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	0	30.00	
3	Establish user-friendly real-time market information system	0	0	0	5	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	3	0	0	0	0	12.00	
3	Establish market intelligence & forecasting (Price, markets and production)	0	0	0	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	10	0	0	0	0	20.00	
3	Facilitate trade	0	0	0	10	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10	0	0	0	0	30.00	
3	Support commodity price guarantee to farmers (Buy Back)	0	0	0	200	0	0	0	0	0	0	200	0	0	0	0	0	0	0	0	200	0	0	0	0	600.00	

Strategy	Initiatives	Short Term								Medium Term								Long Term								Initiative Total	Strategy Total
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD		
3	Support product enhancement and promotion	0	0	0	5	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5	0	0	0	0	15.00	25.00
3	Establish and implement quality assurance and certification system for both domestic and export markets	0	0	0	0	10	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	20	0	0	0	50.00	
4	Review, analyze and revise FNSP	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	
4	Develop RNR Sector development support Policy (fiscal Incentives to RNR Sector dev.)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	
4	Establish mechanism for monitoring and revising RNR Commodity pricing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2.00	
4	Review, analyze and revise the Acts related to RNR Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	18.00	
4	Develop crop and livestock insurance Scheme	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	
4	Review, analyze and develop Agriculture Land use Policy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2.00	

Strategy	Initiatives	Short Term							Medium Term							Long Term							Initiative Total	Strategy Total			
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA			NBC	DOS	PPD
5	Review RNR Research Policy 2012 and Develop RNR Research Strategy	0	0	0	0	0	0	0	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.50	2057.50
5	Strengthen research institutions (technical capacity of researchers, facilities, laboratories)	250	250	9	0	0	0	0	0	150	250	36	0	0	0	0	150	0	55	0	0	0	0	0	0	1150.00	
5	Strengthen training and extension institutions	50	75	80	0	0	0	0	0	50	75	50	0	0	0	0	50	0	0	0	0	0	0	0	0	430.00	
5	Strengthen the laboratory facilities for testing soil, seed, feed, animal health, wildlife genetics), Strengthen regulation of animal welfare	100	150	0	0	0	0	0	0	75	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	475.00	
5	Review the existing HR master plan, HR Gap analysis, strategic HR planning and deployment	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	
6	Integrated RNR service Kiosks (built on concept of CCs and single window service)	0	0	0	0	0	0	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5	0	0	15.00	
6	Develop forest research clearance, online forestry clearance-SDSS, G2C rural timber	0	0	10	0	0	0	3	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	23.00	
																										122.00	

Strategy	Initiatives	Short Term							Medium Term							Long Term							Initiative Total	Strategy Total									
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA			NBC	DOS	PPD						
6	Strengthen Interactive Voice Response (IVR), Bhutan Agricultural Market Information (AMIS)	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4.00		
6	Develop 5 animal health, nutrition, production, extension apps	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.00		
6	Develop Agromet (Agriculture and Livestock), input apps	10	0	0	0	0	0	1	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	10	0	0	1	0	0	32.50	
6	Develop permit and clearances systems for biosecurity, inspection, testing and certification	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	1	0	0	2.50		
6	Develop clearance system for RNR Enterprises, integrated system for RNR sector (Disaster)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00			
6	Develop clear SoPs for RNR service delivery and disseminate in public domain	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	9.00		
6	Advocacy on RNR plans and policies to the stakeholders	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	10	0	30.00		

