CHAPTER 13 NATIONAL LAND USE PLAN AND HOLISTIC SERVICES

13.1 National Land Use Plan

13.1.1 Significance of the National Land Use Plan in Bhutan

Land has been characterized by conflict and symbiosis between human settlements and nature conservation throughout history and if it has required careful coordination in terms of its uses. This has much in common with the concepts supporting GNH, which emphasizes sustainable socio-economic development and environmental and cultural conservation. In Bhutan, a demand for land to accommodate human settlements are especially serious as available land for development is extremely limited due to the steep terrain, meaning that the competition for land between urban settlements and rural settlments is inevitable.

As such, coordination is indispensable to achieve effective land use in Bhutan. Currently, there are legal systems and plans regarding land use in Bhutan, which were established individually for each objective of the use in question, such as urban use, agriculture use, forests and protection. However, there is no obvious system that exists to support the efficient coordination of these legal systems and related plans. Furthermore, there is no nationwide land use map to serve as the basis for the coordination of holistic land use, nor a policy to facilitate the consolidation process.

Therefore, it is now necessary to establish the National Land Use Plan (NLUP), that is, an integrated plan by which all the land use legislation and plans currently in the remit of different sectors can be totally coordinated. The NLUP is expected to be adopted as the National Spatial Plan when the Spatial Planning Bill is enacted.

There are two aspects to the NLUP: one is an “umbrella plan” which presents an envisaged national land use and provides a direction to the plan formulated by the individual sector; the other is “platform” through which to provide common ground where the related land use regulations/plans under different pieces of legislation are coordinated. The platform function is stipulated in Chapter 2 of the Spatial Planning Bill, 2018 as per below.

> Section 8. The scope of spatial planning is as follows:
> c) To coordinate sectorial policies concerning but not limited to transport, industry, agriculture, forestry and culture
> d) To have a regulatory impact on the process of determining the conditions for the location and execution of development
> Section 9. The principles are:
> Spatial planning shall coordinate with and seek to integrate the plans and policies of all sectors

Figure 13.1.1 shows the structure of the NLUP, a related regulatory plan and a regulatory measure. Land use control is implemented by exercising the power of legislation applied to each piece of land. Therefore, in order to ensure the effectiveness of the NLUP, it is essential to link all related legislation to the NLUP. On that account, establishing land use categories in the NLUP is recommended, each of which corresponds to the legislation currently being enacted.

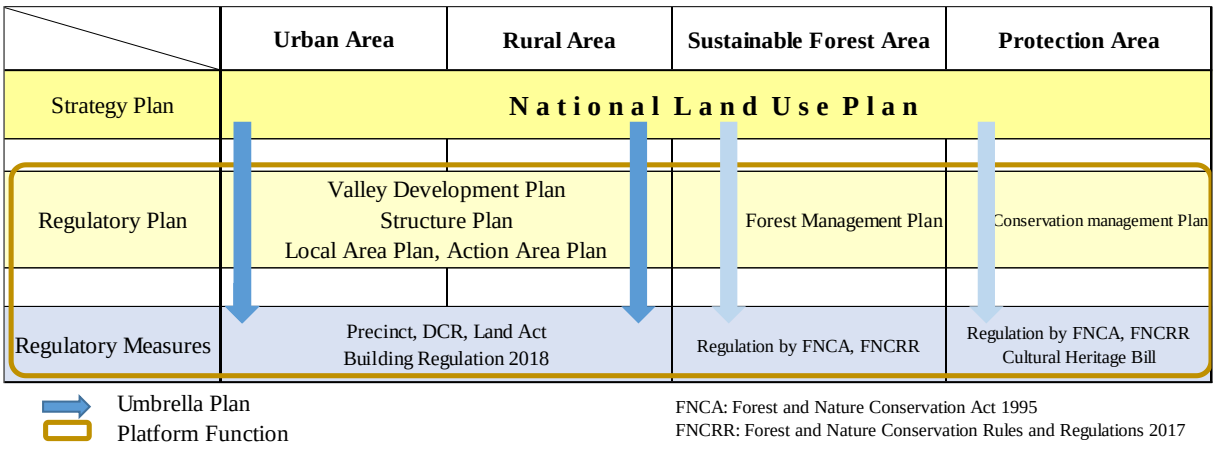


Figure 13.1.1 Structure of the NLUP, Regulatory Plan and Regulatory Measures

13.1.2 Land use category

(1) Purpose of land use category

The land must be manged by a national scheme; however, the method and the level of management should differ depending on the objective of the use of the land. Therefore, it is necessary to formulate land use categories classified by use objectives of the land.

For this, it may be worthwhile to refer to comments made by Ian L. MacHarg, an American landscape architect, in his publication *Design with Nature* from 1969: "It is not appropriate to consider that a land use pattern or category should be simplified/unified to have a single function. Land should be encouraged to have multiple uses by combining the primary usage with the secondary usages, provided that it is feasible to maintain the compatible usages from the viewpoint of the sustainability of the land resources and their management."

