



Bhutan E-RNR Masterplan

April 2016

“By 2023, application of ICTs will accelerate sustainable growth of renewable natural resources sector for equitable socio-economic well-being of the people and the nation”



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Executive Summary

The RNR sector's eleventh five year plan (2013-2018) was used as the guiding framework to develop the Bhutan E-RNR Masterplan. This masterplan is aimed at harnessing the ICT potential of Bhutan in achieving its RNR goals and further strengthening the role of ICTs in accelerating the growth of the RNR sector in a sustainable and equitable manner.

An E-RNR taskforce was set up comprising of members from various departments of the Ministry of Agriculture and Forests (MoAF-ICS, PPD, DoFPS, DoL, CoRBB, DAMC, BAFRA, NBC, DoA), the Department of IT and Telecom and the Bhutan Info-Communications and Media Authority. Critical stakeholders from Department of Hydromet services, MoEA, Bhutan Development Bank Ltd, Bhutan Telecom and Tashi cell were also consulted during the process. Technical assistance was provided by the FAO office in Bhutan together with the FAO and ITU Regional office's for Asia and the Pacific in the development of this E-RNR Masterplan for Bhutan.

This strategy was developed following the framework proposed by the FAO-ITU E-agriculture Strategy Guide¹ (Figure 1)

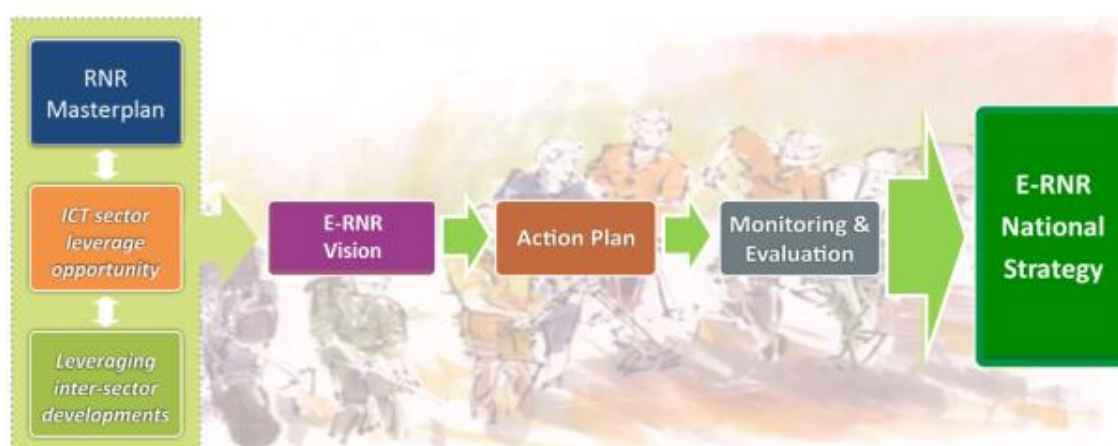


Figure 1: Adapted from the FAO-ITU framework for development of National E-agriculture (E-RNR in case of Bhutan) Strategy

This strategy outlines development of an E-RNR vision, an action plan for key ICT solutions for the sector and a monitoring and evaluation framework. In keeping with the five year planning cycle of the Royal Government of Bhutan, the time frame was set as 2023, which includes the current five year plan (2013-2018) and the next cycle (2019-2023). The plan also identifies the critical ecosystem requirements (e.g. telecom infrastructure, banking infrastructure, e-GIF, hydro-metrological information) and also takes into consideration the existing systems/ solutions and details the plans for developing and implementing six priority solutions.

¹ <http://www.fao.org/asiapacific/resources/e-agriculture-strategy-guide/en/>

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Background

The Royal Government of Bhutan is committed to pursuing an inclusive green socio-economic development model guided by the concept of Gross National Happiness (GNH) and its four pillars:

- I. Promotion of equitable and sustainable socioeconomic development;
- II. Preservation and promotion of cultural values;
- III. Conservation of the natural environment; and
- IV. Good governance.

The sectoral five year plans form the core framework for implementation of government policies. In the Renewal Natural Resources (RNR) sector, Ministry of Agriculture and Forests (MoAF) leads the implementation of the RNR SECTOR 11th FIVE YEAR PLAN (2013-18)². The RNR sector comprises of agriculture, livestock and forestry. The plan envisions achieving *“sustainable natural resources for equitable social and economic well-being of the Bhutanese people and the nation state”*. It has four policy goals and six sectoral key result areas (SKRAs). Information and communication technologies (ICTs) have a great potential to contribute to the growth of the RNR sector respecting the *sustainability* and *equitable well-being* principles through bridging the opportunity gaps posed by geographic, demographic, knowledge and economic factors. Strategic utilization of ICTs would accelerate meeting the policy goals for the current period and also lay the foundation for greater progress in the future planning cycles. The importance of ICTs was also recognized by the 11th Five Year Plan (Section 2.8.4) as an opportunity for the RNR sector.

The deployment of ICTs in RNR is not new in Bhutan. The growth of mobile, Internet, computing devices and social media has significantly enhanced the way RNR stakeholders’ accessed information and communicated, however this is just a fraction of the realizable potential. A number of ICT for agriculture pilot projects have provided rich learnings on sustaining and scaling up ICT in agriculture interventions in the country. A fragmented approach results in wastage of resources, potential loss of benefits that would accrue from the economies of scale, lack of interoperability and increased privacy and security risks. The Government has also laid significant emphasis on these lines through its e-Government Framework.

Recognizing the critical role that ICTs can play in enhancing the efficiency of RNR sector and facilitating achievement of the adopted goals, the Royal Government of Bhutan has developed this **National E-RNR Masterplan**. It is based on the E-agriculture Strategy Guide developed by the Food and Agriculture Organization (FAO) and the International Telecommunication Union (ITU).

² Available at <http://www.moaf.gov.bt/download/Five%20Year%20Plans/11FYP%202013-2018.pdf>

This E-RNR masterplan aims to provide ICT based solutions for the sector's priorities and challenges. In particular these solutions seek to achieve the following results-

- Bridge the skills and knowledge gap in the RNR sector;
- Increase the efficiency of production and diversity of crops, improve logistics (e.g. storage, transportation, farm inputs) and carry out effective monitoring of RNR sector using ICTs;
- Incorporate ICTs in RNR financing, banking and transactions to create a vibrant RNR commercial market;
- Make accurate information available in real time or near real time for the RNR sector leveraging on smart sensing technologies and integration of required databases;
- Improve the confidence in use of extension and advisory services through enhanced online knowledge resources, improved linkage between RNR extensions and researchers and increased responsibility of the advice;
- Enable new and innovative services and improve the efficiency of RNR services utilizing ICT devices & networks, platforms and connected critical databases for RNR sector;
- Promote research and innovation through availability of information and enhancing engagement leveraging on modern communication tools;
- Utilize ICTs to expand the reach of the Bhutanese produce to domestic and international markets;
- Strengthen the tracking and traceability framework nationwide to protect the bio-diversity;
- Reduce individual risks by bridging the information gap and improving the efficiency of risk management tools and procedures using ICTs;
- Proactive coordination with policy makers and regulators of various sectors to create the appropriate enabling environment;
- Facilitate education and enhance efficiency of women in RNR sector through ICT interventions;

Ubiquitous broadband access and reliable broadband connectivity amongst RNR stakeholders is critical to the success of the outcome though the type of connectivity varies across the stakeholders. It is also important to leverage on the ICT solutions of other key sectors such as banking, hydro-met department, land commission, G2C service, telecommunication and IT to identify synergies with RNR.

Achieving these outcomes would in turn facilitate achieving the four policy goals of the E-RNR in the medium term.

1. **Enhance food and nutrition security** by making various kinds of foods available through improved production, access and enabling effective utilization of food.
2. **Enhance sustainable rural livelihood** by making rural livelihood productive and sustainable by generating employment opportunities, increasing rural HH cash income and implement Rural Economic Advancement Programs in the selected vulnerable *geogs*.
3. **Accelerate RNR sector growth** to 4% through agriculture commercialization/diversification, private sector participation and value addition on export
4. **Promote sustainable management and utilization of natural resources** for health, happiness and economy.

In long term, it would be help RGoB set greater sustainable progress targets in the E-RNR sector and the country as a whole. The progress would also facilitate the growth and reach of other sectors such as banking, transport, governance, telecommunication, information technology etc. in terms of engagement, employment, revenue, human resource capability and investment potential.

What is E-agriculture (E-RNR)?

E-agriculture (E-RNR in Bhutan) is evolving in scope as new ICT applications continue to be harnessed in the RNR sector. It is seen as an emerging field focusing on the enhancement of RNR and rural development through improved information and communication processes. In this context, ICT is used as an umbrella term encompassing all information and communication technologies including devices, networks, services and applications; these range from innovative Internet-era technologies and sensors to other pre-existing aids such as telephones, mobiles, television, radio and satellites.

More specifically, it involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture, forests and livestock. Provision of standards, norms, methodologies, tools as well as development of individual and institutional capacities, and policy support are all key components of E-RNR.

The Case for E-RNR

Access to the right information at the right time is crucial for people involved in the RNR sector. This includes farmers, fishers, foresters and other actors in the RNR value chain. Increasingly the challenges faced by small holder farmers because of climate change, irregular rainfall patterns, attack of pest and onset of diseases, drought, desertification and challenges posed in participating in emerging markets are detrimental to the RNR sector's goal.

However, opportunities exist through innovative ICT solutions to address some of these challenges. In recent past, the role that ICTs play in promoting innovation in agriculture sector has been a phenomenal. The role that ICT can play as an instrument of change is potentially transformative. Smallholder farmers, particularly women involved in agriculture, have a huge advantage when the right ICTs are induced into the agriculture value chain. The access to the right information at the right time gives them the capacity to make informed decisions that would affect their livelihoods and thereby play a major role in ensuring food security.

The rapid growth of mobile phone ownership and Internet globally, and in particular in Bhutan, provides new avenues to share and access information. In Bhutan, 628,289 mobile users (84.32%), 349,116 Internet subscribed users, 24,979 fixed broadband subscribers, 7 licensed radio broadcasters covering all 20 Dzongkhags & 205 *geogs*, one state-owned (BBS) and 64 private cable television operators covering 20 Dzongkhags provide connectivity to the country. Digitization has provided the capability for convergence of these traditional network technologies and the emerging ones (e.g. Machine to Machine (M2M), Internet of Things (IoT)) using information technology platforms (e.g. mobile apps, data analytics). These networks, when combined with data availability, required applications and the right enabling environment, can unleash the tremendous innovation potential of the Bhutanese RNR sector responsibly (refer figure below).

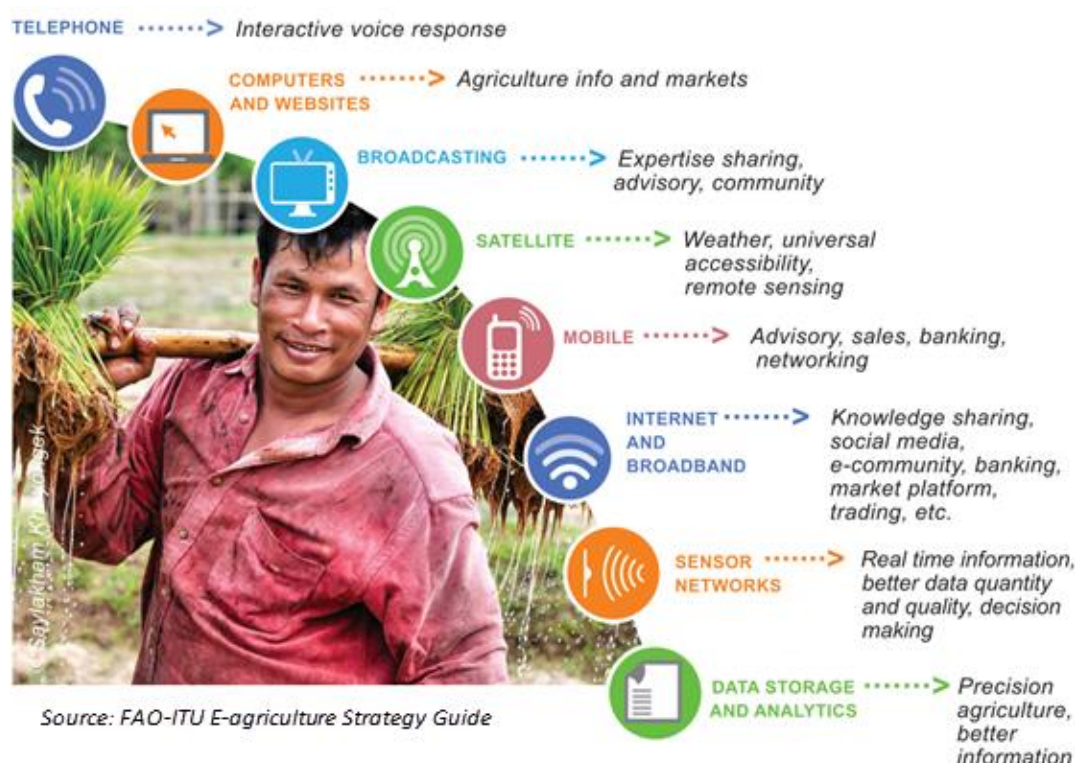


Figure 2: The role of ICTs in RNR

The cross-sectoral nature of the ICT propels growth in other sectors that can be further leveraged by the RNR sector. For example use of data gathering and data analytics by weather department can make micro insurance for RNR sector more efficient. The deployment of mobile banking/mobile money by telecom and banking sector can significantly ease the financing, transactional, social safety and investment challenges. The two combined can create a base for providing social safety net for people involved in RNR sector activities.

While in many farming communities people with phones still rely on basic or feature phones, which offer mainly voice and text services, smartphone access are becoming affordable and their use are on the rise. Social media platforms such as WeChat, WhatsApp are becoming services of common use. The rapid growth of broadband, especially mobile broadband provides a great opportunity for the RNR sector. Access to Internet at the Community Centres (CICs) with guided assistance can significantly improve livelihoods and reduce drudgery. With added banking services, the potential is manifold.

In terms of service capabilities offered by ICTs, new technologies pave the way to advance the services from 'push services' (e.g. radio, television, SMS) and interactive (e.g. G2C services, interactive website) to transactional (e.g. mobile payments, banking services at Community Centres, payment platforms) and finally connected (e.g. a network of sensors and databases integrated over secure platforms monitoring and offering services on various devices and providing timely, accurate and real-time information). Transactional capabilities are the key to linking revenue to services being offered over ICT platforms.

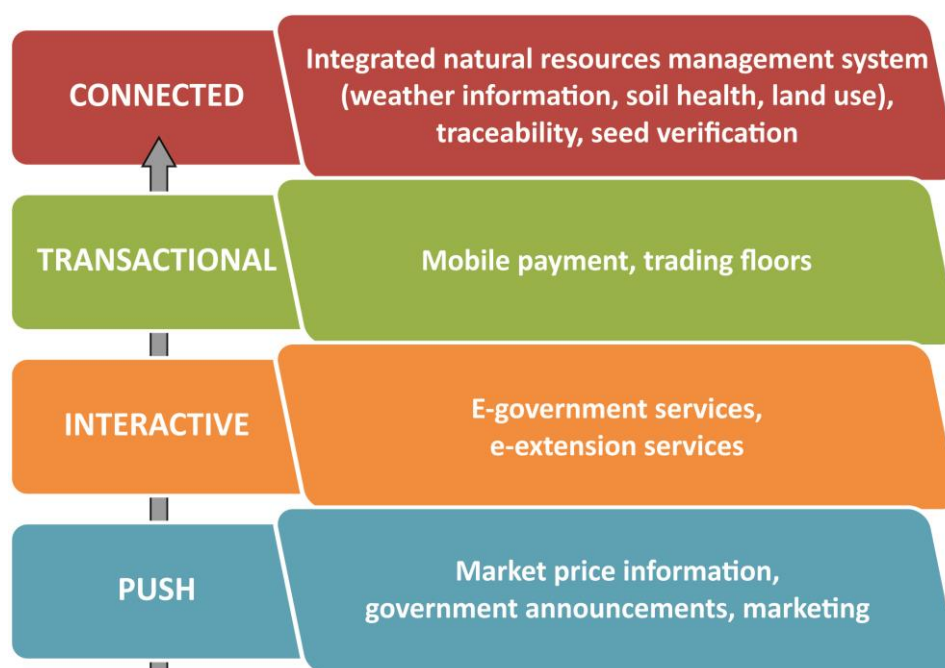


Figure 3: Information exchange over emerging technologies – from push to connected services

Women contribute the major workforce in the RNR sector and the role of ICTs is very crucial in facilitating rapid access to livelihoods related information as well as information needed on exchanging, buying, producing, and selling products and thereby leading to increased productivity gains.

More specifically, E-RNR has the potential to meet the agricultural goals of Bhutan more effectively in the following areas:

- RNR research and national agricultural information systems
- Timely and cost effective farm input supply
- Extension and advisory services
- Increasing production from RNR sector
- Postharvest handling and logistics
- Market access and trade
- Disaster management and social safety nets
- Actuating financial inclusion
- Creating risk mitigation plans
- Disease, livestock health and pest management
- Improving policy environment and effective implementation
- Better data availability and analytics
- Linkage between government, researchers and producers
- Improve farmers' incomes and productivity on a sustainable basis

A Country Overview and Agriculture Policy Environment

1 Country Profile

1.1 Geography

The Royal Kingdom of Bhutan is a landlocked country with an area of 38,394 square kilometers. It is bound by India in the South and South-West and Tibetan autonomous region of China in the North and North-West. Virtually the entire country is mountainous, and ranges in elevation from 100m along the Indian border to the 7,554m Kulha Gangri peak on the Tibetan border. These two extremes frame a landscape which stretches from sub-tropical to arctic like conditions. The maximum East-West stretch of the country is approximately 300 km and North-South about 150 km.



Figure 4: Satellite geography image of Bhutan
(source, http://www.visitbhutan.com/geography_of_bhutan.html)

1.2 Demography

Population of Bhutan according to the National Statistics Bureau of Bhutan as of October 2014 is 745,153 of which majority of population is in the 15-64 age group. According to the Bhutan 11th Five Year Plan, the population is expected to reach 818,791 persons by 2020, and will further increase to 1,038,445 persons by 2050. During the period 2005-2050, the working age population is estimated to grow by around 73.6 per cent. This window of opportunity can result in demographic dividends if accompanied by adequate savings,

investments, sound public policies and the full participation of youth and women. The youth population (15-24 years) is expected to increase from 129,403 in 2020 to 171,563 by 2030.