Strategy	Initiatives	Short Term							Medium Term							Long Term							Initiative Total	Strategy Total			
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA			NBC	DOS	PPD
7	Develop and promote use of modern technologies through digital platforms (Agri. 4.0);	100	65	5	0	0	0	0	100	60	5	0	0	0	0	0	100	0	5	0	0	0	0	0	0	440.00	796.00
7	Assess adoption and impact of technologies	1	2	10	1	0	0	0	1	2	10	1	0	0	0	0	1	2	10	1	0	0	0	0	0	45.00	
7	Upscale clean energy production through promotion of biogas	2	50	0	0	0	0	0	2	50	0	0	0	0	0	0	2	50	0	0	0	0	0	0	0	156.00	
7	Strengthen collaboration with academic institution for research;	5	5	3	2	10	3	2	3	5	5	2	10	2	0	2	2	5	5	2	0	2	0	0	0	76.00	
7	Promote protect cultivation technologies	15	0	0	0	0	0	0	20	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	45.00	
7	Encourage private sector funding and engagement in Research and Innovation	1	2	2	1	5	1	1	1	2	4	1	5	1	0	1	0	2	1	1	0	0	1	0	0	34.00	
8	Increase and intensify access to production inputs	100	150	0	0	5	0	0	100	150	0	0	5	0	0	0	100	150	0	0	0	0	0	0	0	760.00	2721.00
8	Incentivize production of prioritized agriculture and livestock commodities	200	100	0	0	0	0	0	200	100	0	0	0	0	0	0	100	100	0	0	0	0	0	0	0	800.00	

Strategy	Initiatives	Short Term							Medium Term							Long Term							Initiative Total	Strategy Total		
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA			NBC	DOS
8	Diversify food sources and social safety;	150	75	0	0	0	0	0	0	150	100	0	0	0	0	0	150	50	0	0	0	0	0	0	675.00	5008.00
8	Conserve and utilize agro-biodiversity and genetic resources	25	75	0	0	0	75	0	0	25	50	0	0	0	75	0	25	50	0	0	0	50	0	0	450.00	
8	Implement agromet advisory system	10	6	0	0	0	0	0	0	10	0	0	0	0	0	0	10	0	0	0	0	0	0	0	36.00	
9	Develop innovative RNR Sector investment plan	0	0	0	0	0	0	0	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.50	
10	Strengthen National forests resources and forest carbon stock assessment	0	0	170	0	0	0	0	0	0	0	500	0	0	0	0	0	0	500	0	0	0	0	0	1170.00	
10	Conduct aquatic biodiversity assessments and monitoring	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	6.00	
10	Conduct National Tiger and Snow Leopard survey in 2021, and once every five years, Habitat Management	0	0	80	0	0	0	0	0	0	0	80	0	0	0	0	0	0	80	0	0	0	0	0	240.00	
10	Implement METT + for PAs	0	0	450	0	0	0	0	0	0	0	450	0	0	0	0	0	0	450	0	0	0	0	0	1350.00	

Strategy	Initiatives	Short Term								Medium Term								Long Term								Initiative Total	Strategy Total	
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD			
10	Revise and Develop PA management Plans for 10 PAs and 9 other conservation Area management	0	0	120	0	0	0	0	0	0	0	120	0	0	0	0	0	0	0	120	0	0	0	0	0	0	360.00	
10	Strengthen habitat management Interventions	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	90.00		
10	Strengthen conservation of Key species	0	0	31	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	30	0	0	0	0	0	91.00		
10	Develop wildlife strategy	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00		
10	Strengthen antipoaching, human wildlife conflict management and wildlife conservation	0	0	200	0	0	0	0	0	0	0	150	0	0	0	0	0	0	0	150	0	0	0	0	0	500.00		
10	Support /facilitate establishment of nature-based enterprises and hand over to the communities/pvt. sector	0	0	50	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	50	0	0	0	0	0	150.00		
10	Strengthen new CFs and network groups	0	0	15	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	15	0	0	0	0	0	40.00		
10	Strengthen NWPF Management Groups	0	0	5	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	5	0	0	0	0	0	20.00		
10	Training of foresters conducted	0	0	13	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	14	0	0	0	0	0	40.00		

Strategy	Initiatives	Short Term								Medium Term								Long Term								Initiative Total	Strategy Total					
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD							
10	Develop and promote domestication of high value NWFPs	0	0	10	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	10	0	0	0	0	0	0	30.00	55.00				
10	Enhance sustainable management and utilization of forests	0	0	16	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	19	0	0	0	0	0	52.00	55.00					
10	Create two new FMUs and Develop 2 Sustainable Forest Management Plans	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3	0	0	0	0	0	6.00			55.00			
10	Establish new LFMA and develop local forest management plans 8 LFMPs per year)	0	0	16	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	16	0	0	0	0	0	48.00				55.00		
10	Review of FMCB 2004 and development of FMCB 2020	0	0	5	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	9.00					55.00	
10	Develop and strengthen agroforestry programs and interventions	0	0	50	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	25	0	0	0	0	0	125.00						55.00
10	Strengthen watershed management	0	0	20	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	20	0	0	0	0	0	55.00						