It seems appropriate to apply this reference to the current state of Bhutan. The land categorization under the NLUP does not aim to pursue the exclusive use of land for the applied category. It would rather seek to adopt an affirmative view on multiple uses and overlap different categories on the land use map. The policy for coordinating these multiple usages, so that they can harmoniously coexist in overlapped areas, must be the essential point of a land use plan for Bhutan.

For example, the National Land Use Planning Act of Japan formulated in 1974 stipulates that a land use master plan should contain overlaps with five use categories in accordance with MacHarg's postulation.

(2) Proposal of four land use categories

Land use has various patterns and stages, which may be aligned in between the two ultimate objectives of land use, namely, "primary human settlement" at one end, and "primary nature/culture conservation" at the other. Based on this broad view, it is proposed to establish four categories of land use according to the above alignment.

(a) Land for "primary human settlement" shall be categorized into a) an Urban Area and b) a Rural Area, depending on the characteristics of the area, i.e., an area where the urban and commercial character is dominant or an area where agriculture is dominant.
(b) Land for "primary nature/culture conservation" shall be categorized into c) a Sustainable Forest Area and d) a Protection Area, depending on whether sustainable resource use is feasible or nature/culture protection is more important.

(c) To summarize the above, the land should have four categories. What should be noted here is that the four categories are "overlapped" with each other. It is akin to laying four differently coloured place mats on a small table, such that some parts of the mats overlap with each other. It is not like cutting a cake, where land is divided into exclusive zones. A typical example of "overlapping" is a Protection Area, which overlaps with any of the other three areas, Urban Area, Rural Area or Sustainable Forest Area.

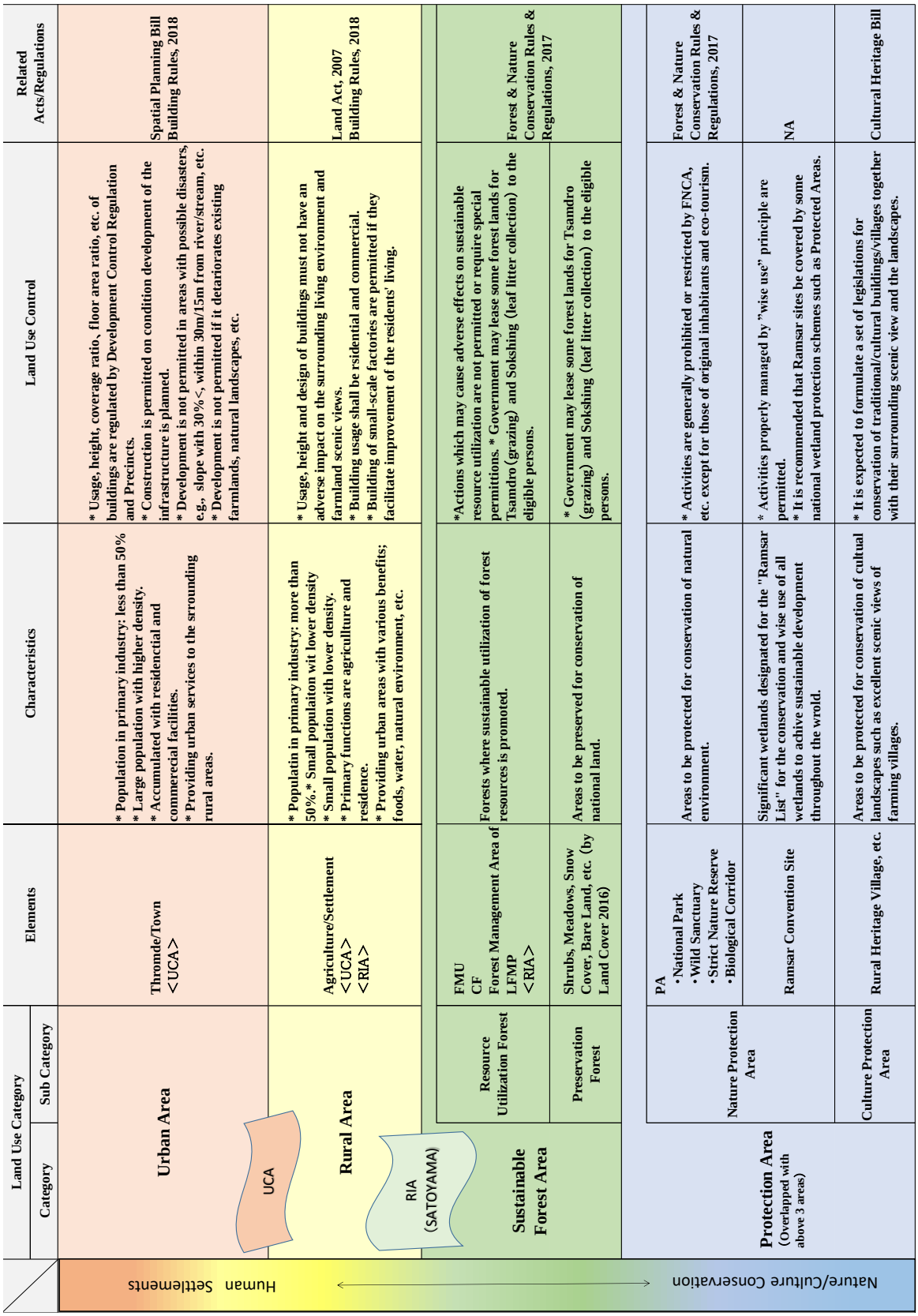


Figure 13.1.2 Outline of Land Use Category

(3) Approach to demarcate land into four land use categories

A procedure for demarcating the land according to the four categories, based on use objectives, for the land use map is proposed below. How to express the overlapped area on the map by prioritizing the area category is also explained.