1.3 Administrative Divisions

Bhutan has a constitutional monarchy. The country is divided into 20 *dzongkhags* (districts), the first-level administrative division, each with its own elected three-year representative. Some larger *dzongkhags* have one or more of an intermediate judicial division, known as *dungkhags* (sub-districts), which themselves comprise two or more *gewogs*. All districts are divided into *gewogs* (blocks or groups of villages), the second-level administrative units that include several villages. There are total 205 Gewogs in the country. A *Thromde* is a third-level administrative division in Bhutan. The Capital of Bhutan is Thimphu.



Figure 5: Dzongkhags demarcation in Bhutan

205 *gewogs* in Bhutan have an RNR Centre comprising of agriculture, livestock and forestry extension agents. In total there are 205 RNR extension centres and 5 RNR research and development centres, 4 RDC sub-centers, 4 regional livestock development centers in the country.

GENERAL			
Area (Sq. km)	38,394		
Administrative Units (Nos.)			
Dzongkhags	20		
Dungkhags	15		
Gewogs	205		
Currency	Ngultrum		
National Language	Dzongkha		

DEMOGRAPHY			
	(numbers)		
Population by Sex	2012	2013	2014
Male	375,554	381,582	387,520
Female	345,125	351,421	357,633
Both Sex	720,679	733,003	745,153
Population by Age Group			
0 - 14	216,972	224,607	227,254
15 - 64	469,450	471,887	480,347
65+	34,257	36,509	37,553
All ages	720,679	733,003	745,153
Overall Sex Ratio	108.8	108.6	108.4
Population Density (person per Sq. km)	18.8	19.1	19.4
Median Age of Population (years)	24.0	24.6	24.7
Ageing Index (elderly per 100 children)	15.8	16.3	15.9
Total Dependency Ratio	53.5	55.3	52.8
Child Dependency Ratio	46.2	47.6	45.5
Old Age Dependency Ratio	7.3	7.7	7.3

NATIONAL ACCOUNTS			
	(million Nu.)		
Indicators	2011	2012	2013
GDP at Current Market Price	84,950.0	97,453.0	104,378.1
Gross National Income (GNI)	79,634.0	89,858.6	97,585.4
Agriculture, Livestock & Forestry Share to GDP (%)	16.3	16.0	16.2
GDP Real Growth (%)	7.9	5.1	2.1
GDP Per Capita (In Nu.)	119,647.9	135,351.3	142,983.7
Final Consumption Expenditure	52,354.9	54,966.0	78,032.6

TRANSPORT & COMMUNICATIONS			
	(numbers)		
	2011	2012	2013
All Roads (Km)	9,491.5	9,491.5	10,578.2
Bridges	292	318	304
Registered Vehicles	62,697	67,519	67,926
Drukair Passengers	166,264	194,283	210,891
Telephone Connections	27,488	27,005	26,485
B-Mobile Subscribers	383,089	4,21,715	406,353
T-Cell Subscribers	96,428	136,077	139,589
Postal Infrastructure	114	128	128

AGRICULTURE			
Centres	(numbers)		
	2011	2012	2013
RNR Extension Centres	139	139	139
RNR Research Centres	4	4	4
Agriculture Extension Centres	40	40	40
Agriculture Seed Production Farms	11	11	11
Farm Mechanization Centres	3	3	3
Livestock Extension Centres	51	51	51
Veterinary Hospital	20	20	20
Regional Veterinary Laboratories	3	3	4
Livestock Farms	12	12	11

Figure 6: Bhutan at a Glance (2014)
(source, <http://www.nsb.gov.bt/publication/publications.php?id=5>)

1.4 Government

Bhutan has 5 constitutional bodies, 31 autonomous agencies, and 10 ministries.

1. Ministry of Agriculture and Forests
2. Ministry of Economic Affairs
3. Ministry of Education
4. Ministry of Finance
5. Ministry of Foreign Affairs
6. Ministry of Home & Cultural Affairs
7. Ministry of Health
8. Ministry of Information and Communications
9. Ministry of Labour and Human Resources
10. Ministry of Works and Human Settlements

1.5 Policy Alignment

The formulation of the Bhutan E-RNR Masterplan takes into account key national development policies, sectoral policies, and relevant legislative framework. It is important that the plan is in line with the constitutional provisions, vision 2020, broad national policies of the country, e-Government framework and facilitates achievements of the Bhutan Vision 2020, the 11th Five Year Plan in general and for the Renewal Natural Resources (RNR) sector. It is also important that the plan is in consonance with the principles of GNH.

1.5.1 Bhutan 2020: A Vision for Peace, Prosperity and Happiness

Adopted in 2000, the Bhutan 2020 provides six guiding principles in the pursuit of its goal “to ensure the future independence, sovereignty and security of our nation-state”:

- 1) Maintenance and strengthening of the distinct Bhutanese identity;
- 2) Maintenance of unity and harmony;
- 3) Ensuring stability;
- 4) Promoting self-reliance;
- 5) Ensuring sustainable development; and
- 6) Demonstrating flexibility and capacity to adapt to change.

1.5.2 The Eleventh Five Year Plan (2013-2018)³

Since 1961, eleven five-year development plans have been adopted. The current 11th Five Year Plan (2013-2018) however is the second five year plan being implemented since the introduction of Democratic Constitutional Monarchy in 2008.

A notable paradigm shift of the 11th plan is the adoption of a Results Based Planning (RBP) framework that articulate clear outcomes and outputs that need to be achieved in order to realize the 11th plan objective of **“Self-reliance and Inclusive Green Socio-Economic Development”**. The formulation of this Bhutan e-Government policy therefore follows the principle and pursues the objective set out in the 11th five year plan, as well as aims at fulfilling the Bhutan 2020 Vision. It is also important to note that all development planning is based on the Bhutan’s unique development philosophy of Gross National Happiness⁴ (GNH).

Gross National Happiness (GNH) broadly encompasses four pillars:

- 1) Sustainable and equitable socio-economic development
- 2) Preservation and promotion of culture
- 3) Conservation and sustainable utilization and management of the environment, and
- 4) Promotion of good governance

³ Download, <http://www.gnhc.gov.bt/five-year-plan/>

⁴ GNH was conceived by the Fourth King His Majesty Jigme Singye Wangchuck in 1972

Expected outcomes and outputs of the 11th plan are defined as Key Result Areas, and have been identified at the national, sectoral, *dzongkhag*⁵, *thromdes*⁶ and *gewog*⁷ levels. At the national level, there are 16 National Key Result Areas (NKRAs). The performance of the central and local government agencies towards delivery of the national key result areas are measured through Key Performance Indicators (KPIs) consisting of baselines and targets.



Figure 7: Bhutan's results based program linkages

The result based programs, formulated and implemented at agency level, contribute towards the sector, *dzongkhag* and *gewog* key result areas. Each of the four GNH pillars has associated NKRAs.

- (I) Sustainable and equitable socio-economic development (4 NKRAs);
- (II) Preservation and promotion of culture (2 NKRAs);
- (III) Conservation and sustainable utilization and management of the environment (4 NKRAs); and,
- (IV) Promotion of good governance (6 NKRAs).

1.5.3 Economic Development Policy 2010 (EDP 2010)⁸

The Economic Development Policy is a main central directive of the government for all ministries and agencies. The policy aims at achieving the two objectives below by 2020:

- ❖ Achieve economic self-reliance by the year 2020
- ❖ Full employment (97.5%)

⁵ Dzongkhag or District is the first-level administrative division in Bhutan

⁶ Thromdes or 'urban municipality' is the third-level administrative division in Bhutan

⁷ Gewog or 'block' or 'village group' is the second-level administrative division in Bhutan

⁸ Download, <http://www.gnhc.gov.bt/approved-policy/>

Six strategies were set out as below,

- (1) Diversify the economic base with minimal ecological footprint.
- (2) Harness and add value to natural resources in a sustainable manner.
- (3) Increase and diversify exports.
- (4) Promote Bhutan as an organic brand.
- (5) Promote industries that build the brand Bhutan image.
- (6) Reduce dependency on fossil fuel especially in respect to transportation.

The draft e-Government policy will take important note of areas of economic opportunities identified in the EDP 2010 (Table 1).

Table 1: Priority Growth Areas (EDP 2010)

Priority Growth Areas	
High Quality Green Services a. High end education b. High-end health services and traditional medicines c. ICT (BPOs, KPOs, Data centres, etc.) d. Tourism and hospitality with emphasis on high value low impact e. Financial services f. R&D and consultancy services	Agro and Forest based production a. Organic farming b. Agro-processing c. Biotechnology including pharmaceutical, nutraceuticals, traditional and herbal medicines d. Forest based products e. Poultry f. Fisheries g. Floriculture h. Health food i. Animal feed j. Apiculture k. Horticulture l. Dairy
Energy a. Hydro electricity b. Solar and wind energy c. Other sources of renewable energy	
Information and Cultural Industry a. Film and media including animation b. Handicrafts c. Textiles d. Fine art including the performing arts e. Publishing f. Festivals, spiritual centres, etc.	Natural Resources a. Select mineral-based products b. Water-based products
	Transportation and Related Services a. Green and non-fossil fuel based modes of transportation b. Mass transportation c. Railways, ropeways and cable cars
Other Manufacturing a. Electronics b. Electricals c. Computer hardware d. Building materials e. Power intensive industries	Construction a. Mechanization b. Green technology
	Waste Management Services

Agro and forest based production form a key component.

1.5.4 RNR Sector 11th Five Year Plan (2013-2018)⁹

The 11th Five year Plan recognizes the positive impact that the performance of RNR Sector would have on improving farmers' livelihoods, economic growth and reduction of poverty. It has set four key objectives of

1. **Enhance food and nutrition security** by making various kinds of foods available through improved production, access and enabling effective utilization of food.
2. **Enhance sustainable rural livelihood** by making rural livelihood productive and sustainable by generating employment opportunities, increasing rural HH cash income and implement Rural Economic Advancement Programs in the selected vulnerable geogs
3. **Accelerate RNR sector growth** to 4% through agriculture commercialization/diversification, private sector participation and value addition on export
4. **Promote sustainable management and utilization of natural resources** for health, happiness and economy

The development of the RNR sector 11th plan has been a participatory and an inclusive process involving consultation with key stakeholders within the RNR sector including the private sector, government officials at national and local levels, development partners and civil society representatives. Stakeholders were involved through participation in workshops/ discussions, where important issues and ideas were identified, discussed, analyzed and agreed upon for incorporation into the plan.

The plan also notes the following principles and sector policy

"The RNR sector is the custodian of the country's renewable natural resources and the natural environment. Its roles and responsibilities in contributing towards realizing the goals of the Vision 2020 and GNH are much greater than generally perceived. Following principles underlines the RNR sector policies, strategies, and programs:

- *A people-centered development; aspirations of people for a better life to be realized through active public participation and community-based institutions; Sustainable economic development based on the country's resource potential and comparative advantages;*
- *A balanced and equitable development based on country's renewable natural resources;*
- *Attaining an environmentally sustainable development by safeguarding the integrity of the country's fragile ecosystem; and*
- *Culturally sensible and responsible development preserving cultural heritage;"*

⁹ Download, <http://www.moaf.gov.bt/download/Five%20Year%20Plans/11FYP%202013-2018.pdf>

1.5.5 Policies related to RNR

Apart from the Constitution of the Kingdom of Bhutan and the Vision 2020, there are a number of other policies linked with agriculture, livestock, pesticides, water, forests, bio-security, wildlife, land amongst others that are relevant for RNR Sector including

Policies in place

The Plant Quarantine Act of Bhutan, 1993; Forest and Nature Conservation Act of Bhutan, 1995; The Seeds Act of Bhutan, 2000; The Pesticides Act of Bhutan, 2000; The Livestock Act of Bhutan, 2001; The Biodiversity Act of Bhutan, 2003; The Food Act of Bhutan, 2005; Land Act of Bhutan, 2007; The Cooperatives (Amendment) Act of Bhutan, 2009; Bhutan Water Policy, 2003; Bio-Security Policy, 2008; Economic Development Policy, 2010; Foreign Direct Investment Policy, 2010; National Forest Policy, 2011; National Irrigation Policy, 2012; RNR Research Policy, 2012; National Food and Nutrition Security Policy of Bhutan; Bhutan National Human-Wildlife Conflict Management Strategy, 2008; Strategy for Protection of Agricultural Areas, December 2009;

Draft Policies

Food Safety Policy (draft), Agriculture Marketing Policy (draft), Agriculture Subsidy Policy (draft), Timber Pricing and Marketing Policy (draft), National Land Policy (draft), Financial Inclusion Policy (draft)

The 11th five year RNR sector plan provides a brief overview (Page 37-39).

1.5.6 Bhutan Telecommunications and Broadband Policy, 2014¹⁰

The E-RNR services and solutions are largely dependent on the accessibility, affordability and quality of the telecommunication infrastructure. Bhutan telecommunications and broadband policy is an important tool. It is a converged telecommunications and broadband policy and with regard to the telecommunications, the policy has six objectives.

- Ensure development of Bhutan's telecommunications sector in line with international trends and that people of Bhutan are able to enjoy quality ICT services;
- Ensure that telecommunications sector provides a strong foundation for Bhutan's ICT enabled knowledge-based society, and a true engine for its socio-economic progress;
- Guide and facilitate evolution of the sector to attain its full potential;
- Ensure that a conducive environment for infrastructure, regulations, private sector participation and government support is promoted;
- Promote innovations in the sector;
- Promote green telecommunications and ensure environmental responsibility.

¹⁰ Download, <http://www.gnhc.gov.bt/approved-policy/>

The Policy covers 17 telecommunications elements.

1) Universal access	2) Universal Service Fund (USF)	3) Green Telecom
4) Licensing framework	5) Competition framework	6) Mobile development
7) Quality of Service (QoS)	8) Consumer protection	9) Security and Privacy
10) Spectrum Management	11) Consolidation of fibre assets	12) Infrastructure sharing and Right of Way
13) Disaster communication	14) Emerging trends	15) Regulatory framework
16) Institutional setup	17) Skills and capacity development	

As for the broadband policy, it identifies 8 objectives and 7 short-medium term goals. The policy defines the entry level broadband at a minimum download speed of 512 kbps. However, it is open for review and revision of the definition of broadband at a later stage.

The eight objectives of the broadband policy are:

- To contribute towards wellbeing and health of the people by provisioning of broadband enhanced health services;
- To contribute towards increased economic welfare of Bhutan and its people by creating sustainable employment opportunities and making Bhutan more attractive for business investments and tourism;
- To promote social development and cohesion through broadband and conserve Bhutan's culture and tradition;
- To enhance public and private sector efficiency and performance through use of broadband;
- To enhance education and training through broadband;
- To harness on benefits of mobile broadband for increased innovation and opportunity especially in taking public services to the people;
- To promote development and access of local content via broadband;
- To enhance global integration and international relations by enabling connection of Bhutanese businesses and communities with the wider world.

The seven short-medium term goals of the broadband policy are:

- 1) To achieve critical mass of broadband service uptake during 11th FYP: The government will work with the private sector to achieve this.
- 2) To have in place a competitive structure for the provision of broadband in Bhutan: The government will examine and remove legal and regulatory barriers to competition. It will ensure that market for broadband services operates competitively.
- 3) To achieve broadband service availability to 80% of both urban and rural communities during the 11th five year plan: 80% of people of Bhutan shall have accessibility to entry level broadband services or better. USF will be used in areas that are not economically viable.
- 4) To ensure affordability of entry level broadband: The government along with relevant stakeholders shall ensure that an entry level broadband service is available to all at an affordable price.
- 5) To support all academic institutions to have access to broadband: 100% of all academic institutions in Bhutan shall have broadband access.
- 6) Government to lead the broadband evolution by delivering its services online over broadband: A significant programme of e-Government transactions that can be performed online and enhanced by broadband shall be developed and progressively implemented during the course of the 11th Five Year Plan.
- 7) Lead government applications: In addition to above, government shall develop a range of lead applications for delivery of new, enhanced or extended services online using broadband.

The e-Gov executive committee under e-Gov governance structure will also serve as the telecommunications and broadband committee which will steer the implementation of this policy and oversee the development of the sector. Additional members from telecom operators, ISPs and BICMA shall be included.

The role of the committee will be to ensure that the telecommunications and broadband policy and the strategic action plan are implemented and to ensure accountability on the part of the ministries, departments and agencies responsible for each action or programme identified in the policy.

1.5.7 Bhutan e-Government masterplan

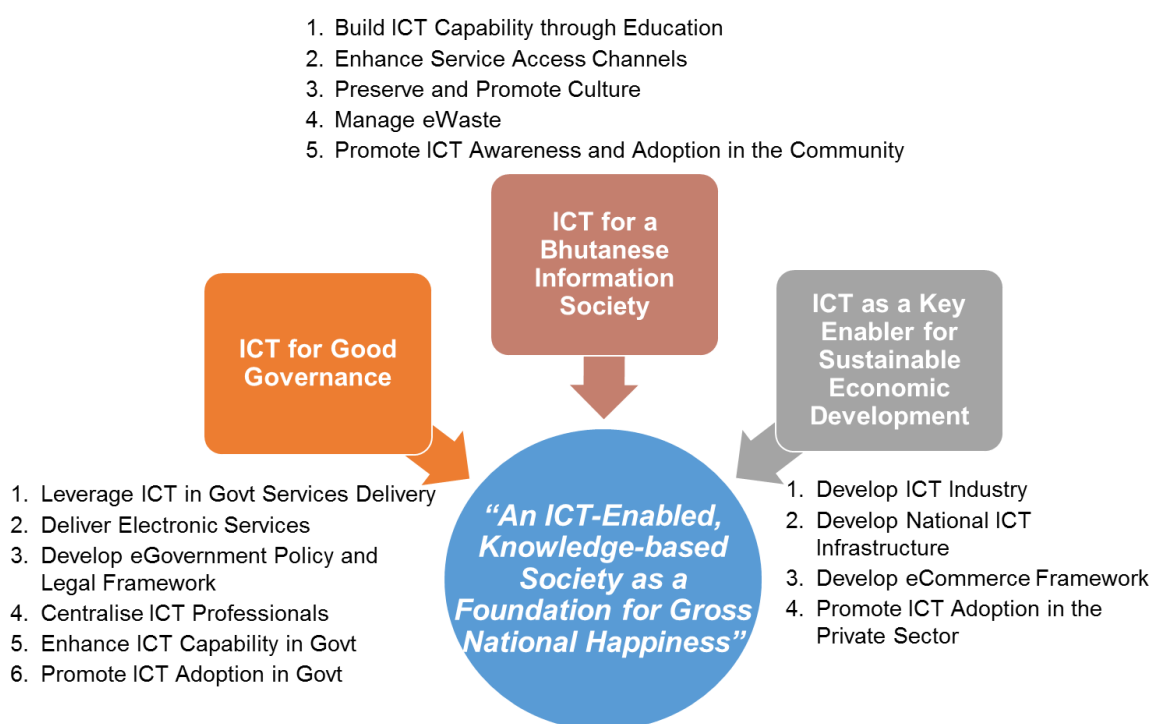
Another important alignment for E-RNR is that with e-Government masterplan as RNR sector service delivery is linked with government to citizen services in a number of ways.