Strategy	Initiatives	Short Term								Medium Term								Long Term								Initiative Total	Strategy Total					
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD							
10	Develop and Implement effective interventions to improve watershed and wetland conditions	0	0	40	0	0	0	0	0	0	0	15	0	0	0	0	0	0	10	0	0	0	0	0	0	65.00	1395.00					
10	Develop and implement innovative financing mechanism	0	0	15	0	0	0	0	0	0	0	15	0	0	0	0	0	0	10	0	0	0	0	0	0	40.00		1395.00				
10	Strengthen bioprospecting initiative for access & benefit sharing	0	0	0	0	0	50	0	0	0	0	0	0	50	0	0	0	0	0	0	0	30	0	0	0	130.00			1395.00			
10	Develop and implement biosecurity management interventions	0	0	5	0	10	0	0	0	0	0	5	10	0	0	0	0	0	5	0	10	0	0	0	0	45.00				1395.00		
10	Promotion of smart wood-based enterprises	0	0	20	0	0	0	0	0	0	0	20	0	0	0	0	0	0	70	0	0	0	0	0	0	110.00					1395.00	
10	Identify and allocate land for sustainable use for feed, fodder and manure	0	75	0	0	0	0	0	0	0	50	0	0	0	0	0	0	50	0	0	0	0	0	0	0	175.00						1395.00
10	Strengthen forest fire management	0	0	20	0	0	0	0	0	0	0	20	0	0	0	0	0	0	20	0	0	0	0	0	0	60.00						
11	Develop and promote improved climate resilient varieties	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	250.00	1395.00					

Strategy	Initiatives	Short Term							Medium Term							Long Term							Initiative Total	Strategy Total			
		DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA	NBC	DOS	PPD	DoA	DoL	DoFPS	DAMC	BAFRA			NBC	DOS	PPD
11	Develop innovative and gender responsive technologies for smart climate resilient farming	50	75	5	0	0	0	0	0	10	75	5	0	0	0	0	0	10	0	5	0	0	0	0	0	235.00	
11	Carry out climate restoration through plantations (400 Ha annually)	0	0	50	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	35	0	0	0	0	0	135.00	
11	National REDD Plus program and benefits strengthened	0	0	60	0	0	0	0	0	0	0	350	0	0	0	0	0	0	0	350	0	0	0	0	0	760.00	
11	Maintain forests capacity for carbon sequestration at 8.248 mill. tons CO ₂ Equivalent	0	0	5	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5	0	0	0	0	0	15.00	
	Sub-sector Total	2694	2220	1629	446	278	129	24	125	2507	1984	2157	418	518	128	27	116	1895	1109	2141	470	418	83	10	115	21641.0	
	Term Total	7545.00							7855.00							6241.00											
	Grand Total	21641.00																									

Annexure 6: Chronology of events leading to the drafting of RNR strategy and officials consulted

Dates	Sequence of events
September, 2018	Agriculture vision 2030 & beyond Task force constituted
November, 2018	Capacity development on agriculture visioning (IFPRI)
February- July 2019	Subsequent changes from RNR vision 2045 to RNR Vision 2040; Comprehensive reviews and sub-sectoral analysis; Briefing to RNR Senior Management
November, 2019	Taskforce reconstituted; RNR strategy document 2040 to be drafted by June, 2020 as input to Economic Roadmap 2030 (erstwhile Vision 2040 document)
December, 2019	Capacity building on drivers of agriculture growth, feminization of agriculture and crop modelling tools (IFPRI)
April- June, 2020	Writeshop and preparation of draft RNR strategy Document 2040. Submission of draft RNR strategy to Ministry
September, 2020	Presentation of draft RNR strategy document to RNR GNH committee meeting; 15 th TF meeting to revise strategy document based on comments received.
February, 2021	Virtual presentation and consultation ⁶ on draft RNR strategy 2040 with the Dzongkhag RNR sector heads, CFOs, Central Programs and Regional centers
March, 2021	Finalized RNR strategy 2040 and submitted to ministry