1) Urban Area

In accordance with the criteria of an Urban Area described in 11.2.3 (Land use control in Urban/Rural Areas), thromdes/towns designated as Urban Areas are shown in Table 13.1.x. Out of 60 thromdes/towns selected as towns in the PHCB 2017, 54 thromdes/towns are included in the list of Urban Areas in the NLUP.

To compare with 50 towns listed in the PHCB 2005, 6 towns have been excluded and instead, 10 towns have newly been designated as Urban Area. As such, the –

of the towns consisting Urban Area shall flexibly change in accordance with the change of criteria required for urban areas over time.

Table 13.1.1 Thromdes/Towns in Urban Areas (PHCB 2005/2017)

	Thromde/Town	Dzongkhag	Population		increase or decrease	
			2005	2017	2005 -2017	%/year
1	Thimphu Thromde	Thimphu	79,185	114,551	1.45	3.1%
2	Phuntsholing Thromde	Chhukha	20,537	27,658	1.35	2.5%
3	Paro Town	Paro	2,932	11,448	3.90	12.0%
4	Gelephu Thromde	Sarpang	9,199	9,858	1.07	0.6%
5	Sandrupjongkhar Tromde	Sandrupjongkhar	8,595	9,325	1.08	0.7%
6	Wangdue Phodrang Town	Wangduephodrang	6,714	8,954	1.33	2.4%
7	Mongar Town	Mongar	5,793	7,646	1.32	2.3%
8	Punakha Town	Punakha	2,292	6,262	2.73	8.7%
9	Bhmthang Town	Bumthang	4,203	6,243	1.49	3.4%
10	Samtse Town	Samtse	4,981	5,396	1.08	0.7%
11	Tsirang Town	Tsirang	1,666	3,448	2.07	6.2%
12	Tashi Yangtse Town	Trashiyangtse	2,735	3,187	1.17	1.3%
13	Trongsa Town	Trongsa	2,695	3,122	1.16	1.2%
14	Trashigang Town	Trashigang	2,383	3,037	1.27	2.0%
15	Zhemgang Town	Zhemgang	3,007	2,711	0.90	-0.9%
16	Haa Town	Haa	2,495	2,596	1.04	0.3%
17	Daga (dzong) Town	Dagana	1,146	1,547	1.35	2.5%
18	Lhuentse Town	Lhuentse	1,175	1,500	1.28	2.1%
19	Gasa Town	Gasa	402	779	1.94	5.7%
20	Denchi Town	Pemagatshel	–	340	–	–
21	Nganglam Town	Pemagatshel	1,018	5,418	5.32	14.9%
22	Tsimasham Town	Chhukha	6,449	3,977	0.62	-3.9%
23	Gomtu Town	Samtse	4,254	3,661	0.86	-1.2%
24	Sarpang Town	Sarpang	2,619	3,152	1.20	1.6%
25	Rangiung Town	Trashigang	633	2,024	3.20	10.2%
26	LhamoiDzingkha	Dagana	778	1,961	2.52	8.0%
27	Samdrupchoelin Town	Sandrupjongkhar	393	1,713	4.36	13.1%
28	Khasadrapchu Town	Thimphu	–	966	–	–
29	Panbang Town	Zhemgang	379	800	2.11	6.4%
30	Lobesa Town	Punakha	–	784	–	–
31	Autsho Town	Lhuentse	301	775	2.57	8.2%
32	Yadi Town	Mongar	–	730	–	–
33	Nobding Town	Wangduephodrang	473	713	1.51	3.5%
34	Damji Town	Gasa	–	587	–	–
35	Jyenkana Town	Haa	–	502	–	–
36	Beteykha Town	Paro	–	465	–	–
37	Kuengarabten Town	Trongsa	–	424	–	–
38	Chhmay Town	Bumthang	–	393	–	–
39	Duksum Town	Trashiyangtse	283	360	1.27	2.0%
40	Mendrelgang Town	Tsirang	–	62	–	–
41	Kanglung Town	Trashigang	1,717	3,223	1.88	5.4%
42	Gedu Town	Chhukha	4,288	2,849	0.66	-3.3%
43	Jomotsangkha Town	Sandrupjongkhar	957	1,136	1.19	1.4%
44	Khaling Town	Trashigang	1,349	1,129	0.84	-1.5%
45	Olde Pemagatshel Town	Pemagatshel	1,066	1,038	0.97	-0.2%
46	Dala Town	Chhukha	1,652	1,037	0.63	-3.8%
47	Drametse Town	Mongar	541	969	1.79	5.0%
48	Lingmethang Town	Mongar	819	952	1.16	1.3%
49	Sipsu Town	Samtse	904	617	0.68	-3.1%
50	Dagapela Town	Dagana	145	578	3.99	12.2%
51	Drukjeyganq Town	Dagana	552	575	1.04	0.3%
52	Nangkor Town	Pemagatshel	672	522	0.78	-2.1%
53	Wamgrong Town	Trashigang	581	484	0.83	-1.5%
54	Resarbu Town	Trashigang	153	211	1.38	2.7%
55	Rurichu Town	Wangduephodrang	335	213	0.64	-3.7%
56	Khothakpa Town	Pemagatshel	238	146	0.61	-4.0%
57	Yalang Town	Pemagatshel	35	62	1.77	4.9%
58	Kheriqonpa Town	Pemagatshel	141	61	0.43	-6.7%
59	Sunkosh Town	Dagana	115	52	0.45	-6.4%
60	Mongling Town	Pemagatshel	66	38	0.58	-4.5%
	Total of 60 Census towns		196,041	274,967	1.40	1.03
	Total of 54 Census towns		195,111	274,395		