The Bhutan e-Government masterplan has been adopted since 2013. The masterplan replaces the previous Bhutan ICT Policy and Strategy (BIPS) 2004. The masterplan sets out ICT vision, ***“An ICT-Enabled, Knowledge-Based Society as a Foundation for Gross National Happiness”***.

The masterplan aims at the following outcomes:

- ICT for Good Governance
- ICT for a Bhutanese Information Society; and
- ICT as a Key Enabler for Sustainable Economic Development

The masterplan also determines strategies for each desired outcome as shown below.



Vision, Desired Outcomes and Strategies

Figure 8: e-Gov masterplan Vision, Desired Outcomes and Strategies

The Bhutan e-Government masterplan suggests that an e-Government policy be developed to cover four broad areas:

The e-Government policy will be developed to cover four broad areas:

i) Connectivity

- Provide backbone ICT infrastructure and facilitate the roll out of services to areas which are commercially not viable and that might not otherwise be served through the operation of market forces.
- Provide affordable ICT access at entry levels for the people of Bhutan.
- Provide Internet access and usage to benefit all communities in Bhutan whether they are academic, professional, urban, rural or local communities.

- Provide a dedicated, high speed and secure government intranet connecting the *dzongkhag*, *gewog* and *dungkhags* offices.

ii) Security

- Establish Bhutan Computer Response Team (BtCIRT) to serve as the national agency cyber security incidents that constantly monitors, prevents and manages incidents.
- Establish the government data centre with secure, high quality and availability infrastructure, server, and storage systems, where all government systems will be housed.
- Conduct regular ICT security audit for mission critical systems.

iii) Service Delivery

- Establish website interface standards.
- Develop common standards to enable sharing of data and interoperability of services.
- Include provision to support Dzongkha, including Dzongkha localization, to avoid cost of re-developing systems later on. The standard for the common platform and applications needs to include the provision to enter, store, transmit, query, display, and properly collate (sort) Dzongkha Unicode data in UTF-8 or UTF-16 format. Such things as usernames and passwords should also be compatible with Dzongkha.
- Treat development of security applications such as those in the area of national security, government communications e.g. government email encryption separately to enable higher level of security.
- Enforce the use of government email for official government electronic communications.
- Provide e-services that are accessible from anywhere and anytime and leverage the mobile platform where feasible.
- Establish a single source of truth through the development of common data hubs.

iv) Deployment

- Aggregate ICT demand of government agencies and DHI portfolio companies to negotiate for bulk supply of ICT products and services e.g. computer desktops and notebooks, software licenses, application development and maintenance services.
- Strict vigilance over the testing and acceptance of products and services supplied to avoid procurement of products and services that do not meet requirements.
- Enforce the use of authorized software to combat virus/security and address legal/moral issues.

- Consider open source software over proprietary software to address current issues like system incompatibility, low cost of maintenance and ease of procurement (e-GIF will address this issue).
- DITT/MoIC will be the lead agency in developing and implementing the e-Government policy in close coordination with the line agencies. Given the importance and urgency of the policy to be put in place, the policy is proposed to be formulated in the first year of the 11 FYP.
- The e-Government policy shall be flexible and adaptive to reflect the pace of change and ensure that the best outcomes are delivered to the Bhutanese society at any point in time. The policy shall be a living document, and will be reviewed and revised regularly to ensure its maximum currency and effectiveness.

1.5.8 Protocol for Policy Formulation and GNH Policy Screening

Bhutan has adopted GNH Policy Screening¹¹ as a tool to assess the impact of introducing new policies on GNH and to mainstream GNH into all new policies being formulated.

1.5.8.1 e-Governance Framework and RNR Steering Committee

In order to achieve effective planning, implementation and deployment of ICTs in government, avoid duplication and ensure cross-sector collaboration of ICT data and services, a multi-layered e-Governance framework has been institutionalized. All new databases and services are required to conform to e-Government Interoperability Framework (e-GIF) and undergo prior approval processes.

For the existing E-RNR strategy implementation the existing process can serve as the steering committee with the inclusion of RNR GNH committee as the decision making committee of the Ministry of Agriculture and Forests.

¹¹ GNH Centre Bhutan Policy Screening Tool <http://www.gnhcentrebhutan.org/what-is-gnh/gnh-today/a-policy-screening-tool/>

B Strategic context for E-RNR in Bhutan

1 RNR system status in Bhutan

RNR sector comprising of agriculture, livestock and forestry is arguably the most important sector of the Bhutanese economy. It has taken a centre stage in the Royal Government of Bhutan development agenda in the wake of trade deficit and the global increase in the food prices¹². It contributes up to nearly 16.18% of GDP (2013), accounts for 4.3% of exports (NSB, 2012) and is the single largest sector that provides livelihood to over 55 percent of the population as per Labour Force Survey 2013.

The incidence of poverty in rural areas of Bhutan was recorded to be much higher (16.7% in 2012) than in urban areas (1.8%). Further, 69% of the country's population resides by engaging themselves in subsistence- semi commercial kind of farming for their livelihood. This clearly indicates the greater role that RNR sector can play in poverty alleviation.

The contribution of Agriculture, Livestock and Forestry (RNR) to the GDP stood at 16,888.98 million Nu in 2013, second only to construction at 17,602.41 million Nu. In the RNR sector, agriculture is the largest contributor accounting for 9.18% (out of 16.18%) of the GDP followed by livestock (4.11%) and forestry & logging (2.89%) (Refer: Figure 9).

GDP by Economic Activity at Current Prices (2009 - 2013)						Percentage Share of GDP by Economic Activity at Current Prices (2009 - 2013)					
(Nu. in million)											
Sectors	2009	2010	2011	2012	2013	Sectors	2009	2010	2011	2012	2013
1. Agriculture, Livestock & Forestry	11,158.67	12,177.83	13,868.37	15,558.29	16,888.98	1. Agriculture, Livestock & Forestry	18.23	16.80	16.33	15.96	16.18
1.1 Crops	5,668.24	6,530.14	7,665.37	8,635.21	9,580.49	1.1 Crops	9.26	9.01	9.02	8.86	9.18
1.2 Livestock	2,894.92	3,109.68	3,473.20	3,996.79	4,289.67	1.2 Livestock	4.73	4.29	4.09	4.10	4.11
1.3 Forestry & Logging	2,595.51	2,538.01	2,729.79	2,926.29	3,018.82	1.3 Forestry & Logging	4.24	3.50	3.21	3.00	2.89
2. Mining & Quarrying	1,392.03	1,616.89	1,941.73	1,961.96	2,867.26	2. Mining & Quarrying	2.27	2.23	2.29	2.01	2.75
3. Manufacturing	5,017.23	6,324.15	7,044.82	8,623.12	8,878.49	3. Manufacturing	8.20	8.72	8.29	8.85	8.51
4. Electricity & Water Supply	11,813.45	12,763.60	11,911.61	12,303.14	14,801.51	4. Electricity & Water Supply	19.30	17.61	14.02	12.62	14.18
4.1 Electricity	11,786.11	12,740.27	11,886.16	12,274.39	14,772.35	4.1 Electricity	19.25	17.57	13.99	12.60	14.15
4.2 Water Supply	27.34	23.33	25.45	28.75	29.17	4.2 Water Supply	0.04	0.03	0.03	0.03	0.03
5. Construction	7,469.68	10,308.86	13,916.57	17,669.80	17,602.41	5. Construction	12.20	14.22	16.38	18.13	16.86
6. Wholesale & Retail Trade	2,935.27	3,752.55	4,641.79	5,917.59	6,526.92	6. Wholesale & Retail Trade	4.79	5.18	5.46	6.07	6.25
7. Hotels & Restaurants	537.61	608.01	948.65	1,298.83	1,536.06	7. Hotels & Restaurants	0.88	0.84	1.12	1.33	1.47
8. Transport, Storage & Communications	5,989.87	6,943.32	8,526.11	9,256.04	9,743.45	8. Transport, Storage & Communications	9.78	9.58	10.04	9.50	9.33
9. Financing, Insurance, Real Estates & Business Services	4,962.11	5,545.89	7,007.73	7,412.13	8,064.75	9. Financing, Insurance, Real Estates & Business Services	8.11	7.65	8.25	7.61	7.73
9.1 Finance & Insurance	3,466.21	3,987.66	5,136.84	5,384.96	5,781.09	9.1 Finance & Insurance	5.66	5.50	6.05	5.53	5.54
9.2 Real Estate & Dwellings	1,460.30	1,507.70	1,815.30	1,947.27	2,198.01	9.2 Real Estate & Dwellings	2.39	2.08	2.14	2.00	2.11
9.3 Business Services	35.60	50.53	55.59	79.90	85.66	9.3 Business Services	0.06	0.07	0.07	0.08	0.08
10. Community, Social & Personal Services	7,963.33	9,262.50	10,882.24	11,248.97	11,536.50	10. Community, Social & Personal Services	13.01	12.78	12.81	11.54	11.05
10.1 Public Administration	4,728.37	5,517.28	6,478.03	6,775.74	7,931.34	10.1 Public Administration	7.72	7.61	7.63	6.95	7.60
10.2 Education & Health	3,234.96	3,745.21	4,404.22	4,473.23	3,605.16	10.2 Education & Health	5.28	5.17	5.18	4.59	3.45
11. Private Social & Recreational Services	276.42	297.97	338.03	390.05	436.44	11. Private Social & Recreational Services	0.45	0.41	0.40	0.40	0.42
12. Taxes Net of Subsidies	1,704.90	2,895.07	3,922.37	5,813.03	5,495.31	12. Taxes Net of Subsidies	2.78	3.99	4.62	5.96	5.26
GDP	61,220.56	72,496.64	84,950.01	97,452.96	104,378.08	Overall GDP	100.00	100.00	100.00	100.00	100.00

Source: National Accounts Statistics, NSB

Source: National Accounts Statistics, NSB

Figure 9: Contribution of RNR Sector to GDP

¹² Bhutan RNR Statistics 2015 (<http://www.moaf.gov.bt/bhutan-rnr-statistics-2015-online/>)

The RNR sector continues to grow at low rate (Figure 10) with agriculture exhibiting a growth rate of 3.89% at constant prices in 2013, followed by livestock (2.42%) and forestry (1.62%).



Source: Statistical Yearbook, NSB

Figure 10: RNR sector growth

The NSB 2014 notes

“Agricultural practices have changed tremendously over the years. Until a decade ago, agriculture was practiced on a subsistence basis. Whatever was produced on the farm was consumed having little or no marketable surplus. The farm production is supplemented by keeping different kinds of domestic animals such as cattle for draught and milking purpose, chicken for eggs and pigs for meat etc. At higher altitudes, herds of yaks and sheep are also kept for draught and milking.

Owing to the improved communication facilities in the country, there is an increasing tendency to go for cash crops like apples in the temperate north; oranges, areca nut and cardamom in the subtropical south. Other cash crops that are exported include ginger, chilies and vegetables. Strategies to increase livestock and cereal production include the propagation and practice of double cropping of the paddy production and distribution of high yield varieties. In the livestock sector the artificial insemination covers not only for the Jersey breeds that are high yielding but also for the production of Jatsa and Jatsam that are local high yielding varieties.

As a result, increasing number of farms is mechanized with sizable investment on the machinery and other inputs that are subsidized by the government.”

Given the rugged terrain, only 112,549 hectares of land is under agriculture accounting for 2.93%. It comprises of 31,910.8 hectares of wetland, 68,254.8 hectares of dry land and 12,384 hectares of orchards¹³. The slope distribution of the country poses challenges to the agriculture. An analysis carried out in the Bhutan RNR statistics report notes-

“..about 5.7% of the total geographical area at the national level has its slope above 100%, which is quite prone to “very severe “soil erosion

¹³ Source: Land Cover Mapping Project 2010, NSSC/PPD, MoAF, Thimphu (NSB 2014)

followed by 43.8% of the area with slope between 50-100%. According to LUPP, 1995 this category is susceptible to “more severe” soil erosion and therefore, interventions have to be well designed to either avoid or prevent climate change induced disasters. On further analysis, it was found out that about 14.05% of the total geographical area is having slope between 0-25% with slight to moderate risk of soil erosion (LUPP, 1995). There is a scope for expansion of agricultural activities in this category after excluding forested areas, water bodies, built-up areas, snow cover and other categories of land use not feasible for agriculture.”

A GIS database overlaying various information sources such as demography, agriculture information, land characteristics, soil nature would provide deep insight into agricultural planning.

The major cereal production includes paddy, maize, wheat/barley and potato while major horticulture crops are mandarin, chilli, apple, arecanut, ginger, mustard and cardamom.

One of its aims for the 11th plan is to ensure food security and increase income through management of arable, horticulture crops and medicinal plants. Access to markets, farm inputs, construction of farm roads and application of improved technologies are some of the prioritized means to achieve the goal. ICTs have the potential to enhance the efficiency in areas of market access, improved farm inputs as well as logistics.

The livestock composition in Bhutan includes local cattle, mithun, yak, zozom, buffalo, horse, pig, poultry, sheep, goat, cat and dog with poultry and local cattle accounting for the majority (81.5%) in 2013. The country has 80.90% forest area with 70.46% under tree cover (LCMP 2010). The livestock is used for a variety of activities including food, fertilizers, source of raw materials for clothes, labor force on the farms and transportation. It is especially important for the highlanders. In Bhutan, the livestock production includes milk, butter, cheese, eggs, beef, pork, mutton, chicken and fish. The self-sufficiency of the livestock production is high for milk (68.2%), butter (82.6%), cheese (74.7%), eggs (100%), mutton (83%) and low for beef, pork, chicken and fish. There are religious sensitivities around killing in Bhutan and most of the meat products are imported.

Preserving the forests, animals and plants as well as enhanced bio-diversity are important key result areas of the 11th five year plan. The royal government has committed to maintain at least 60% of the country's area under forests covers for all times to come. Bhutan also embodies the concept of community forest to create employment opportunities and as of 2014-2015 fiscal years, over 2,400 people have been recorded as employed in the community forest across the country, of which female represents 17.6% and male constitutes 82.4% of the total employed.

While timber and other natural resources have increasing demand, forest fire remains a major challenge. 45, 095 acres of area was burnt in 2013-2014 as a result of forest fire in 64 recorded instances. Forest fire alerts are important areas for consideration under early warning systems. Another important challenge is forest offences, which are on the rise.

Another key area of concern in this segment is human-livestock-wildlife conflict. Electric fencing continues to be the main emphasis of the government to reduce the losses due to these conflicts.

The agriculture trade stands at 2542.433 million Nu of exports against 6776.806 million Nu of imports reflecting a heavy imbalance. In 2014, potatoes (689 million), cardamom (421 million), oranges (543 million), cordyceps (375 million), apples (139 million), wheat flour (112 million) and vegetables, spices & oilseeds (116 million) remain the major exports that exceeded 100,000 million Nu in value. Major imports that exceed the same value during the same period include rice (1788 million), dairy products (1246 million), oils & fats (996 million), beef (501 million), vegetables (411 million), wheat (416 million), sugar (330 million), pork (313 million), fish (394 million) and chicken (165 million).

The agricultural farmers' groups (FGs) and cooperatives (Coops) are agricultural enterprises, jointly operated by group or groups of people for their mutual, social, cultural and economic benefits. It is a community organization voluntarily formed to operate on specific or mixed enterprises by pooling together the available resources with the members. As of December 2014 there are 40 cooperatives with 1,699 members and 263 farmer groups with 5,940 member households registered with department of agricultural marketing and cooperatives

Irrigation Channels

Irrigation channels are a critical issue in the agricultural system of Bhutan. As of 2013, about 2,583 kilometers of irrigation channels have been constructed covering 80,847 acres (32,718 hectares) of agriculture land with 46,096 beneficiary households. About 92.4 % of the total irrigation channels were found to be functional (by 2013) covering 94.2 percent of the area benefitting 93.3% of the rural households. Smart water management and modern practices using sensors can improve the efficiency of irrigation system.

Farm roads

Farm inputs such as seeds, fertilizers, machinery, market access, and access to work force are heavily dependent on the accessibility of farm roads. At the national level, at least 68.35 percent of the households were found to be within less than an hour from the nearest motorable road point, while 8.45 percent were located more than six hours walking distance away from motorable road point in 2013. ICTs can be very effective substitute to remote areas in terms of planning as well as market access reducing substantially the need for physical travel as well as making travel more productive through advanced information availability and increased engagement.

Market infrastructure

Access to market information system and trading facilities are some of the key benefits that ICTs can bring to agriculture. During the tenth five year plan, at least 465 market infrastructures were created including collection sheds (45), field pack house (4), green

house (1), market shed (24), sales outlet (39), store house (55) and other sheds (297). The price data of food commodities is maintained by the Department of Agricultural Marketing and Cooperatives (DAMC) and is available to farmers using IVRS over one of the mobile operators' networks. There is an urgent need to create a comprehensive Market Information System in the country to boost domestic and international trade as well as increase cash income.

RNR sector is also the largest employer. As per Labour Force Survey 2013, the labour force participation increased from 62.2 percent in 2012 to 64.4% in 2013. Also, the labour force participation rate for male has also increased from 65.7% in 2012 to 72.1% in 2013, while the female participation rate has decreased from 63.2% in 2012 to 58.9% in 2013.

(Numbers)

Infrastructure	2010	2011	2012	2013
RNR (Common services)				
RNR Extension Centers	138	139	139	139
RNR Research Centers	4	4	4	4
RNR Research sub-stations	6	6	6	6
Soil and Plant Analytical Laboratory	1	1	1	1
Agriculture				
Agriculture Extension Centers	40	40	40	40
Agriculture Seed Production Farms	11	11	11	11
Farm Mechanization Centers	3	3	3	3
Farm Mechanization Training Centers	1	1	1	1
National Mushroom Center	1	1	1	1
National Post Harvest Center	1	1	1	1
National Plant Protection Center	1	1	1	1
Livestock				
Regional Hospitals	20	20	20	20
Livestock Extension Centers	42	42	42	42
Regional Veterinary Laboratories	3	3	3	4
Livestock Farms	11	11	11	11
Fodder Seed Production Center	1	1	1	1
Vaccine Production Centre	1	1	1	1
National Artificial Insemination Center	1	1	1	1
National Cold Water Fishery Center	1	1	1	1
National Warm Water Fish Culture Center	1	1	1	1
National Center for Animal Health	1	1	1	1
Forestry				
Territorial Division HQs	12	12	12	12
National Parks	5	5	5	5
Range Offices	55	55	55	55
Beat Offices	80	80	80	80
Nature Conservation Study Center	1	1	1	1
Wildlife Sanctuaries	3	3	3	3
Nature Study Center	1	1	1	1
Percent of Forest cover	72	70.46	70.46	70.46
Percent of Protected Area	51.25	51.4	51.4	51.4

Source: Policy & Planning Division, MoAF, Thimphu.
Statistical Yearbook of Bhutan: 2014

Figure 11: Provides a summary of the RNR sector infrastructure in Bhutan.