MoAF officials who have contributed:

1. Dasho Rinzin Dorji, Secretary, Ministry of Agriculture and Forests, Thimphu
2. Ms. Kinlay Tshering, Director, Department of Agriculture, MoAF, Thimphu
3. Mr. Kencho Thinlay, CPO, PPD, MoAF, Thimphu
4. Mr. Ganesh B. Chettri, Advisor, DoA (*Superannuated in September 2019*)
5. Mr. Chetem Wangchen, Mechanization Specialist, AMC, DoA
6. Mr. Dorjee (Ph.D), Principal Research Officer, NPPC, DoA
7. Mr. Sagar Acharya, Sr. Agriculture Officer, DoA (*Study leave*)
8. Mr. Sangay Chophel, Sr. Planning Officer, PPD (*EOL*)
9. Ms. Kinlay, Sr. Forestry Officer, DoFPs (*Study leave*)
10. Ms. Ngawang Dema, Forestry Officer, DoFPs
11. Mr. Nima Sherpa, Planning Officer, PPD (*Study leave*)
12. Mr. Sonam Jamtsho, Sr. Planning Officer, PPD

List of officials consulted and presented with the draft

1. Lyonpo Yeshey Penjor, Hon'ble Minister
2. Dasho Rinzin Dorji, Secretary
3. Dr. Tashi Samdup, DG, BAFRA

⁶ Consultations with Dzongkhag and Regional centres were planned during November- January along with the annual review and planning workshops but was hampered due to lockdown. Therefore was conducted virtually

4. Mr. Ugyen Penjor, DG, DAMC
5. Dr. Tashi Yangzome Dorji, Director, DOL
6. Mr. Rabgye Tobden, Director, DoS
7. Mr. Karma Tshering, Chief, PPD
8. Ms. Nima Om, DCLO, Legal Services, DOS
9. Mr. Kinlay Tshering, Offtg. Director, DOFPS
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18. Pema Chofil, PD, ARDC, Bajo
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b) Central Programs, Dzongkhag and Regional livestock sub-sector groups

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7. Kul Bdr. Gurung, DLO Thimphu
8. Chandra Ghalley, LPO Samtse

9. Tshendu, ADLO, Sarpang
10. Loden Jimba, DLO Paro
11. Thinley Rabten, DLO Pemagatshel
12. Dawa Dorji DLO Lhuntse
13. Tshegang Norbu, LPO Paro
14. Naina Sing Tamang, DLO Tashigang
15. Pema Wangchuk, DLO Daganga
16. Gyenbo Dorji, LPO Thimphu
17. Thinley Dorji,

c) Forestry and other sub-sector groups

1. Gyaltshen Dukpa, CFO Thimphu
2. Dimple Thapa, CFO Tsirang
3. Jigme Dorji, CFO Zhemgang
4. Karma Jigme Temphe, Chief, SFED
5. Karma Leki , CFO Tashigang
6. Karma Tempa, CFO Mongar
7. Karma Tenzin, CFO Wangdi
8. Kelzang Choden,
9. Kencho Dukpa, CFO Dagana
10. Lhakpa Tshering,
11. Pema Dendup, Offg. CFO, JDNP
12. Phuntsho Tobgay,
13. Rinzin Dorji, Offtg. CFO, Gedu
14. Samten Wangchuk, CFO, RMNP
15. Sonam Wangdi, CFO, NCD
16. Tashi Dorji,
17. Tashi Tobgyel, CFO, JSWNP
18. Thinley Wangdi, CFO Samtse
19. Tenzin Wangda,
20. Tshering Dorji,
21. Tshering Samdrup
22. Tshering Tempa, CFO, BTC
23. Ugyen Dorji,
24. Ugyen Tshering, CFO JWS
25. Wangchuk Dorji, CFO SWS
26. Yoenten Norbu, CFO, TNP
27. Naiten Wangchuk, CEO, FCBL
28. Rinchen Yangzom, NBC
29. Ugyen Lhamo, HRO, HRD

d) Presentation was made and feedback sought from all BAFRA officials virtually alongside their meeting on biosecurity strategy development (19th February, 2021)