Urban Area

・Sandrupjongkhar Thromde inclules Deothang Town
・Mongar Town includes Gyelpozhing Town, Kilkha Town
・Zhemgang Town inclules Tingtibi Town
・Tsimasham Town includes Tsimalakha Town, Chhukha Town

Dzongkhag Thromdess | Yenlag Thromdes | Towns of Commercial Centre
Census Towns other than Urban Area

Note: Wamgrong Town and Resarbu Town are included as Urban Areas as they are regarded as conurbation towns, as described below, even though they do not satisfy the population criterion.

Table 13.1.2 is a summary of the 54 thromdes/towns listed as Urban Areas in the NLUP.

Table 13.1.2 Number of Thromdes/Towns Listed as Urban Areas

Type of Urban Area	Number of Thromdes and Towns
Dzongkhag Thromde	20
Yenlag Thromde	20
Commercial Centre	14
Project Towns	To be determined
Total	54

2) Rural Area

A Rural Area shall comprise agricultural lands and settlements. In the NLUP, a Rural Area is defined as cultivated agricultural land (chhuzhing, kamzhing, orchard), based on the Land Cover 2016 classification. Most of the settlements in a Rural Area are included.

In Land Cover 2016, numerous plots of cultivated agricultural land are dispersed in thromdes and other Urban Areas, given that it visualizes existing land rather drawing a land use plan. The NLUP has adopted this because a procedure specific to defining a Rural Area does not seem to have been established in Bhutan. Another suggestion for the Rural Area demarcation method from a planning viewpoint is to designate buffer areas in the form of farm roads as Rural Areas. A "buffer area" means an area within the same distance from some specified object. Farm roads are spread out over the country and act as community roads, which connect a number of villages to major roads, with their buffer areas considered to cover considerable portions of a Rural Area.

Further, the area surrounding a Rural Area within a 500-m buffer is to be designated as a Rural Intervention Area (RIA), which is in line with the satoyama concept[1] from Japan. In the Land Cover document, an RIA falls under the forest category; however, in the NLUP, it is categorized as a Rural-forest Overlapped Area as it is an interface zone between human activities and nature and has traditionally supported the livelihood of rural people.

Where a Rural Area is located in (overlaps with) a Protection Area, it is depicted as a Protection Area whose overlapped area is considered to be designated as a "multiple-use zone" according to the provisions of the Forest and Nature Conservation Act.

3) Sustainable Forest Area

A Sustainable Forest Area is state-reserved forest land, which is a legal definition of "forest" in the 1995 Forest and Nature Conservation Act (FNCA)[2]. This area can be subcategorized as follows: Resource Utilization Forest, which includes a Forest Management Unit (FMU), a Community Forest (CF) etc., and a Preservation Forest.

Where a Sustainable Forest Area overlaps with a Protection Area, the latter is prioritized, with the overlapped area depicted as a Protection Area.

The boundary between a Resource Utilization Forest and a Preservation Forest will be precisely

[1] Satoyama is derived from the Japanese term from landscapes that represent how human activities are interrelated with the natural environment. The landscapes include woodland, grassland, paddy fields, farmland, rivers and human settlements. The Ministry of the Environment of Japan and the United Nations University Institute for the Advanced Study of Sustainability (formerly the United Nations University Institute of Advanced Studies) jointly initiated the Satoyama Initiative to support harmony between societies and nature by promoting socio-economic activities that are in line with natural processes.

[2] According to the FNCA, "forest" means any land and waterbody, whether or not under vegetative cover, in which no person has acquired a permanent and transferable right of use and occupancy, irrespective of whether such land is located inside or outside forest boundary pillars. This includes land registered in a person's name as tsamdrog (grazing land) or sokshing (woodlot) for collection of leaf litter.

delineated according to the results of a Local Forest Management Plan (LFMP) for each gewog. LFMPs have recently been operationalized and, to date, covered 10% of the total forest area. Therefore, the NLUP has provisionally adopted the "forest" area in the Land Cover 2016 as the Resource Utilization Forest, and "shrubs", "meadows", "snow cover", "bare land" etc.as the Preservation Forest. Under the LFMP scheme, the areas with steep slopes and difficult access are excluded from the manageable forest, even if they are located in "forest" according to the Land Cover document and thus are to be comprised in Preservation Forest in the NLUP.