2 RNR, development goals and challenges

There is a new recognition of the vital role RNR plays in economic growth and poverty reduction. This renewed interest in agriculture also comes in urgent need for Bhutan to substitute imports and thereby narrow the trade deficit gaps.

Recognizing that if the performance of RNR Sector improves, farmers' livelihoods and economic growth will improve and poverty will be reduced, four key objectives are set out to be fulfilled during the 11th plan:

1. **Enhance food and nutrition security** by making all kinds of foods available through improved production, access and enabling effective utilization of food.
2. **Enhance sustainable rural livelihood** by making rural livelihood productive and sustainable by generating employment opportunities, increasing rural HH cash income and implement rural economic advancement programs in the selected vulnerable *geogs*
3. **Accelerate RNR sector growth** to 4% through agriculture commercialization/diversification, private sector participation and value addition on export
4. **Promote sustainable management and utilization of natural resources** for health, happiness and economy

The 11th five year plan also mentions the following principles and sector policy

"The RNR sector is the custodian of the country's renewable natural resources and the natural environment. Its roles and responsibilities in contributing towards realizing the goals of the Vision 2020 and GNH are much greater than generally perceived. Following principles underlines the RNR sector policies, strategies, and programs:

- *A people-centered development; aspirations of people for a better life to be realized through active public participation and community-based institutions; Sustainable economic development based on the country's resource potential and comparative advantages;*
- *A balanced and equitable development based on country's renewable natural resources;*
- *Attaining an environmentally sustainable development by safeguarding the integrity of the country's fragile ecosystem; and*
- *Culturally sensible and responsible development preserving cultural heritage;"*

The plan comprises of four objectives and six key result areas (Refer Fig 12.a). Each SKRA has its specified outcomes, outputs and key performance indicators (KPIs). The six SKRAs contribute towards the four pillars of GNH (Refer Fig. 12.b).

Fig 12.a Strategic Framework for 11th Plan

Fig 12.b SKRAs and their relationship with GNH pillars

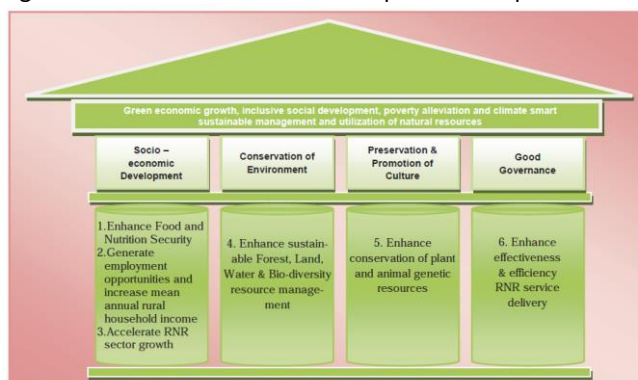


Figure 12: Strategic framework – SKRAs and their relationship with GNH pillars

The plan also recognizes that “Although much has been achieved in the past plan periods, challenges still remain in achieving food security, poverty reduction, transformation of agriculture from subsistence to commercial farming, markets and efficient use of inputs” and focuses on a series of strategies

- I. Optimization and effective utilization of resources to enhance productivity and production,
- II. Farm mechanization
- III. Strengthening commercialization and agriculture marketing
- IV. Land development and consolidation
- V. Water resource management and irrigation
- VI. Participation in commodity value chain and compacts
- VII. Sustainable management and utilization of natural and biodiversity resources
- VIII. Contract farming and private sector participation
- IX. Enhance investment in RNR sector
- X. Adapting to climate change and disaster risk reduction
- XI. Encouraging research, innovation and technology
- XII. Farmer groups and cooperatives
- XIII. Infrastructure development (farm road, market, distribution, processing, storage, extension centers, quality control and diagnostic labs, research facilities, and, forestry and quarantine outposts, marketing support facilities, input generating centers)
- XIV. Governance and service delivery (policy & legal framework, improved information management and dissemination, rural economic advancement program, extension services, institutional strengthening and human resources development, improving the monitoring and evaluation of the program)

A number of these strategies have effective solutions based on ICTs or where ICTs can make significant contribution.

2.1 The RNR sector priorities

The six SKRAs of the RNR sector specified in the 11th five year plan include

- SKRA 1: Enhance food and nutrition security by making various kinds of foods available through improved production, access and enabling effective, utilization of food
- SKRA 2: Generate employment and increase mean annual cash income
- SKRA 3: Accelerate RNR sector growth through commercial farming (Exports)
- SKRA 4: Enhanced sustainable Management of Biodiversity Resources
- SKRA 5: Enhanced conservation of Plant and Animal Genetic Resources
- SKRA 6: Enhanced Effectiveness of RNR service delivery

These SKRAs are quite broad and in essence are also likely to serve as longer term goals for the country and were considered as the starting point for the strategy.

The E-RNR taskforce identified a set of priorities that are important to deliver the expected outcome for each SKRA (Table 2).

Table 2: Priority areas for RNR Sector identified by the taskforce

Priority areas for RNR sector
SKRA 1: Enhance food and nutrition security by making various kinds of foods available through improved production, access and enabling effective, utilization of food
Increased production and productivity of staple crops
Increased vegetable and fruits production for nutrition security
Diversified food basket
Promotion of sustainable and safe production system (organic farming)
Introduction of improved high yield/breeds of crops and livestock and farm inputs
Improved agricultural and livestock productivity
Improved integrated plant nutrient management (IPNM)
Promotion and strengthening of farm mechanization
Improved access to farm roads, electrical fencing and irrigation
Improved post-harvest services
SKRA 2: Generate employment and increase mean annual cash income

Promotion of commercial farming (mechanization)
Making agriculture farming attractive
Supporting youths registered with MoLHR on agricultural farming ventures
Packaging of activities (land, subsidy etc.) all in one package for youth
Promoting high value crops
Promoting farmer groups & cooperatives
Encouraging SME programs
Inclusion of agriculture studies in school curriculums
Access to micro finance
Enhancing private sector participation through contract farming (PPP) and FDI
SKRA 3: Accelerate RNR sector growth through commercial farming (exports)
Availability of land (enabling land leasing/acquisition policy, land consolidation)
Availability of attractive credit facilities
Availability of adequate manpower (skilled labor, technical backstopping)
Better Infrastructure (irrigation, farm shop, access to farm road, feed & food processing plants, storage etc.)
Availability of inputs (seeds, fertilizers, pesticides)
Availability of interested entrepreneurs to take up commercial farming
Economy of scale through cooperatives and groups
Exploration of potential markets
Better research and extension services- value chain analysis, information dissemination on administrative procedures
Farm mechanization
SKRA 4: Enhanced sustainable Management of Biodiversity Resources
Constitutional provision of maintaining a minimum of 60% forest cover for all time to come.
Sustainable utilization of resources , limiting the over harvesting or exploiting of natural resources through prescription of relevant management plan

Implementation of policies and other relevant legislations in place (Water Act, FNCA, NEPA, Biodiversity Act, NBSAP)
Community based conservation programme
Increasing eco-tourism opportunities as an incentive
Peoples' participation and volunteerism in natural resource management
Sustainable agriculture production
Management and prevention of forest fire
Plough back mechanism (e.g. PES-payment for environment service)
Access and benefit sharing (ABS)
Research and information dissemination
Strengthened protection and enforcement of natural resources
Parties to CITES and other international obligation
Zonation and demarcation of protected areas
SKRA 5: Enhanced conservation of Plant and Animal Genetic Resources
Strengthening Gene Bank
Collection and storing of germplasm of indigenous/endangered species
Maintaining 60% of the country's area under the forest cover
Sustainable management of natural resources
Increasing community participation (community based conservation efforts (in-situ))
Increasing community participation through community forestry activities/private forestry activities
Establishing eco-tourism activities
Preparation of protected area management plan
Zero tillage/conservation farming
Regulating the trade on endangered material and restriction of imports
Leverage on 'DrukREN' for International linkage on research and technology generation
Addressing IP related issues with regards to genetic resources

Conservation of land races
SKRA 6: Enhanced Effectiveness of RNR service delivery
Effective information dissemination(awareness on services, market info., etc)
Strengthen staff capacity and knowledge
Establish infrastructure including office equipment rationalization of extension coverage and introduction of virtual 'Zomdue', community centres
Strengthen G2C services [Should be up 24/7, e-payment & e-lending services to be integrated]
Reduction in time of service delivery
Enhance / introduce service delivery through 'Electronic' & 'Mobile (IVR)' mode [text / voice]

However, delivering these priorities requires overcoming the challenges that the sector faces. These challenges impede meeting the outcome and outputs that the plan envisages.

The next stage was to identify these challenges. The E-RNR taskforce identified thirty four (34) key challenges and the SKRAs that these challenges *directly* impact.

2.2 RNR Sector Issues, Challenges and Opportunities

2.2.1 Issues and Challenges

Presented below are some of the major issues and challenges confronting Bhutanese RNR sector. For the viability of sector the issues/challenges below must be addressed:

- a. Limited arable land (2.9 percent of the total land area excluding pasture lands)
- b. Vulnerability to soaring food prices (net food importer)
- c. Loss of prime agriculture land to development activities
- d. High logistic cost due to poor infrastructure
- e. Farm labor shortages (rural-Urban migration)
- f. Wildlife damage to food production
- g. Limited commercial scale farming (land fragmentation)
- h. Vulnerability to climate change impacts
- i. Limited capacity for bio-safety & security
- j. Difficult access to finance
- h. Requirements for producing accurate statistics to guide policy decisions

Thirty-four challenges were identified and the impact of these on each SKRA was examined (Table 3)

2.2.2 Opportunities

Despite several constraints, there are also opportunities for RNR sector growth:

- a. The pristine natural environment is suited for producing high value livestock and horticultural products using organic production techniques for export
- b. Strong political commitment
- c. Enabling legal instruments for commercialization of agriculture, farmer groups and cooperatives, conservation of natural environment
- d. Potential for horticulture development, organic farming, harvesting NWFPs and use of community and private forestry, bio-prospecting, agro-eco tourism
- e. Potential for enhanced cereal production in selected areas (southern belt and certain pockets)
- f. Abundant electricity for agro-processing and value addition

Table 3: Challenges in meeting the Bhutan RNR sector goals as identified by the E-RNR taskforce

No	Challenges	Enhance food and nutrition security by making various kinds of foods, available through improved production, access and enabling effective, utilization of food	Generate employment and increase mean annual cash income	Accelerate RNR sector growth through commercial farming (Exports)	Enhanced sustainable Management of Biodiversity Resources	Enhanced conservation of Plant and Animal Genetic Resources	Enhanced Effectiveness of RNR service delivery
		SKRA 1	SKRA 2	SKRA 3	SKRA 4	SKRA 5	SKRA 6
1	Geographical terrain (35% of land with more than 55% in slopes) and limited arable land (8%)	x	x	x			
2	Fragmented and small land holding	x		x			
3	Encroachment of urbanization into productive agricultural lands	x			x	x	
4	Lack of information on soil health and fertility management	x					
5	Land degradation including erosion, compaction and overuse	x				x	
6	Lack of irrigation, water scarcity, overuse of water, poor management of watershed	x		x	x		
7	Access to markets	x	x	x			
8	Access to farm inputs (including high quality seeds, fertilizers etc.,)	x	x	x			
9	Access to farm inputs (agricultural workforce)	x	x	x		x	x
10	Climate change (including loss of biodiversity and wildlife, increased level of GHGs)	x			x		
11	Human-wildlife conflict	x	x	x	x		
12	Pests and diseases	x					
13	Limited food basket	x					
14	Lack of post harvest storage facilities, and transportation	x	x	x		x	x
15	Lack of appropriate legal and policy frameworks	x		x	x		
16	Farm drudgery/ lack of mechanization		x				
17	High cost of production, low returns		x	x			
18	Religious sentiments increases cost		x	x			
19	Lack of cooperation from private partners		x				
20	Access to microfinance, difficult loan procedures, need of mortgage, high interest rates		x	x			
21	Lack of training facilities for upgrading technical knowledge and skills		x		x	x	x
22	Availability of low cost insurance and risk guarantee schemes	x		x			
23	Increased rate of rural-urban migration			x			
24	Monitoring and evaluation of groups and cooperatives			x		x	
25	Poor extension services	x	x	x	x	x	x
26	Unsustainable use of natural resources				x		
27	Management of waste				x		
28	Forest fire				x		
29	Illegal trafficking of natural resources				x		
30	Political interest and good governance				x		
31	Lack of integration of e-payment module						x
32	Lack of or limited connectivity and Inadequate facilities with service providers						x
33	Lack of monitoring and feedback systems						x
34	G2C services not fully functional						x

Such challenges and issues will not only hinder the performance of RNR sector but will affect, first and foremost, the poor and vulnerable section of the society and developmental prospects of the country which are dependent mostly on environment and natural resources.

Addressing all these challenges is important. However, limitation of resources and necessary preparedness would not allow addressing all these at one point of time. It is crucial that there is a balance observed between short term challenges that are urgent and long term challenges such as environmental, climate change, disaster and gender that are important but might be irreversible. Also, ICT based solutions do not offer similar impact on all these challenges. For example creation of an e- market may have larger role of ICTs as compared with improving the quality of land for agriculture

A practical analysis of the challenge is necessary to undertake prioritization based on real life constraints. In the context of Bhutan, the taskforce placed high consideration on:

- **GOAL IMPACT:** the impact a challenge has on the agricultural goal and the impact that ICTs have in addressing the challenge;
- **TIME AND RESOURCE CONSTRAINT:** the time frame required *and* the availability of financial, technical and human resources within the desired time frame;
- **ENABLING ENVIRONMENT:** the policy, regulatory & legislative facilitation and presence of investment interests;

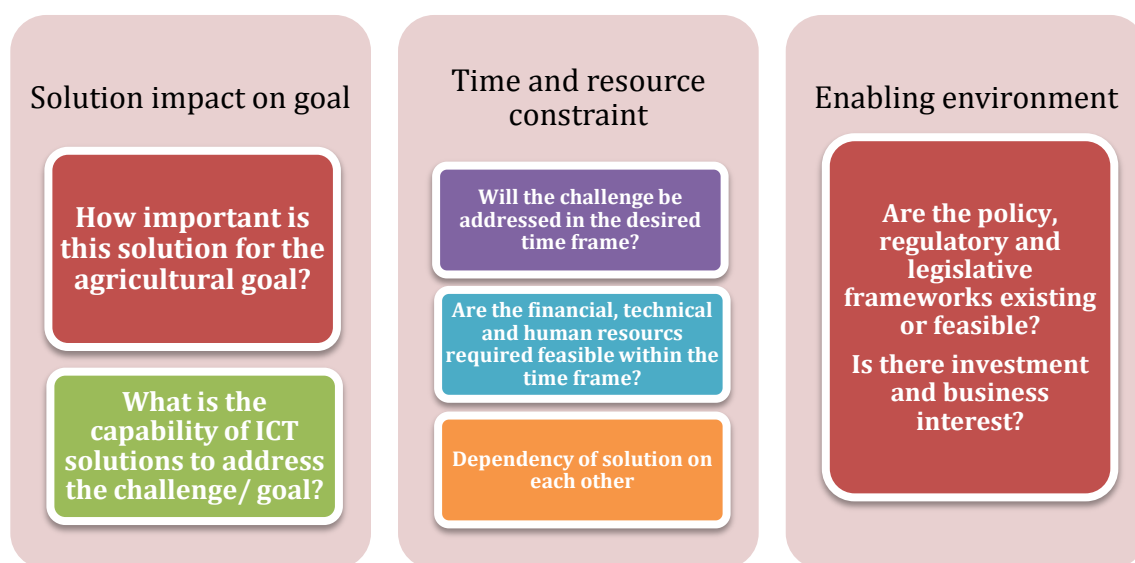


Figure 13: Mapping the impact of a solution to the goal and feasibility check

Before delving into the solutions that ICTs can provide, an assessment of the status of the ICT sector and the future plan was undertaken.

3 Status of ICT Infrastructure, Services and Adoption

ICT infrastructure and services form the core element of E-RNR masterplan. Availability of the infrastructure, the types of applications and the level of adoption by the users is important. The various ICT elements include

Public ICT networks and devices

- Telecom network reach by coverage and take up (mobile, broadband and fixed)
- Status of broadband backbone
- Affordability of devices and telecom services
- PCs, laptops, smartphones penetration
- End user terminal device - level of penetration
- Community Information Centres (CICs)

Private ICT networks and devices

- Deployment of e-Gov network and ICT networks by MoAF and RNR extensions
- Sensing networks for information gathering
- Availability of databases
- Linkage and interoperability of these databases
- Availability of data analytics platforms

ICT applications and services

- ICT applications and services platforms
- E-Government (G2C) services and their adoption
- Mobile banking and e-banking services
- Agriculture information services

3.1 Public ICT networks and devices

Ensuring hi-speed broadband networks including last mile connectivity is the key for successful deployment of e-services and the ICT uptake at large. Recognizing that Bhutan's terrain is quite mountainous and difficult to navigate and that Bhutan's mobile industry has grown rapidly in the last many years, mobile devices will continue to be the primary way to connect people especially in remote villages and communities. Mobile devices are also going to be the primary vehicle for government and private interests to connect with civilians on a regular basis as well as during emergencies. With these connections, the government must focus on putting in place mobile/wireless broadband networks apart from optical fiber backbone which is already underway.

Infrastructure in this context also includes ensuring sufficient capacity and sustainable community centres, which have been deployed by the Government of Bhutan at *gewog* level. These community centres serve as an ideal channel for promoting ICTs and for public service

delivery. The government also needs to ensure necessary infrastructure used within the government itself e.g. government intranet, government data centre, and etc.

3.2 Community Centres

The DITT/MoIC was mandated by the Royal Government of Bhutan to establish one community centre (CC) in each of the 205 *geogs* in the country. The project was started in mid-2009 and in the first phase DITT established 100 CCs. With assistance from SASEC Information Superhighway Project¹⁴ which aimed at connecting 4 countries i.e. Bangladesh, Bhutan, India, and Nepal, 30 community centres (CCs) have been established under the project. Currently, out of 195 community centres (CCs) established, 156 are connected with Internet and 5 are in progress for completion within 2015. The last remaining five will be constructed in tandem with rural electrification project. These CCs have formed a so-called 'Village Network'.

The Government approved 5 year subsidy to Bhutan Post, who were operating and managing the CCs. The management is now being shifted to BTBL, which serves as a great advantage to E-RNR services as it can also offer financial services.

In most cases, the RNR extension centres are located close to the community centres. These RNR centres, which act as the information hub at the *geog* level, are central to implement the E-RNR strategy and require Internet connectivity.

3.3 High-speed Broadband Backbone Networks

Optical Fiber Networks

During the 10th five year plan, the government had undertaken the National Broadband Master Plan Implementation Project (NBMIP) to build a nation-wide fiber optic infrastructure for the country. Under the project, Optical Ground Wire (OPGW) and All Di-electric Self Supporting (ADSS) fibers have been rolled out in all 20 *dzongkhags* and 187 *gewogs*. The government aims to connect fiber optic network to all 20 *dzongkhags* (18 with OPGW and 2 with ADSS) and 192 *gewogs*. The work is in progress for connecting 9 *gewogs* which is scheduled to be completed in tandem with the rural electrification project of BPC and remaining 4 *gewogs* are off the electricity grid plan of BPC. Given that investment in the fiber optic network cannot be commercially viable for any operator in the country at present, the government has consolidated all existing OPGW belonging to Bhutan Telecom and Bhutan Power Corporation for which they have received fair compensation.

Further to reduce the cost of connectivity, no depreciation and O&M cost shall be loaded to the lease rent until such time cost recovery becomes feasible. The intent of the government here is to ensure a level playing field for all operators and to help improve competition at the

¹⁴ South Asia Sub-regional Economic Cooperation (SASEC) Information Highway Project is a project initiated and funded by ADB

service level.

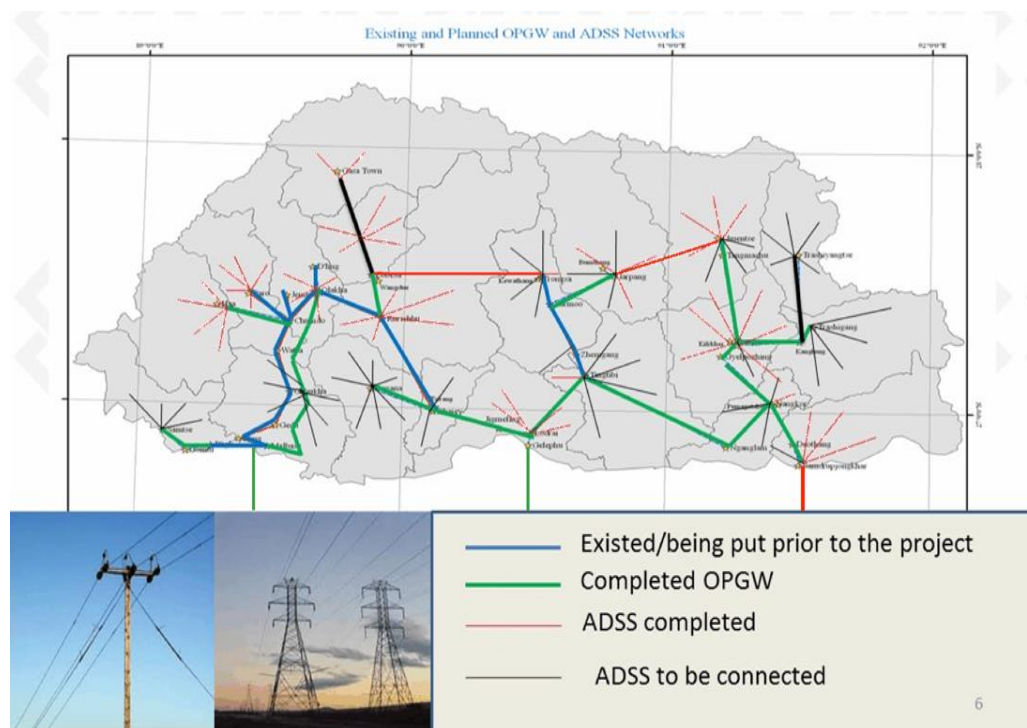


Figure 14: Planned OPGW and ADSS network map

- OPGW connectivity in 18 districts (*dzongkhags*), ADSS connectivity in 2 districts, ADSS connectivity in 192 blocks (*gewogs*)
- Fibers owned by government
- O&M of 2.1% to Bhutan Power Corporation (BPC); depreciation cost of 3.17% paid to BPC
- Dark fibers leased to TSP/ISPs free of cost

In partnership with BPC, the Ministry of Information and Communications (MoIC) has rolled out fibres throughout the country on power transmission and distribution infrastructure. So far fibre optic cables have reached 20 districts and 192 gewogs. The fibres have been leased to the telecom operators for free to keep the price of services low. Bhutan Telecom and Tashi InfoComm are already providing services using this infrastructure.

Currently, all the *dzongkhags* and 192 *gewogs* have the physical fibers connected, while the works to lay fiber to the remaining 9 *gewogs* is under progress. The four remote *gewogs* of Soe, Naro, Lunana and Lingshi will be connected by radio technology as these *gewogs* doesn't have power distribution network to carry the fiber. While the OPGW cables form the core backbone infrastructure connecting all district administrative centres, the ADSS fiber are being extended from this core network and terminated in a strategic location in the *gewogs*, from where Internet Service Providers (ISPs) will serve homes and schools, Basic

Health Units (BHUs) and other offices from that point of presence. The two telcos have already leased a pair of OPGW fiber and are providing services in all the districts. Meanwhile, other ISPs have also applied for leasing a pair of fiber to take services to all the *dzongkhags*.

The project was kick-started in 2009 and is targeted for completion by end of 11 FYP. The focus now in the 11FYP would be on last mile connectivity. The ministry will work with the telcos to see how the last mile services could be served.

International Gateways

A Second International Gateway at Gelephu in Sarpang *dzongkhag* has been established and operationalized to create the required redundancy¹⁵. Power Grid Corporation of India Limited (PGCIL) has strung OPGW between Bongaigoan and Gelephu (BPC Gantry) to facilitate this connectivity.

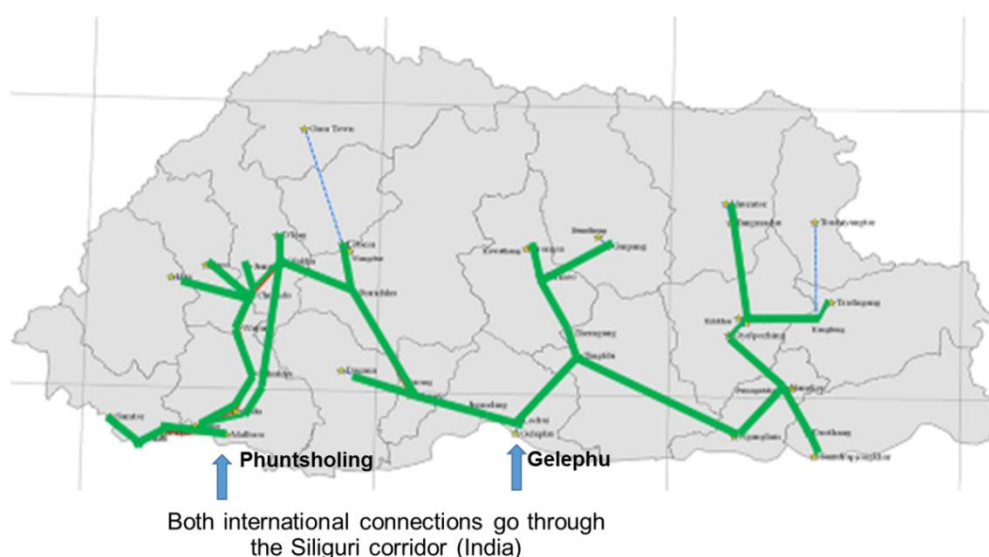


Figure 15: International Internet gateways in Bhutan

The government also wishes to establish the third international gateway in Samdrupjongkhar, a town of Samdrupjongkhar district to connect Bhutan through India to Bangladesh (Cox Bazaar) which has SEA-ME-WE-4 cable landing.

¹⁵ The first International Gateway is in Phuntsholing of Chukha District

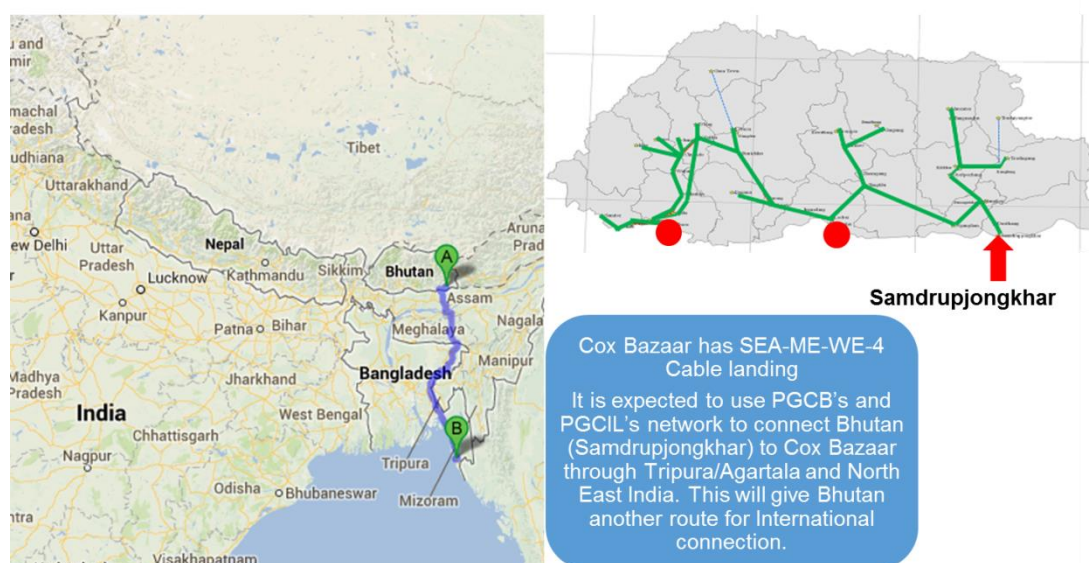


Figure 16: Internet gateways – Bhutan

DrukREN

The SASEC project also facilitates connections to all colleges and research institutes as well as national museum & library. DrukREN is a Bhutan's initiative to connect all hospitals and education (university level) and research institutes such as colleges and institutes under the Royal University of Bhutan (RUB), private degree colleges/institutes, Jigme Dorji Wangchuck National Referral Hospital (JDWRH), regional and *dzongkhag* hospitals, Renewable Natural Resources Research Centre (RNRRC) and Centre for Bhutan Studies (CBS).

With this internal network established, Bhutan would then connect to the global academic Internet, TEIN¹⁶. DrukREN would be established by leasing bandwidth from Internet Service Providers (ISPs). Last mile fiber cables to RUB colleges and institutes (both public and private), and regional hospitals, which will form the core of DrukREN, are being established under the National Broadband Masterplan Project. Further, DrukREN will then be connected to National Knowledge Network (NKN) of India. This connection to NKN will be achieved through the regional network being built under the ongoing SASEC Information Highway Project.

In summary, the policy directs that the RGoB will continue investing in rolling out high-speed broadband infrastructure including optical fiber networks and wireless broadband networks in order to achieve the goal of National Broadband Policy in that *"80% of people of Bhutan shall have access to entry level broadband services or better"*. With the increasing mobile subscriptions and demand for mobile data in Bhutan, the government recognizes the potential of mobile devices as a means for delivering public e-services. In this regard, the government will promote deployment of 3G and beyond; while ensuring affordability at least

¹⁶ TEIN (Trans Eurasia Information Network) funded by the European Union (EU) connects National Research and Education Networks (NRENs) in the Asia Pacific.

at entry levels for all people in Bhutan. The government shall ensure fiber broadband access for all academic institutions in Bhutan.

3.4 Last Mile Connectivity

Various cost-effective technology options will be examined and explored in order to ensure universal access especially in remote rural areas. Universal services shall be ensured for all people in Bhutan including those living in urban areas and marginalized groups of people. For this Universal Access and Service, the government and the national regulatory authority shall ensure availability, affordability, and accessibility with the last one meaning accessible by all people including those with different disabilities.

The government and the national regulatory authority shall utilize Universal Service Fund (USF) with care considerations and not to distort the market but to promote market forces. In this regard, areas where telecommunications access is not available shall be determined and divided into zones i.e. (i) Served zone or commercially service available zone; (ii) Underserved zone or commercially viable zone whereby the government shall apply some incentives to promote market forces; and, (iii) Underserved zone whereby subsidy is needed and most likely from the USF.

Mobile Communications

In July 2000, Bhutan saw the first fully state owned telecom operator, Bhutan Telecom, which was corporatized from the Department of Telecommunications. In 2003, Bhutan Telecom launched the first mobile communication service in the country. In 2008, Tashi InfoComm Limited, a private telecom operator started its operation. Today, the mobile sector has achieved up to 84.3% penetration with 628,289 subscribers, as per Bhutan at a Glance 2015¹⁷. All 205 Gewogs and most villages have access to mobile services and for the remaining villages without mobile services, assessment is underway to cover these villages with mobile services under phase IV of the rural mobile connectivity project using the universal service fund.¹⁸

All 205 *gewogs* have access to mobile services. There are 13 ISPs (BICMA Annual Report 2014) licensed ISPs currently serving Internet and hosting facilities. Between leased lines, fixed broadband, 3G, GPRS/EDGE and dial up, the country has achieved sizable access of Internet to the population with a take up of 46.85% (349,116) per every 100 inhabitants using Internet services. However, more people are connected using broadband and leased line connectivity.

¹⁷ Bhutan e-Government Master Plan, 2013, page 13

¹⁸ Source: 1. Annual Info-Comm and Transport Statistical Bulletin (6th Edition, 9th March 2015, page 13; 2. Annual MoIC Report 2015

High Speed Last Mile Access

Bhutan has 2G, 3G and 4G (LTE) networks operational in the country. Mobile Internet (EDGE/GPRS) and mobile broadband (3G/4G) services are the most preferred mode for accessing the Internet in the country.

- 1) BTL 3G coverage in 17 *dzongkhags* and partial/limited 4G-network coverage in Thimphu;
- 2) TashiCell coverage in 14 *dzongkhags*.

3.5 Alignment with e-Government Initiative

Royal Government of Bhutan is undertaking an e-Government initiative. Many of the features of the e-Government initiative require alignment with E-RNR masterplan.

Government Intranet and Data Centre

Thimphu Wide Area Network (TWAN) is a government intranet connecting all the ten ministries, the Prime Minister's office, more than 95 government agencies and 20 *dzongkhag* administration offices (i.e. *dzongkhag* LAN or DLAN) through dedicated, high security and high speed network. It is also aimed that TWAN will connect all 205 *gewogs* via the Community Centres (CCs). This means these CCs are connected to both the Internet and the government intranet. Currently 167 CCs have been connected to TWAN. The connection of *dzongkhag* offices to the Internet and government intranet are achieved by leveraging the infrastructure of the telecoms and ISPs.

TWAN includes such important public administration systems as Public Expenditure Management System (PEMS), Multi-Year Rolling Budget System (MYRB), Planning and Monitoring System (PLaMs) and Civil Service Information System (CSIS). The TWAN is also designed to support all G2C and G2B e-services, and new government systems such as the e-Procurement and geospatial information systems planned for implementation during the 11th five year plan.

Currently, government agencies procure and maintain their own servers and network equipment either at their own premise or host with data centre service providers both locally and abroad. This demand for data centre services continues to increase as agencies leverage ICT for service delivery.

The 11th five year plan sees the need to establish a Government Data Centre (GDC) to provide services to government agencies. The GDC will be designed to ensure the highest level of reliability and availability so as to sustain mission-critical operations. Consideration will be placed in the area of physical infrastructure, security control, power supply, racks, environmental control, fire detection and suppression, 24/7 customer support and structured cabling.

e-Gov Framework and e-GIF

The e-Government Governance Framework institutionalized under the eGovernment system, endorsed by the cabinet vide Executive Order c-3/153/463 dated 13th March, 2014 aims to ensure smooth implementation of eGovernment masterplan. The eGov Governance mandates all eGov ICT projects to be reviewed through DITT to prevent duplication of effort and resources, optimize & share available/existing resources wherever possible, enable system integration & interoperability, thus fostering collaboration across agencies to derive synergy.

E-Government Interoperability Framework (e-GIF)

The e-Government Interoperability Framework (e-GIF) helps defines standards for government agencies to integrate and interoperate. The framework promotes good governance through sharing of standard data and systems and services across the Government. It facilitates the delivery of efficient and effective automated services of the highest standards and quality.

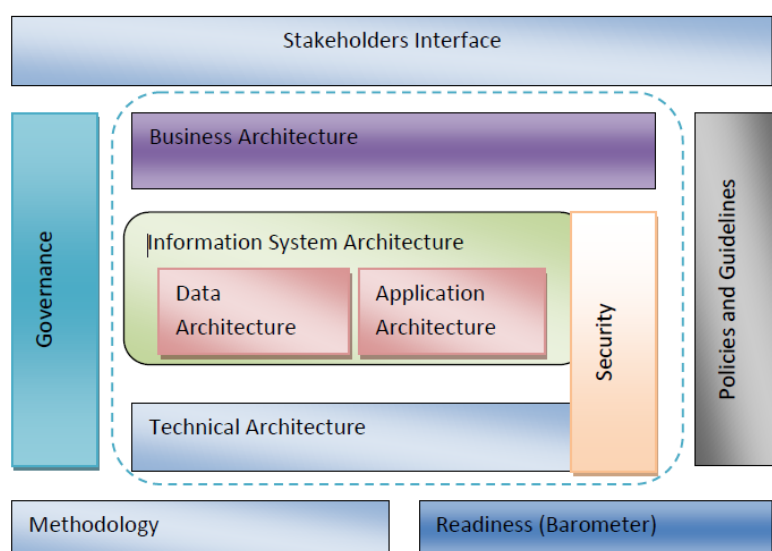


Figure 17: e-Government Interoperability Framework (e-GIF)

The four main components of eGIF are:

i) Business Architecture

The Business Architecture describes the different lines of business and the associated government functions that cut across the boundaries of different agencies.

ii) Applications Architecture

The Applications Architecture describes the common applications and application components that can be shared across the Government. It includes the technical standards and security considerations pertaining to the design and implementation of solutions and applications.

iii) Data Architecture

The Data Architecture lists the data definitions and data elements of common and shared data that are used across the Government. It will describe the data pertaining to 'People', 'Land' and 'Business' data hubs which are commonly used by various agencies' applications. It also defines technical standards, design and security considerations and best practices related to the management of data.

iv) Technical Architecture

The Technical Architecture defines the infrastructure technologies and their respective technical standards to enable better system integration and interoperability across the Government. It also defines the security considerations and standards related to the infrastructure technologies.