4) Protection Area

A Protection Area is an area where the protection of nature and culture is obligated by any legislation, which relates to, and thus overlaps with, any of the above three categorized land types. The area should be subcategorized as a Nature Protection Area and a Cultural Protection Area. A Nature Protection Area consists of a Protected Area (PA: including Biological Corridors) designated under the FNCA of 1995 and Ramsar sites. A Cultural Protection Area is expected to comprise Rural Heritage Villages designated under the Cultural Heritage Bill.

In drawing the overlaps with the three other areas on the land use map, Urban Areas shall be prioritized over Protection Areas, while Protection Areas shall be prioritized over Rural and Sustainable Forest Areas.

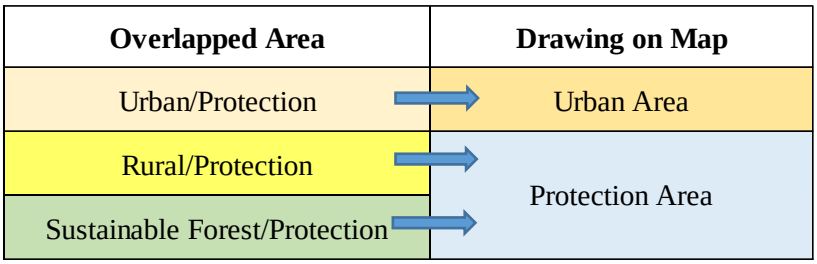


Figure 13.1.3 How to Draw Overlapped Areas on the Land Use Map

(4) Frame of land use

A frame of the land use by use category is defined to meet the land use policy. Table 13.1.3 shows the procedure to set the land use frames for the current and future land uses respectively.

Table 13.1.3 Procedure of Setting Land Use Frame

		Land Use Category	2017	2030
	i	Urban Area	54 Thromdes/Towns	Required residential land to be added
	ii	Rural Area	Cultivated Agriculture by Land Cover 2016	Urban area expansion to de deducted
a		States Reserved Forest Land	b－(i ＋ii)	b－(i ＋ii)
	iii	Sustainable Forest Area	a－iv	a－iv
	iv	Protection Area	by "Forest Facts and Figures 2017" Ramsar Convention Site	60% of the national land area
b		Total	－	－

Table 13.1.4 shows the estimated land use frame in 2017 and 2030.

Table 13.1.4 Current/Future Land Use Frame

(unit:㎢)

		Land Use Category	2017		2030		increase and decrese	
			area	%	area	%	area	%
	i	Urban Area	141	0.36%	158	0.41%	17	0.04%
	ii	Rural Area	1,000	2.58%	983	2.53%	-17	-0.04%
a		State Reserved Forest Land	37,630	97.06%	37,630	97.06%	0	0.00%
	iii	Sustainable Forest Area	17,876	46.11%	14,367	37.06%	-3,509	-9.05%
	iv	Protection Area	19,753	50.95%	23,263	60.00%	3,509	9.05%
b		Total	38,771	100.00%	38,771	100.00%	0	0.00%

Note:
1) The total area 38,771km^2 is calculated based on GIS data provided by DHS and does not conform to 38,394km^2 by Land Cover 2016.
2) Urban area in 2030 = Urban Area in 2017 + required residential land in Table 13.1.3
3) Rural Area excludes overlaps with Urban Area and Protection Area which is smaller than Cultivated Agriculture of Land Cover 2016.
4) Rural Intervention Area (RIA) is not reflected in this table.
5) Protection Area includes PAs (including Biological Corridors), Royal Botanical Park and Ramsar Wetland Sites.
6) Protection Area overlapped with Urban Area is included in Urban Area. Protection Area overlapped with Rural and Sustainable Forest Areas is included in Protection Area.

(5) Land use map with four categories

The following is a land use map based on the four categories explained above.

In this map, the four land use categories are defined as follows:

- Urban Area: 54 Thromdes/towns
- Rural Area: Cultivated Agriculture Land of Land Cover 2016
- Sustainable Forest Area: Legal definition of SRFL by Forest and Nature Conservation Act, 1995
- Protection Area: Nature Protection Area and Cultural Protection Area
- Nature Protection Area: National Parks, Wild Sanctuaries, Biological Corridors and Ramsar sites