Source: ITU/DITT Report on e-Government, March 2015

Leveraging G2C Services

The Royal Government of Bhutan has a public service delivery platform to offer Government to Citizen services online (<https://www.citizenservices.gov.bt/web/guest/home>). These services are offered through the website and through the community centres and a few m-services can also be availed through the mobile apps. G2C contact center toll free hotline no. is 1199. Few m-services can also be availed through the mobile apps.

Leveraging on Mobile Application Industry

The mobile market is booming. The advent of data-centric networks, high-performing mobile devices, and engaging applications has put mobile at the center of computing evolution around the world. Recognizing the opportunity, the government of Bhutan requested ITU for assistance to better understand the landscape, the opportunities, the challenges, and the technology and policy framework required to launch a government-to-citizen initiative to reach more citizens in more places.

In response to the request, in 2012 ITU conducted and concluded a study on “emerging mobile applications opportunity” with aims to understand the specific requirement of Bhutan and the conditions in the field and, based on the data and information, devise a mobile application strategy for the top four prioritized areas of interest. The four mobile application areas that are chosen for initial launch are agriculture, disaster management, financial services, and health.

To foster growth of mobile usage in the country, the report provides the following recommendations and suggestions:

- Enable the use of cheaper smartphone devices. Operators should be allowed to bundle and offer handset packages without a surcharge. Mobile smartphones and tablets should be classified as computers and the 30 per cent surcharge should be reduced or eliminated.
- Lower data tariffs to promote usage. As consumers see the benefits of being connected and of accessing anywhere-anytime data services, usage will evolve from being seen as luxury services to necessity.
- Promote local application developer ecosystem. While apps developed for a wider market are available, the mobile data/app market will not grow unless there are locally relevant applications and services. Government and the private industry should take steps to encourage entrepreneurs to build applications, compete on quality, and be rewarded on successful implementations. Operators will have to play a strong role in such an endeavor.
- Look at application areas that can benefit from being customized in Dzongkha. While most of the urban population is quite conversant and fluent in English, to bring the broader population into the mobile data realm, applications will have to be adapted to local language as well as iconography for visual implementations. For critical

application areas such as agriculture and disaster management, IVR-based applications can serve as a good intermediate step.

- Improve upon the reliability and performance of the data networks as well as the applications infrastructure. If consumer expectation can be met then mobile services usage and adoption will increase.
- Build local talent. The Bhutan IT market is relatively small, so bringing in overseas talent or outsourcing is not an ideal option. Since this is going to be a long-term sustainable industry, it is best to focus on growing the developer ecosystem locally and have enough work and projects for them that the ecosystem stays viable and sustainable.
- Build network for capacity especially for critical applications such as disaster management, health, and finance. The network should be robust enough to cope with sudden increases in traffic.
- Foster research and development on mobile apps by providing research grants, seed funds and business development funds. Bhutan Innovation and Technology Centre (BITC) in the IT park can be leveraged and used as an innovation test bed.

3.6 Status of e-RNR Services in Bhutan

Bhutan has undertaken several initiatives in using ICT for RNR including collection of necessary information and also launch of services. The required information for the E-RNR services rests not only with the Ministry of Agriculture and Forests but also with other departments such as the national land commission, department of hydromet services, Ministry of Information and Communications, BICMA etc. cross-sector cooperation is critical and the current e-Gov process greatly facilitates such coordination.

Some of the existing E-RNR services such as e-Pest, supply of machinery, Issuance of timber permit are offered on the G2C platform, while others such as commodity auction prices is available using IVRS over Bhutan Telecom network. However, the IVRS is not available over TashiCell network due to interoperability issues.

A list of proposed RNR services being offered over G2C platform is tabulated below.

Table 4: Proposed RNR services being offered over G2C platform

Agriculture G2C Services	Livestock G2C services	Forestry G2C Services
• Laboratory Services • Supply of Plant Protection Input Based on Seasonal Indent • Plant Protection Advisory Service • Supply of Plant Protection Input-Outside Indent	• Livestock Feed Fodder Services • Input Supply of Livestock • Input Supply of Feed and Fodder • Animal Health	• Issuance of Permit for Rural Timber • Issuance of Permit for Firewood, Flagpoles and Fencing Poles • Approval for Removal of Forest Produce from Private Registered Land

Window • Supply of machinery and mechanical parts • Technical guidance - repair / maintenance • Supply of Agriculture Inputs		• Issuance of Permit for Sand, Stones, Boulders, Bamboo, Leaf Mould, Top Soils • Issuance of Permit for Non-Wood Forest Products (NWFP)
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The country also has several lessons learnt from services that could not go beyond pilot stages to sustainable phase owing to technical challenges, financial resources or capacity requirement.

It would be advisable to align the proposed RNR services that are to be offered by the government to citizen by RNR utilizing the G2C platform. However, separate consideration would need to be given to services that do not fit under this framework or require capabilities that are not offered by the current G2C platform.

C Developing the E-RNR vision

The RNR sector forms the centre stage in the Royal Government of Bhutan development agenda in the wake of trade deficit and the global increase in the food prices. Not only does it serve the important role of food self-sustainability but also as a source of livelihood for the majority of citizens. The sector is an essential pillar for rural development and gender empowerment. The proliferation of information and communication technologies in Bhutan in terms of adoption by individuals and institutions, transformative capability of its applications and multi-sector institutional deployment provides a tremendous opportunity for the RNR stakeholders to leverage upon. These sectors in addition to RNR include rural development, natural resource management, hydromet department, governance, education, banking, insurance, information technology, telecommunications, media, transportation and logistics. It is also characterized by significant roles played by individuals, public enterprises, the private sector and international development and donor agencies. A vision for this sector, therefore, needs to harness the potential across multiple sectors while recognizing the varying expectations and roles of different types of RNR stakeholders.

The FAO-ITU framework for development (Figure 18) of vision entails –

- Establishment of E-RNR steering committee and taskforce
- Understanding the national agriculture goals, priorities and challenges
- Development of an initial vision
- Detailing the E-RNR outcomes to meet the vision
- Analysing the ICT solutions that can realize the E-RNR outcomes
- Refining and finalizing the E-RNR vision and outcomes



Source: FAO, ITU

Figure 18: E-agriculture (E-RNR in Bhutan) vision development

1 E-RNR Steering Committee and Taskforce

A national approach to E-RNR that has been developed in an inclusive manner, involving representatives of all RNR and other critical stakeholders, will ensure that adequate capacity building needs are identified and based on the state of ICT within that country, ensuring that no key stakeholder group is left out of the process. In addition, this will ensure that ICT access challenges (including their costs and quality) posing hindrances to the adoption of use of these tools, notably in rural areas, are identified and tackled at higher level in a systematic manner. Such strategic alignment will result in better sustainability of solutions, cost-effectiveness and their wider adoption.

A national approach will also help improve the coordinated planning and funding of development and avoid duplication and the waste of resources. ICT for RNR projects are sometimes duplicated in different ministries as well as service providers targeting the same stakeholders. Systematic effort in planning and setting up a national e-agriculture approach allows for a streamlining of government efforts, ensuring the judicious use of scarce resources while providing a clear direction to the private sector, donors and other stakeholders.

Furthermore, the process of developing a national e-agriculture approach may reveal the need for related institutional changes or adjustments and instituting ICT interoperability framework leading to an enabling regulatory environment for the deployment, adoption or integration of innovative technologies. The elaboration of such an approach offers the opportunity not only to raise awareness but also to clarify the main components and potential benefits of e-agriculture for the vast majority of stakeholders and their role in realizing that potential.

As an outcome of the e-Governance framework, such coordination mechanisms are already in place in Bhutan. The steering committee in the RNR Sector is proposed as a combination of the GNH Committee of the Ministry of Agriculture and Forests and the existing e-Governance framework (Figure 19). The MoAF has constituted an E-RNR taskforce comprising of representatives from various departments of the MoAF and representative from Ministry of Information and Communication (MoIC) and Bhutan Info-Comm and Media Authority (BICMA).

The E-RNR taskforce recommendations can be submitted to GNHC of the MoAF for decisions of strategic nature. The E-RNR taskforce can form working groups involving other critical stakeholders based on identified priority services. For example, mobile banking services would require involvement of banks, banking regulators, telecom operators and community centres as critical stakeholders while an application for weather forecast would require hydromet department as a critical stakeholder.

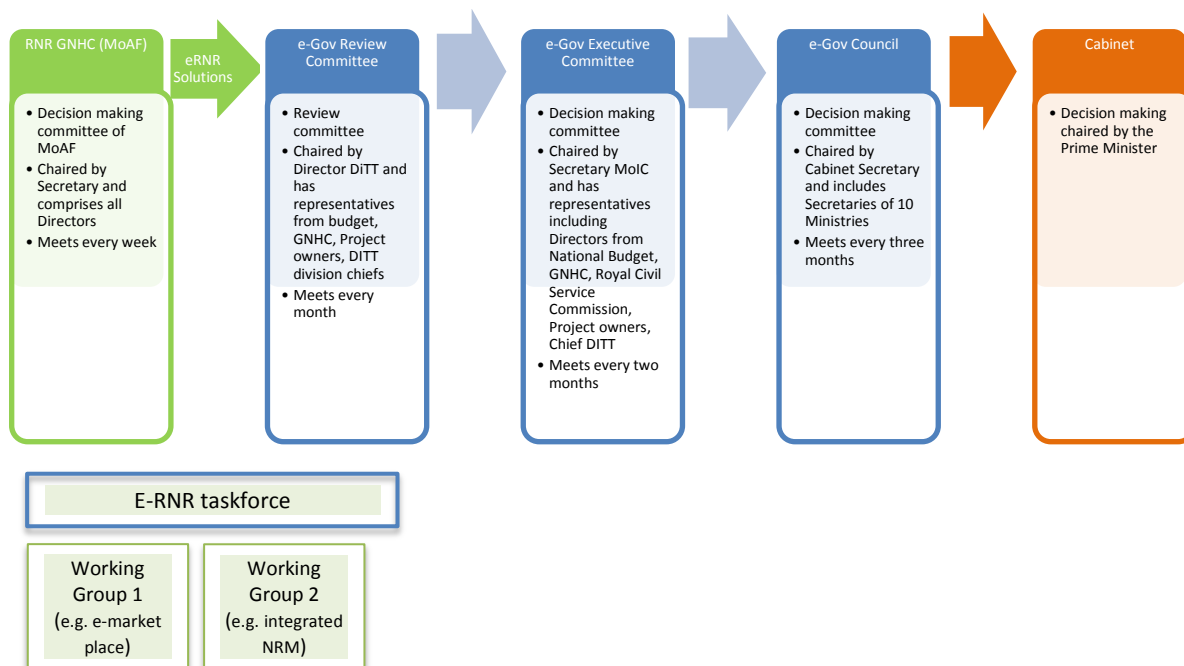


Figure 19: Decision making process for e-agriculture in Bhutan (Steering Committee)

2 E-RNR Vision for Bhutan

The E-RNR taskforce after detailed discussion considers a time framework of 8 years to set the context for E-RNR visions. The rationale behind 8 years is to include two five year planning cycles, the 11th five year plan (2013-2018) and the 12th five year plan (2019-2023). This would enable strategic alignment with budget cycles and planning cycles of other government departments. However, individual output level alignment needs to take into account the planning cycles of other stakeholders.

After due consultation and keeping in view the cardinal principles of GNH, the national agriculture vision and the leverage potential of ICT, an E-RNR vision was set up as follows:

“By 2023, application of ICTs will accelerate sustainable growth of renewable natural resources sector for equitable socio-economic well-being of the people and the nation.”

The vision embodies the sustainable growth and equitable societal principles of the country while looks to mainstream ICTs in the development agenda. ICTs have the potential to meet the RNR goals of Bhutan more effectively by

- Making accurate information available in real time or near real time for the RNR sector leveraging on smart sensing technologies and integration of required databases;
- Effective monitoring of RNR sector using ICTs;
- Strengthening tracking and traceability framework nationwide to protect the bio-diversity;
- Bridging the skills and knowledge gap in the RNR sector using e-learning and networking tools;
- Improving the confidence in use of extension and advisory services through enhanced online knowledge resources,
- Facilitate education and enhance efficiency of women in RNR sector through ICT interventions;
- Promoting research and innovation through availability of information and enhancing engagement leveraging on modern communication tools;
- Improved linkage between RNR extensions and researchers and increased responsibility of advice;
- Increasing the efficiency of production and diversity of crops,
- Improving logistics (e.g. storage, transportation, farm inputs),
- Incorporating ICTs in RNR financing, banking and transactions to create a vibrant RNR commercial market;

- Utilizing ICTs to expand the reach of the Bhutanese produce to domestic and international markets;
- Enable new and innovative services and improving efficiency of RNR services utilizing ICT devices & networks, platforms and connected critical databases for RNR sector;
- Bridging the information gap and improving the efficiency of risk management tools and procedures using ICTs;
- Introducing new and improving the efficiency of existing risk management services such as micro-insurance, government subsidy, others;
- Increasing the transparency and awareness on policies and regulations
- Proactively coordinating with policy makers and regulators of various sectors to create the appropriate enabling environment;

3. E-RNR expected outcomes

Effective deployment of ICTs in the RNR by 2023 would make a transformative impact on the RNR sector of Bhutan. It is expected to deliver the following E-RNR outcomes through a number of ICT solutions (or eSolutions).

1. Increase the availability, accuracy and speed of information relating to RNR sector to the stakeholders
2. Improve the awareness and skills of farmers, livestock herders and other RNR sector end users leveraging on ICTs
3. Enhance the research capability, quality of extension advisory and adoption of credible best practices in the RNR
4. Improve the profitability of RNR products and services through efficient logistics, universal and connected ICT infrastructure, better market access
5. Promote innovation in E-RNR services
6. Reduce the individual risks of RNR sector stakeholders
7. Strengthen the policy and regulatory capability, and awareness in the RNR sector

4 Feasibility of E-RNR Vision and Outcomes

It is important that the vision and outcomes are actionable and can be realized through feasible solutions. These outcomes should realize the expected transformation that ICTs will bring about in the Bhutan's RNR sector. The expected changes that ICT solutions should make to realize these outcomes and the vision were detailed (refer figure 20). A monitoring and evaluation framework for these outcomes would report on the progress.

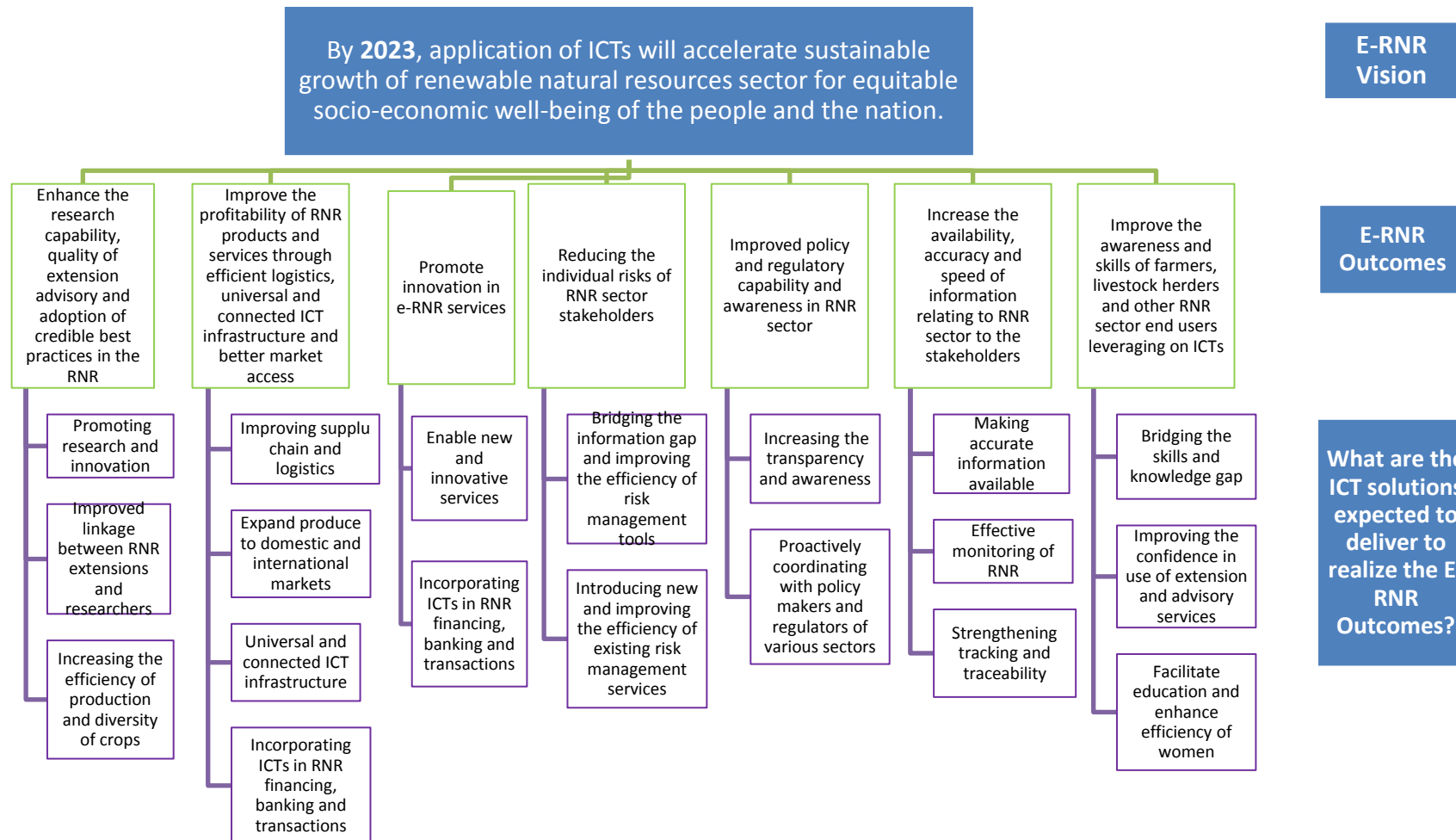


Figure 20: Relationship between E-RNR vision and E-RNR outcomes

5 Strategic Recommendations

5.1 Recommendation 1: Ensure availability of universal and connected infrastructure at affordable rates that are critical for e-agriculture services.

Specific focus is required in these areas:

- Universal access to broadband keeping in view demographic as well as geographic requirements, as a number of e-agricultural applications require connectivity in areas with sparse or no human population;
- Connectivity of RNR centres with reliable broadband;
- Interconnection of critical databases with application platform;
- Platform for sharing of information with services delivered by non-government entities;
- Creation or use of a secure digital application platform;
- Low cost end user broadband devices;

5.2 Recommendation 2: Strengthen the development, linkage and interoperability of databases and application platform important for e-RNR services.

Specific focus is required in these areas:

- Create and update government databases to provide information critical to develop E-RNR services;
- Linkage and integration of databases critical for RNR sector;
- Ensure compliance with e-Government Interoperability Framework;
- Adopt open data and implement data sharing framework;
- Utilize the existing G2C service platform for government services;
- Develop appropriate security and privacy policies and guidelines.

5.3 Recommendation 3: Develop e-RNR services and applications, and promote innovation through ICT use.

Specific focus is required in these areas:

- Develop applications to deliver priority E-RNR services;
- Develop the ecosystem (e.g. policies, guidelines, connectivity, data availability, information, research, education, skills) for innovation in E-RNR services;
- Enhance the efficiency and sustainability of existing E-RNR services;
- Develop framework for service delivery by private sector using digital platform;
- Improve the financing, trading and marketing in RNR sector through ICTs.

5.4 Recommendation 4: Engage critical stakeholders in solution development, implementation, and uptake through cross-sector cooperation.

Specific focus is required in these areas:

- Promote proactive coordination with key stakeholders from RNR, banking, telecom, IT, governance, hydromet, insurance, end user representatives, donor agencies, others;

- Develop cooperation and collaboration mechanisms with other responsible entities in the areas critical for E-RNR;

5.5 Recommendation 5: Enhance research-extension-farmer linkages using ICTs to improve the quality of research and extension services.

Specific focus is required in these areas:

- Promote research and innovation through availability of information and enhancing engagement leveraging on modern communication tools;
- Improve the linkage between RNR extensions and researchers, and promote increased responsibility of advice;
- Increase the efficiency of production, disease prevention and diversity of crops through ICT solutions.

5.6 Recommendation 6: Enhance the monitoring and sensing framework for agriculture using ICTs.

Specific focus is required in these areas:

- Make accurate information available in real time or near real time for the RNR sector leveraging on smart sensing technologies and integration of required databases;
- Facilitate effective measurement, observation and monitoring of RNR sector using ICTs;
- Facilitate effective monitoring of diseases, livestock health and pest infection;
- Strengthen the tracking, verification and traceability framework nationwide for RNR sector.

5.7 Recommendation 7: Improve the awareness and skills of farmers, livestock herders and other RNR sector end users leveraging on ICTs that would increase their productivity and profitability.

Specific focus is required in these areas:

- Bridge the skills and knowledge gap in the RNR sector using e-learning and networking tools;
- Improve the confidence in use of extension and advisory services through enhanced online knowledge resources”;
- Facilitate education and enhancing the efficiency of women in RNR sector through ICT interventions;

5.8 Recommendation 8: Reduce the individual risks of RNR sector stakeholders.

Specific focus is required in these areas:

- Bridge the information gap and improving the efficiency of risk management tools and procedures using ICTs;
- Introduce new, and improve the efficiency of existing, risk management services such as micro-insurance, disaster (agriculture and non-agriculture) alert, government subsidy, others;

5.9 Recommendation 9: Improve the policy and regulatory capability, awareness and compliance in the RNR sector.

Specific focus is required in these areas:

- Increase the transparency and awareness on policies and regulations
- Develop and strengthening the current the current policy, legislative and regulatory frameworks by identifying gaps, addressing them and creating guidelines;
- Proactively coordinate with policy makers and regulators of various sectors to create the appropriate enabling environment;

D NATIONAL E-RNR ACTION PLAN FOR BHUTAN

1 E-RNR Action Plan

The E-RNR action plan would enable the government to:

- Identify all components of E-RNR expected outcomes, how they should be governed, funded, implemented and coordinated to ensure that results are achieved at a national, state and local level;
- Identify key stakeholders and engage with them effectively in designing, implementing and sustaining the activities; and
- Prioritize the activities in implementation phases to achieve tangible outcomes.

The FAO-ITU framework for development of action plan was adopted. The plan identified thirty-six outputs (E-RNR solutions) in the context of Bhutan and detailed six priority outputs for the first phase.

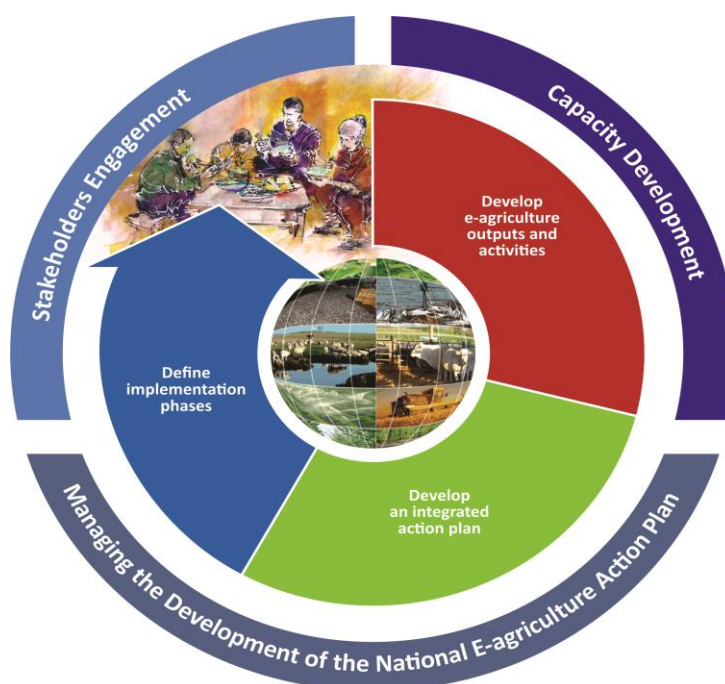


Figure 21: FAO-ITU framework for development of E-agriculture (E-RNR) action plan

2 RNR Challenges and ICT Solutions

The challenges of the RNR sector (refer Section 2.2) were discussed by the taskforce and possible solutions were identified. ICT does not have similar impact on all RNR challenges and to gauge the impact of ICT solution on each challenge a detailed analysis was carried out. The impact of each challenge on the SKRA was identified and the possible eSolution was developed (Table 5).

Agricultural challenge
Access to markets
SKRAs impacted
SKRA 1 : Enhance food and nutrition security by making various kinds of foods, available through improved production, access and enabling effective, utilization of food
SKRA 2 : Generate employment and increase mean annual cash income
SKRA 3 : Accelerate RNR sector growth through commercial farming (Exports)
E-agriculture Solution
Creation of e/m-market place, market information and scalable payment systems for national and international, promotion and awareness raising on use of e/m-services;

For a more detailed representation refer to the e-agriculture toolkit sheet **CHALLENGES AND SOLUTIONS (C2)**. *Sample attached below*

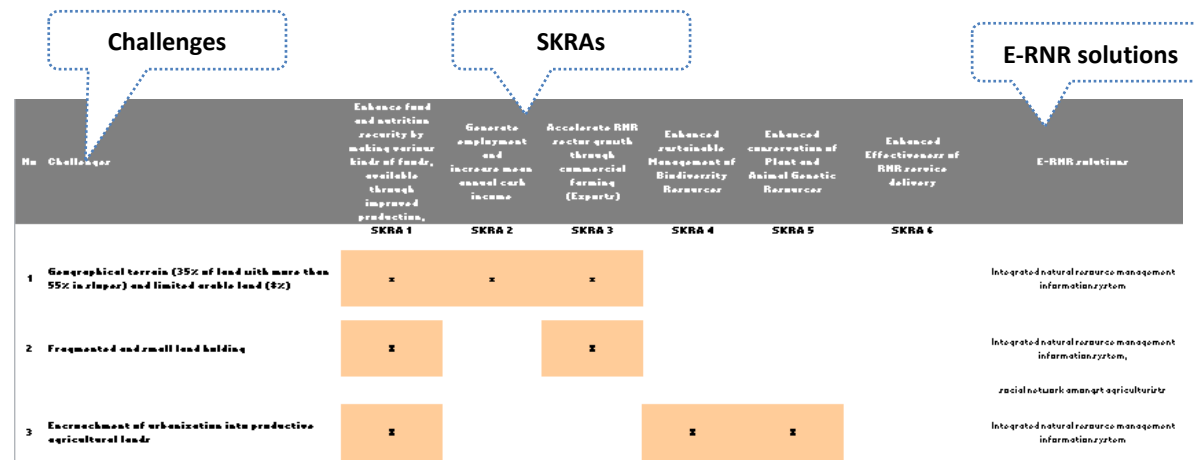


Figure 22: Example of linkage between challenges, SKRAs, and e-agriculture solution

When reclassified on the basis of solutions, 36 independent ICT solutions were identified and detailed.

Table 5: ICT solutions for RNR sector in Bhutan

	Name of solution	Description
1	Integrated natural resource management information system (INRM)	Information system that includes GIS data (incl. high resolution satellite image) and other information on land use / land cover / land degradation, soil map /land fertility, forest resources use, geo portal and geo morphology, glacier mapping, irrigation details, Bio-diversity, disaster management, weather forecasting, farm roads, transmission lines, fire history.
2	Social network amongst RNR users	To create a network of agriculture sector stakeholders including (producers, marketers, extension workers, policy makers etc.) to distribute information (informal) and enhanced engagement
3	Credible RNR content aggregation and packaging	Creation of RNR content , which is packages for information (video, audio, website, text) or capacity building
4	E-RNR advisory services (with possible consumer protection)	Advisory services offered by extension workers, consultants, researchers in country or abroad through electronic media (phone, Internet, email, video chat), face to face meetings or paper reports. Recognizing that the lack of credibility may deter agriculturists to deploy good agricultural practices, credible advisory services with consumer protection can be created. These can be paid or reused and would complement availability of content in open mode. The dissemination can be through computers, telecom, Internet or broadcasting network
5	Distance learning of skills and education related to RNR	Use of video, audio, text, brochure on good agricultural practices and their dissemination through web based, mobile based, print and broadcasting networks. Using multimedia tools to build skills and offer distance education. It also includes vocational and skill based courses.
6	Smart water management	Deployment of sensors, GIS maps to manage information around water and manage their smart utilization. Knowledge sharing, access to weather data online, Geo-referenced (map) water source identification (ground water, river, etc.), sub-surface moisture sensors
7	E-RNR market place	Creation of e/m-market place, market information and scalable payment systems for national and international, promotion and awareness raising on use of e/m-services;
8	Logistics (storage and transport) information linking agriculture service providers and markets	Creation of database of storage and transportation service providers with information management, tracking and payment capability

9	Certified higher yielding seeds verification and traceability	Database with web interface (barcoded) to verify the authenticity of seeds
10	Online RNR workforce information and services	Creation of online workforce (skilled and non-skilled) requirement and availability information system
11	Agromet data	Online availability of weather and other climate data, forecasting, knowledge base
12	RNR early warning system	Early warning systems for agriculture stakeholders against disasters and hazards Fire alert and response system, integration with disaster management
13	Information on climate smart technologies and climate resilient crops & breeds	Information, access to training on climate smart agricultural practices, new technologies
14	GIS wildlife movement (e-wildlife surveillance), Area mapping of wildlife crop damage/prone, Online system for wildlife conflict management, wild life cyber tracking and alert	Traps, trackers, sensors with capability to information on wildlife movement
15	Online compensation for crop and livestock affected	Database of livestock with capability of remote verification and online compensation
16	e-Pest surveillance system	Pest online database with historic vector linked with crop lifecycle, climate data, video based verification, remote compensation and GIS maps. Pests and pest management online database, advisories, knowledge sharing
17	Online food quality and safety verification and bio-safety monitoring	Online monitoring of food quality and bio-safety
18	Online information on offseason crop production technology package	Information, access to training on offseason crop production
19	Accessible information resources on government policies	Information and access to government policies
20	Farm mechanization information and service	Creation of online machine and equipment information system linked with market machine availability and rentals
21	Information on enabling environment and agri-business opportunities	Information for investment opportunities for entrepreneurs and international investors, buyers, suppliers

22	Electronic banking and payment	Creation of banking facilities for all using electronic / mobile banking. Utilizing CICs for micro banking (account opening, loans, trading)
23	Credit rating and loan availability	Create a credit management system that makes credits available using simplified procedure and online verification. A credit rating mechanism can also be developed.
24	Linking research institutes with extensions and producers	Linking research institutes with extensions and agriculturists for anytime anywhere learning, online certification.
25	Setting up / strengthening of IVR systems	A system to provide voice based services
26	Leveraging Community Information Centres with Agriculture Centres	Linking CICs and CCs to harness agriculture information base (agro sensors at CC) with ICT and banking information
27	Policy guidelines and support to agri-insurance providing companies	Guidelines to enable micro-insurance, field database, disaster, compensation
28	Monitoring of groups / cooperatives through online systems	Creation of database, linking of database, registration and monitoring processes
29	E-RNR extension monitoring	Creation of monitoring feedback and extension service request and complaint redressal.
30	Traceability and DNA barcoding of prioritized species	DNA barcoding of wildlife & plants and tracking at checkpoints
31	Information on fertilizer history by land area	An application to provide history of fertilizer use in the land area.
32	Universal mobile broadband connectivity, deployment of low cost mobile phones, tablets	3G, 4G connectivity with tablets and broadband services
33	Interoperable and secure e/m-agriculture applications platform with content	An integrated application platform interoperable with e-gov services for E-agriculture service delivery
34	Consumer complaint management regarding E-RNR services, call centre with IVRS	A common call centre, ICT based complaint redressal mechanism to manage e-agriculture services
35	Integrate E-RNR services with G2C	Service integration of e-government and e-agriculture services including security, interoperability
36	Remote video based surveillance	A solution to carry out remote video based information capture and remote surveillance.

Each of these could address one or more challenges and would have an impact on one or more than one E-RNR outcome.

2.1 E-RNR Outcomes and Solutions

The next stage was to prioritize the E-RNR solutions based on the impact each solution has on the outcomes, the vision and the feasibility of its implementation in the required time frame.

Two stages of mapping were carried out

- the number of E-RNR solutions that impact each outcome
- the number of E-RNR outcomes that each solution impact

The mapping exercise was carried out to validate whether the solutions addressed all E-RNR outcomes and were not skewed towards a few of them (Figure 23 (a))

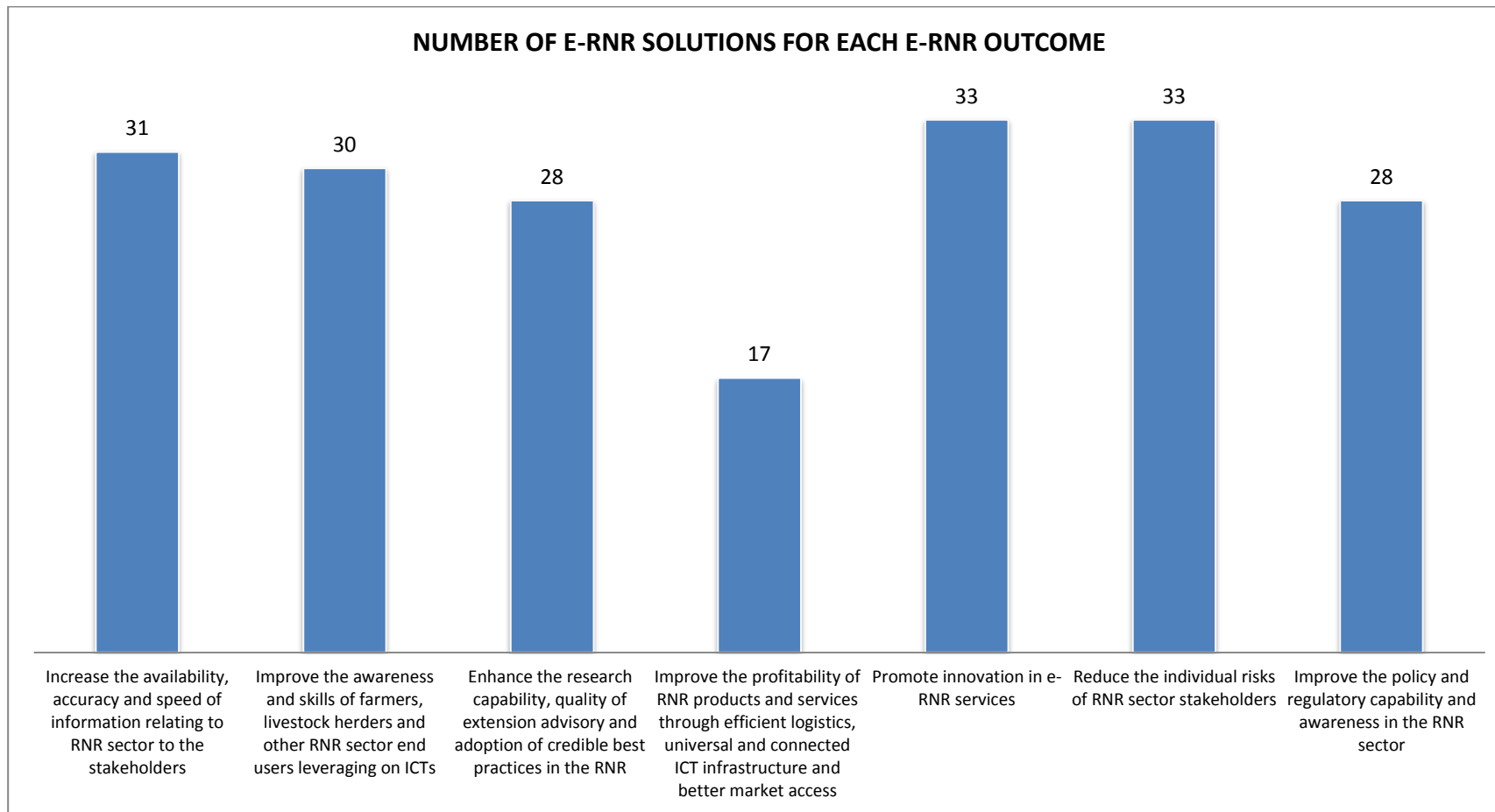


Figure 23 (a): Mapping of E-RNR solutions with E-RNR outcomes

Another analysis was undertaken to see which solutions impact maximum number of outcomes (Figure 23 (b)). Although it provides a snapshot of which outcomes a particular solution will impact it does not provide the intensity of impact.