- Cultural Protection Area: Rural Heritage Villages

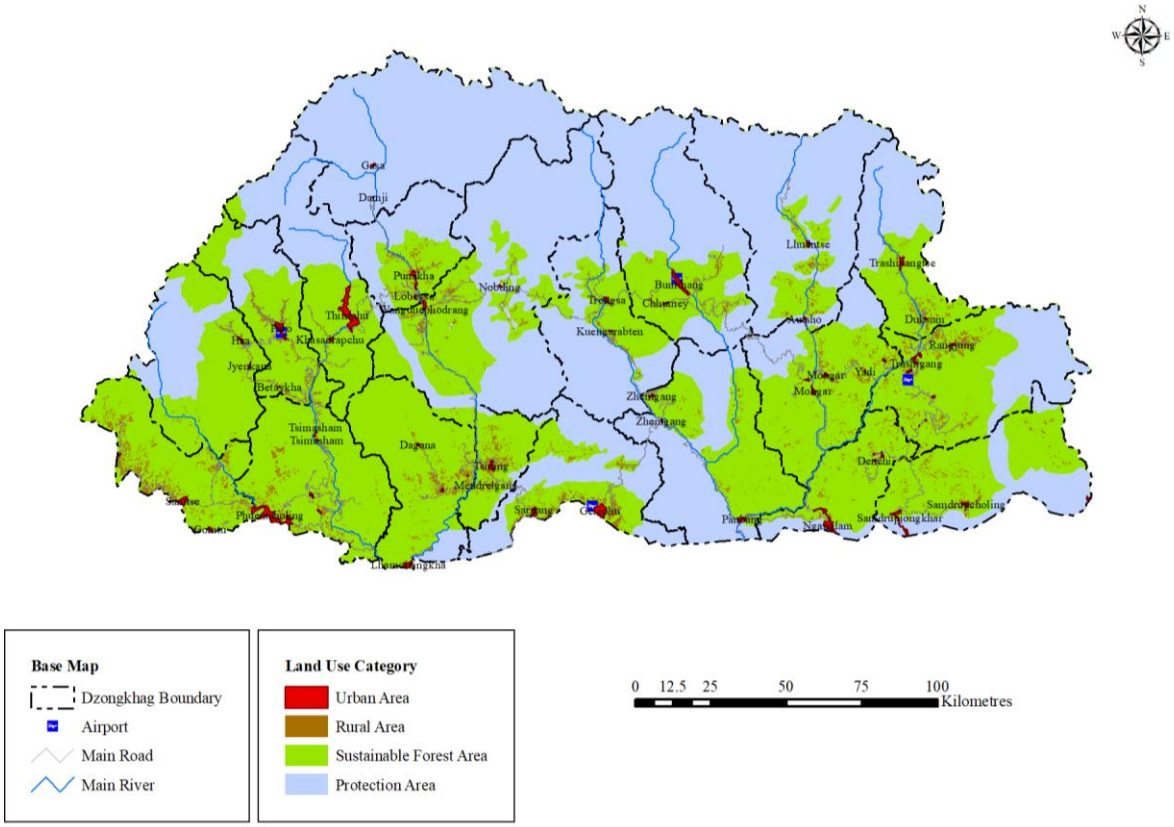


Figure 13.1.4 Land Use Map with Four Categories

13.1.3 National Land Use Plan

The NLUP consists of a land use plan document ("Document") and a land use map ("Map"). The Document provides principles and policies of land use, which forms the basis of the government administrative measures as well as activities of the private sector. The Map is an overview of the land use of the nation, based on the land use category, which provides comprehensive information on the land so that it may form a basis of the coordination of diversified land uses.

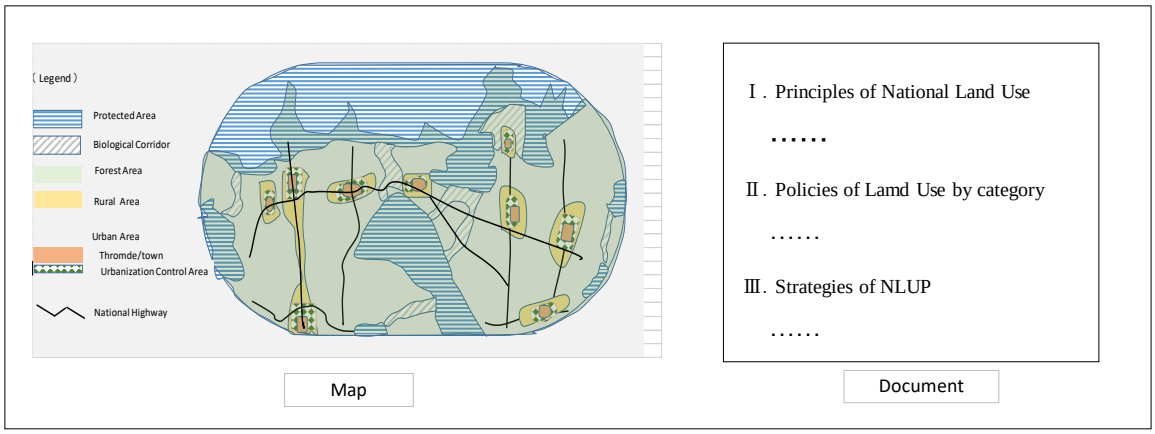


Figure 13.1.5 Image of Map and Document for the NLUP

13.1.4 National Land Use Plan - Document

(1) Principles of the land use plan (Document)

Considering the challenging terrain of Bhutan, it is encouraged to regard multiple uses of land or "land use overlaps" in the positive context and proceed the co-existence and the coordination of different land usages instead of seeking the exclusive land use. This approach is leading to the "Middle Path" thought in Bhutan which is to be pursued based on the following principle of land use.