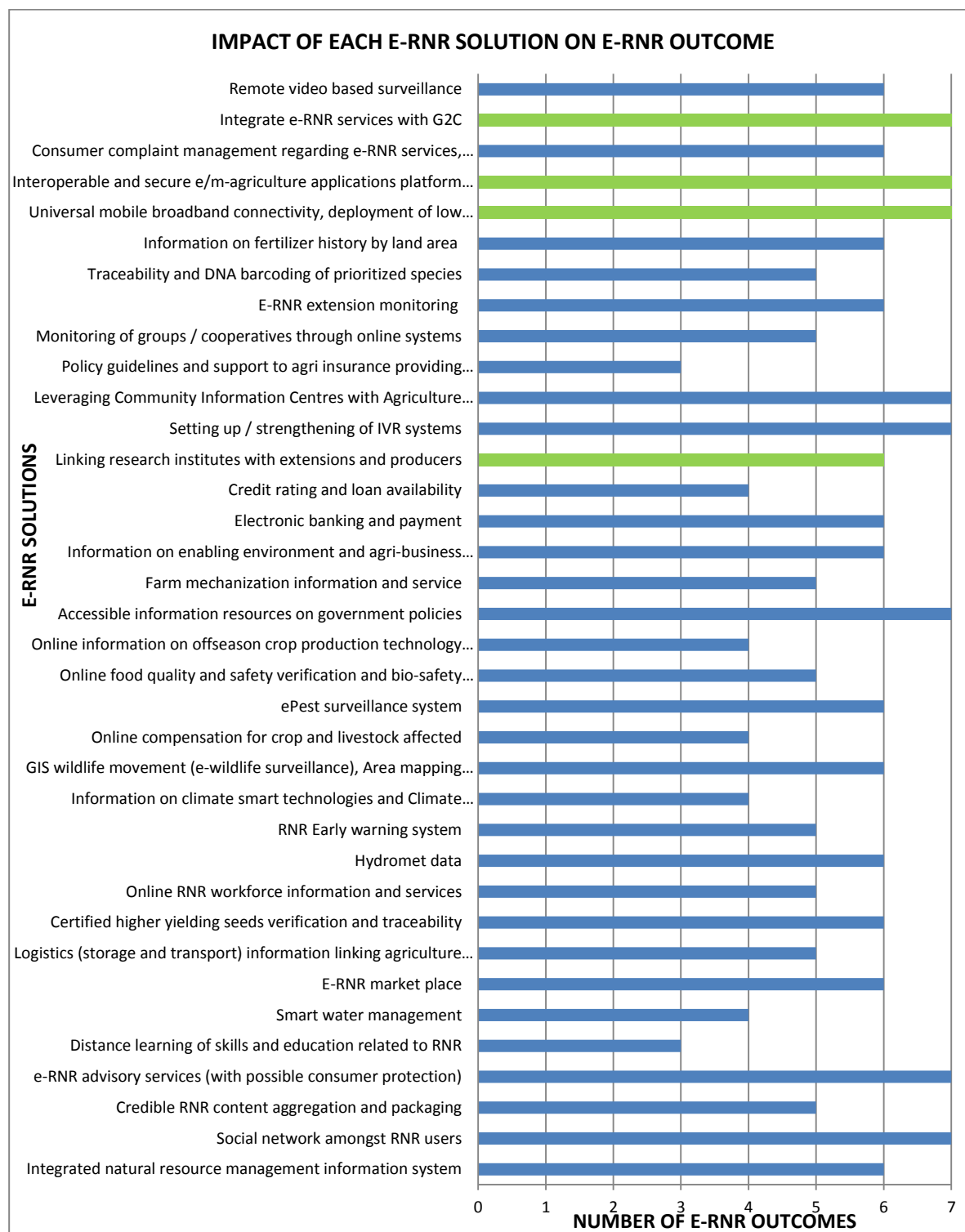


Figure 23 (b): Mapping of E-RNR solutions with E-RNR outcomes

These solutions (Outputs) primarily deal with a range of issues such as availability of adequate ICT infrastructure, improving efficiency of existing services, encouraging new and innovative services, enhancing knowledge and skills, improving availability and accessibility of data and information.

Priority was given to solutions with impact on larger number of outcomes and that having greater intensity of impact. It was also important to take into consideration the feasibility of implementation of the solution in the timeframe. For example, it is important to ensure that services that necessarily require broadband to the end users are rolled out in alignment with the broadband roll out plan.

2.2 E-RNR Action Plan

An E-RNR action plan was developed for the period 2016-2023 (Figure 24). The solutions were prioritized taking into consideration the following factors:

- **Continuing and strengthening the existing E-RNR services:** Some of the E-RNR services have already been developed such as e-Pest surveillance, farm mechanization and machinery;
- **Development of ICT infrastructure:** ICT infrastructures roll out is key to the delivery of E-RNR services but are governed by other government plans and operators business considerations. However, providing connectivity to RNR extensions is of critical nature and is required to be accorded a priority by the Ministry of Agriculture and Forests.
- **Development and Interoperability of databases:** Development and alignment of critical databases to e-Government framework and their interoperability with e-GIF is a time consuming task. Also, capacity building and preparation is required to convert the existing data to the e-GIF format.
- **Continuing nature of some solutions:** Some of the solutions are of continuing nature e.g. Skill development and awareness, information availability online.
- **Scope of 11th Five Year Plan:** The budgetary cycle of the 11th five year plan ends by 2018. It is important that the activities to be undertaken are aligned with the expectations and a scope of 11th five year plan.
- **Approval process:** Development of ICT solutions requires e-Government framework approval. It is important to take this timeline into account.

It is also important to note that the action plan has the flexibility to adjust based on changing priorities and development in other sectors.

e-RNR Solution requirement		2016	2017	2018	2019	2020	2021	2022	2023	e-RNR solutions planned
1	Integrated natural resource management information system									Integrated Natural Resources Management Information System
2	Social network amongst RNR users									RNR helpline
3	Credible RNR content aggregation and packaging									
4	e-RNR advisory services (with possible consumer protection)									E-RNR Extension and Advisory system; RNR helpline
5	Distance learning of skills and education related to RNR									
6	Smart water management									
7	E-RNR market place									Online RNR marketplace and supply chain management information system
8	Logistics (storage and transport) information linking agriculture service providers and markets									Online RNR marketplace and supply chain management information system
9	Certified higher yielding seeds verification and traceability									
10	Online RNR workforce information and services									Online RNR marketplace and supply chain management information system
11	Hydromet data									Agrometeorological Information Services
12	RNR Early warning system									Agrometeorological Information Services
13	Information on climate smart technologies and Climate resilient crops & breeds									
14	GIS wildlife movement (e-wildlife surveillance), Area mapping of wildlife crop damage/prone, Online system for wildlife conflict management, wild life cybertracking and alert									
15	Online compensation for crop and livestock affected									
16	ePest surveillance system	EXIST								
17	Online food quality and safety verification and bio-safety monitoring									
18	Online information on offseason crop production technology package									
19	Accessible information resources on government policies	EXIST								
20	Farm mechanization information and service									Online RNR marketplace and supply chain management information system
21	Information on enabling environment and agri-business opportunities									
22	Electronic banking and payment									M-banking/ online transaction for agricultural services
23	Credit rating and loan availability									M-banking/ online transaction for agricultural services
24	Linking research institutes with extensions and producers									
25	Setting up / strengthening of IVR systems									RNR helpline
26	Leveraging Community Information Centres with Agriculture Centres									
27	Policy guidelines and support to agri insurance providing companies									
28	Registration and Monitoring of groups/cooperatives through online system									E-RNR Extension and Advisory system
29	E-RNR extension monitoring									E-RNR Extension and Advisory system
30	Traceability and DNA barcoding of prioritized species									
31	Information on fertilizer history by land area									
32	Universal mobile broadband connectivity, deployment of low cost mobile phones, tablets									
33	Interoperable and secure e/m-agriculture applications platform with content									
34	Consumer complaint management regarding e-RNR services, call centre with IVRS									
35	Integrate e-RNR services with G2C									
36	Remote video based surveillance									

	Linked with development of ICT infrastructure
	Linked with e-RNR solutions and services

Figure 24: Bhutan E-RNR action plan

3 Priority E-RNR Solutions

Amongst the identified solutions in the action plan, six new solutions have been accorded high priority and are considered for start of implementation from 2016. These include.

3.1 Integrated Natural Resources Management Information System

Information system that includes GIS data (incl. high resolution satellite image), information on land use, land cover/land degradation, soil map/land fertility, forest resources use, geo portal and geo morphology, glacier mapping, irrigation details, bio-diversity, disaster management, weather forecasting, farm roads, transmission lines, fire history.

Integrated Natural Resource Management System												
Brief description	Information system that includes GIS data (incl. high resolution satellite image), information on land use, land cover / land degradation, soil map /land fertility, forest resources use, geo portal and geo morphology, glacier mapping, irrigation details, Bio-diversity, disaster management, weather forecasting, farm roads, transmission lines, fire history.											
Existing Information in Digital Format	Land use, Land cover, soil map / soil fertility, farm roads, geo portal, bio-diversity portal, weather forecasting, forest resources, transmission lines, Fire history, geo morphology, Glacier mapping (GLOF), Irrigation map											
Information to be confirmed	Flood map, Drought Map											
Information not existing	High resolution satellite											
Stakeholder engagement	Lead - ICS (MoAF) Critical Stakeholders: Land commission, Hydromet, MoAF, DITT, BPC, MoWHS, Dept. Of Geology and Mines (DGM)											
Linkage with Outcomes	Linkage with Outcomes											
Linkage with strategy	Linkage with Strategic Recommendation (s)											
Identifying dependencies	Critical pre-requisite activities (activity number and title) Approval from e-Gov Committee Coordination with critical stakeholders Financial resources											
Implementation plan	Start and End of activity	2016	2016	2016	2017	2017	2017	2017	2018	2018	2018	2018
	Start	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
	Requirement analysis of existing INRM related databases Vs proposed solution											
	Alignment of RNR databases with e-GIF format											
	Prepare a INRM proposal according to e-Gov template											
	Approval of e-Gov Committee											
	Form working group meeting with all critical stakeholders											
	Develop a technical framework in consultation with DITT											
	Develop a detailed implementation plan of implementing INRM											
	Implementation schedule											
Monitoring and Evaluation	Monitoring and Evaluation											
	List of linked outcomes											
Key Risks Associated	Delays in approval from GNHC and e-Gov Committee											
	Lack of financial resources											
	Lack of interest from other departments to share data											
	Unavailability of data											

Figure 25: Bhutan INRM solution activity plan

3.2 E-RNR Extension and Advisory system

Advisory services offered by extension workers, consultants, researchers in country or abroad through electronic media (phone, Internet, email, video chat), face to face meetings or paper reports. Recognizing that the lack of credibility may deter agriculturists to deploy good RNR practices, credible advisory services with consumer protection can be created. These can be paid or reused and would complement availability of content in open mode. The dissemination can be through computers, telecom, Internet or broadcasting network. The system will facilitate data capture, monitoring and feedback on extension service, service request and linkage with complaint redressal system. It will also include monitoring of cooperatives and other groups.

E-RNR Extension and Advisory System												
Outputs												
Brief description	Advisory services offered by extension workers, consultants, researchers in country or abroad through electronic media (phone, Internet, email, video chat), face to face meetings or paper reports. Recognizing that the lack of credibility may deter agriculturists to deploy good RNR practices, credible advisory services with consumer protection can be created. These can be paid or reused and would complement availability of content in open mode. The dissemination can be through computers, telecom, Internet or broadcasting network. Creation of systems to capture data, monitoring and feedback on extension service, service request and linkage with complaint redressal system. It will also include monitoring of cooperatives and other groups.											
Stakeholder engagement	Lead facilitator (s): Development by ICS and implementation by Department Heads under MoAF Critical stakeholders: MoAF departments and agencies, Telecom Operators, DITT											
Implementation plan	Start and End of activity	2016	2016	2016	2017	2017	2017	2017	2018	2018	2018	2018
		Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
	Prepare a proposal according to e-Gov template	Start	Complete									
	Approval of e-Gov Committee											
	Form working group meeting with all critical stakeholders											
	Develop a technical framework											
	Capacity building for content creation											
	Make content available for use											
	Capacity building for content creation											
	Implementation schedule											
Key Risks Associated	Please prepare detailed implementation plan (if the activity is complex)											
	Monitoring and Evaluation											
	Delays in approval from GNHC and e-Gov Committee											
	Lack of financial resources											
	Lack of capacity for extension agents											
	Lack of human resource											
	Lack of e-RNR content											

Figure 26: Bhutan E-RNR solution activity plan

3.3 Online RNR marketplace and supply chain management information system

Creation of e/m-market place, market information and scalable payment systems for national and international, promotion and awareness raising on use of e/m-services. The solution would also facilitate the creation of a database of storage and transportation service providers with information management, tracking and payment capability.

E-RNR Market Place and Supply Chain Management												
Activity Number												
Brief description	Creation of e/m-market place, market information and scalable payment systems for national and international, promotion and awareness raising on use of e/m-services. Creation of database of storage and transportation service providers with information management, tracking and payment capability.											
Stakeholder engagement	Development : ICS (MoAF), DAMC (MoAF) Critical Stakeholders: Banks, BAFRA, Agriculture cooperatives, MoAF, FCBL, Wholesale markets, Revenue & Customs, Bhutan Exports Association,											
Linkage with strategy	Linkage with Output(s)											
	Output 1-1 Output 4.1											
	Linkage with Strategic Recommendation (s)											
	Reco 1 Reco 4											
Implementation plan	Start and End of activity	2016 Apr-Jun	2016 Jul-Sep	2016 Oct-Dec	2017 Jan-Mar	2017 Apr-Jun	2017 Jul-Sep	2017 Oct-Dec	2018 Jan-Mar	2018 Apr-Jun	2018 Jul-Sep	2018 Oct-Dec
	Prepare a proposal according to e-Gov template											
	Approval of e-Gov Committee											
	Form working group meeting with all critical stakeholders											
	Requirement analysis and development of technical framework including interworking of existing services											
	Stakeholders agreement for data sharing											
	Implementation schedule											
	Please prepare detailed implementation plan (if the activity is complex)											
	Monitoring and Evaluation											
	Review											
Key Risks Associated	Unavailability of data											
	Delays in approval from GNHC and e-Gov Committee											
	Lack of financial resources											
	Lack of interest from partners Lack of human resource											

Figure 27: Bhutan E-RNR marketplace and supply chain management solution activity plan

3.4 M-banking/ online transaction for agricultural services

Creation of facilities to do banking related services for agriculture using electronic/mobile banking. Utilizing CICs for micro banking (account opening, loans, trading). Create a credit management system that makes credits available using simplified procedure and online verification. A credit rating mechanism can also be developed.

3.5 RNR helpline

A system to provide common call centre services to give technical advisory, answer enquiry and redress complaints, using IVR, applications, SMS, email, social media etc.

RNR help desk												
Activity Number												
Brief description	A system to provide common call centre services to give technical advisory, answer enquiry and redress complaints, using IVR, applications, SMS, email, social media etc.											
Stakeholder engagement	Lead Facilitator: MoAF Critical stakeholders for development: MOAF departments, Telecom Operators, DITT, BICMA Critical stakeholders for operation: MOAF departments, Telecom Operators,											
Linkage with strategy	Linkage with Output(s)											
	Output 1-1 Output 4.1											
	Linkage with Strategic Recommendation (s)											
Identifying dependencies	Reco 1 Reco 4											
	Critical pre-requisite activities (activity number and title)											
	Approval from e-Gov Committee Coordination with critical stakeholders Financial Support from MoAF, Donors, Telcos											
Implementation plan	2016 2016 2016 2017 2017 2017 2017 2018 2018 2018 2018 Apr-Jun Jul-Sep Oct-Dec Jan-Mar Apr-Jun Jul-Sep Oct-Dec Jan-Mar Apr-Jun Jul-Sep Oct-Dec											
	Start and End of activity											
	Prepare a proposal according to e-Gov template Start Complete											
	Approval of e-Gov Committee											
	Form working group meeting with all critical stakeholders											
	Develop a technical framework in consultation with Telecom operators											
	Develop a detailed implementation plan											
	Implementation schedule											
Key Risks Associated	Monitoring and Evaluation											
	Review											
	Delays in approval from GNHC and e-Gov Committee											
	Lack of financial resources Lack of interest from telecom operators Lack of human resources to handle call centre											

Figure 28: Bhutan RNR helpdesk solution activity plan

3.6 Agrometeorological Information Services (Mobile application)

Online availability of weather and other climate data forecasting information, accessed from agromet division, dissemination through mobile application.

Agromet Mobile Applications							
Activity Number							
Brief description	Online availability of weather and other climate data forecasting for RNR and dissemination through aps						
Stakeholder engagement	Lead facilitator: MoAF Critical stakeholders to be consulted: MoAF, Hydromet, Telecom Service Provider						
Linkage with strategy	Linkage with Output(s)						
	Output 1-1						
	Output 4.1						
	Linkage with Strategic Recommendation (s)						
Identifying dependencies	Critical pre-requisite activities (activity number and title)						
	Approval from e-Gov Committee						
	Coordination with critical stakeholders						
	Financial resources						
Implementation plan	Development of application						
	Telecom operators should be interoperable (IVRS)						
		2016	2016	2016	2017	2017	2017
		Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep
	Prepare a proposal according to e-Gov template						
	Approval of e-Gov Committee						
	Form working group meeting with all critical stakeholders						
	Development of application						
Key Risks Associated	Stakeholders agreement for data sharing						
	Implementation schedule						
	Please prepare detailed implementation plan (if the activity is complex)						
Monitoring and Evaluation			Review				

Figure 29: Bhutan agromet mobile application solution activity plan

E Monitoring and Evaluation for E-RNR services

The E-RNR monitoring framework includes monitoring of outcomes and outputs.

1. Monitoring of Outcome

The E-RNR outcomes for the masterplan includes

- Increase the availability, accuracy and speed of information relating to RNR sector to the stakeholders
- Improve the awareness and skills of farmers, livestock herders and other RNR sector end users leveraging on ICTs
- Enhance the research capability, quality of extension advisory and adoption of credible best practices in the RNR
- Improve the profitability of RNR products and services through efficient logistics, universal and connected ICT infrastructure, better market access
- Promote innovation in E-RNR services
- Reduce the individual risks of RNR sector stakeholders
- Improve the policy and regulatory capability and awareness in the RNR sector

The suggested KPIs for the outcomes include.

E-RNR Outcome	KPIs
Increase the availability, accuracy and speed of information relating to RNR sector to the stakeholders	- Number of critical databases online - Number of new datasets available remotely - Number of actionable information sent out over various delivery platforms
Improve the awareness and skills of farmers, livestock herders and other RNR sector end users leveraging on ICTs	- Number of engagement session conducted with farmers,

	livestock herders, foresters and other RNR sector users
Enhance the research capability, quality of extension advisory and adoption of credible best practices in the RNR	- Number of RNR staff with improved technical skills - Number of trainings to extension staff in environmentally sound practices
Improve the profitability of RNR products and services through efficient logistics, universal and connected ICT infrastructure, better market access	- X% increase in profitability of RNR products and services - Change in farmers' ability to market produce and access newer markets
Promote innovation in E-RNR services	- Number of new & innovative E-RNR services developed, implemented and utilized by stakeholders
Reduce the individual risks of RNR sector stakeholders	
Improve the policy and regulatory capability and awareness in the RNR sector	

A detailed M&E plan would need to be developed after adoption of the action plan and priority services.