(a) Maintaining the existing land use:

The current land use has been created with a long historical background. Therefore, the existing land use must be respected, and its environment shall not drastically be converted.

(b) Irreversibility of land use:

The land, when it is negatively affected by large-scale development, such as quarries in forests, is difficult to restore to the previous state and thus requires a vast amount of time and financial burden, which sometimes inhibits the restoration. The irreversibility of the land caused by developments should be strictly borne in mind.

(c) No development without planning:

It is imperative that every development project be supported by an officially approved plan such as Local Area Plan. "No development shall be approved without land use plan." is an internationally accepted standard for development.

(d) Judgement for propriety of land use:

A propriety of a land use plan and the execution shall be judged with a comprehensive perspective, considering influence on the environment, disaster prevention and economic effects. The base of the requirement is not to reduce the holistic value of the land.

(e) Recommendation of scientific approach:

A scientific approach is indispensable for judgement of propriety of land use plans and development projects, which facilitates understanding and consensus of the stakeholders. One of the currently representative utilities is GIS and it is important to continuously up-date the data so that the latest information is always available.

(2) Policies of land use by category (Document)

1) Urban Area

Urban Area defined in Table 13.1.1 comprises various sizes and levels of Thromdes and towns, however, it is not feasible nor efficient to execute planning, formulating regulations and development for all the urban area all at once in view of the human and financial resources currently available. Therefore, it is required to prioritize the Thromde/towns for the execution based on the factors such as an expected population growth in the future.

As for the commercial centre towns, one of the suggestions is to prioritize towns with more than 1,500 population (Gedu, Kanglung, etc.) and conurbation towns for the execution. These towns are currently required to pay the rural taxes; however, it should be studied to revise their taxes to the urban taxes, or to have them pay some alternative fees for the urban services their residents receives.

Identification of Thromde/towns where UMA to be established

(a) Estimation of urban population in the future.

- ✓ For four large Thromdes (Thimphu, Phuntsholing, Gelephu and Sandrupjongkha), the future population is estimated considering the planned regional development projects.
- ✓ For other Thromdes/towns, the estimation is made based on the population change from 2005 to 2017.
- ✓ For 2017- 2023, population change is estimated to continue at the same pace as 2005-2017. For 2023-2030 the change is calculated as 80% of that for 2017-2023.
- ✓ In case of the towns where the populations have decreased during 2005-2017, the estimates afterward are kept stable as the decrease is considered to be temporary caused by the completions of industrial projects and so forth Population of Old Pemagatshel town is estimated to continue downward as the cause of the decrease is the transfer of Thromdes and expected to continue.
- ✓ Population growth is particularly conspicuous in Paro town and Nganglam town due to the new urban development projects. However, these projects will shortly be completed, thus the growth rate is set at 50% of that for 2005-2017.
- ✓ For towns newly listed as Urban Area for which no census data is available, 102.7% growth is applied, which is the average growth rate of 50 Thromde/towns for which 2005/2017 data are available.

(b) Estimation of require residential land in the future

Residential land required to meet the population growth shall be calculated. The calculation is conducted with the population density of 80 persons/ha[3] referring to Spatial Planning Standards, on the premise of developments by Local Area Plans (LAPs).

As a result, the total residential land required in Urban Area in 2030 was estimated at 17km^2. The result of the i) and ii) above is shown in Table 13.1.5.

[3] In the case of development by land pooling method, the population density may be assumed as 120 persons/ha.

Table 13.1.5 Estimation of Population Growth and Required Land in Urban Area

	Thromdes/Towns	**Popln. 2005**	**Popln. 2017 (a)**	population growth rate (12 year)	population growth rate (1 year)	**Poplin. 2023**	**Poplin. 2030 (b)**	Population Change from 2017 to 2030 (b)−(a)	Planned Densities of towns (Poplin./㎢)	Required Residential Land in 2030 (㎢)
1	Bhmthang Town	4,203	**6,243**	1.49	1.034	7,609	9,157	2,914	8,000	**0.4**
2	Chhmay Town	—	**393**	—	1.027	461	535	142	8,000	0.0
3	**Phuntsholing Thromde**	20,537	**27,658**	1.35	1.025	32,304	36,622	8,964	8,000	**1.1**
4	Tsimasham Town	6,449	**3,977**	0.62	*1.000*	3,977	3,977	0		
5	Gedu Town	4,288	**2,849**	0.66	***1.000***	2,849	2,849	0		
6	Dala Town	1,652	**1,037**	0.63	***1.000***	1,037	1,037	0		
7	Daga (dzong) Town	1,146	**1,547**	1.35	1.025	1,797	2,068	521	8,000	0.1
8	Lhamoizingkha	778	**1,961**	2.52	1.080	3,113	4,809	2,848	8,000	0.4
9	Dagapela Town	145	**578**	3.99	1.122	1,154	2,216	1,638	8,000	0.2
10	Sunkosh Town	115	**52**	0.45	0.936	35	24			
11	Drukjeyganq Town	552	**575**	1.04	1.003	587	598	23	8,000	0.0
12	Gasa Town	402	**779**	1.94	1.057	1,084	1,479	700	8,000	0.1
13	Damji Town	—	**587**	—	1.027	688	799	212	8,000	0.0
14	Haa Town	2,495	**2,596**	1.04	1.003	2,648	2,698	102	8,000	0.0
15	Jyenkana Town	—	**502**	—	1.027	589	683	181	8,000	0.0
16	Lhuentse Town	1,175	**1,500**	1.28	1.021	1,695	1,900	400	8,000	0.0
17	Autsho Town	301	**775**	2.57	1.082	1,244	1,940	1,165	8,000	0.1
18	Mongar Town	5,793	**7,646**	1.32	1.023	8,784	10,002	2,356	8,000	0.3
19	Drametse Town	541	**969**	1.79	1.050	1,297	1,704	735	8,000	0.1
20	Lingmethang Town	819	**952**	1.16	1.013	1,026	1,101	149	8,000	0.0
21	Yadi Town	—	**730**	—	1.027	856	994	264	8,000	0.0
22	Paro Town	2,932	**11,448**	3.90	**1.057**	15,995	21,894	10,446	8,000	**1.3**
23	Beteykha Town	—	**465**	—	1.027	545	633	168	8,000	0.0
24	Denchi Town	—	**340**	—	1.027	399	463	123	8,000	0.0
25	Nganglam Town	1,018	**5,418**	5.32	**1.085**	8,838	14,006	8,588	8,000	**1.1**
26	Olde Pemagatshel Town	1,135	**1,038**	0.91	0.993	993	952	−86		
27	Kheriqonpa Town	141	**61**	0.43	0.933	40	27			
28	Nangkor Town	672	**522**	0.78	***1.000***	522	522	0		
29	Mongling Town	66	**38**	0.58	0.955	29	22			
30	Yalang Town	35	**62**	1.77	1.049	83	108			
31	Khothakpa Town	238	**146**	0.61	0.960	114	91			
32	Punakha Town	2,292	**6,262**	2.73	1.087	10,351	16,609	10,347	8,000	**1.3**
33	Lobesa Town	—	**784**	—	1.027	919	1,067	283	8,000	0.0
34	**Sandrupjongkhar Tromde**	8,595	**9,325**	1.08	1.007	10,016	12,449	3,124	8,000	0.4
35	Samdrupchoelin Town	393	**1,713**	4.36	1.131	3,576	7,168	5,455	8,000	**0.7**
36	Jomotsangkha Town	957	**1,136**	1.19	1.014	1,238	1,341	205	8,000	0.0
37	Samtse Town	4,981	**5,396**	1.08	1.007	5,616	5,830	434	8,000	0.1
38	Gomtu Town	4,254	**3,661**	0.86	***1.000***	3,661	3,661	0		
39	Sipsu Town	904	**617**	0.68	***1.000***	617	617	0		
40	**Gelephu Thromde**	9,199	**9,858**	1.07	1.006	10,419	20,850	10,992	8,000	1.4
41	Sarpang Town	2,619	**3,152**	1.20	1.016	3,458	3,771	619	8,000	0.1
42	**Thimphu Thromde**	79,185	**114,551**	1.45	1.031	137,056	161,243	46,692	8,000	**5.8**
43	Khasadrapchu Town	—	**966**	—	1.027	1,133	1,315	349	8,000	0.0
44	Trashigang Town	2,383	**3,037**	1.27	1.020	3,429	3,840	803	8,000	0.1
45	Rangiung Town	633	**2,024**	3.20	1.102	3,619	6,258	4,234	8,000	**0.5**
46	Kanglung Town	1,717	**3,223**	1.88	1.054	4,416	5,933	2,710	8,000	**0.3**
47	Khaling Town	1,349	**1,129**	0.84	***1.000***	1,129	1,129	0		
48	Wamgrong Town	581	**484**	0.83	***1.000***	484	484	0		
49	Resarbu Town	153	**211**	1.38	1.027	248	288	77		
50	Tashi Yangtse Town	2,735	**3,187**	1.17	1.013	3,440	3,695	508	8,000	0.1
51	Duksum Town	283	**360**	1.27	1.020	406	454	94	8,000	0.0
52	Trongsa Town	2,695	**3,122**	1.16	1.012	3,360	3,599	477	8,000	0.1
53	Kuengarabten Town	—	**424**	—	1.027	497	577	153	8,000	0.0
54	Tsirang Town	1,666	**3,448**	2.07	1.062	4,960	6,979	3,531	8,000	0.4
55	Mendrelgang Town	—	**62**	—	1.027	73	84	22	8,000	0.0
56	Wangdue Phodrang Town	6,714	**8,954**	1.33	1.024	10,340	11,831	2,877	8,000	0.4
57	Nobding Town	473	**713**	1.51	1.035	875	1,061	348	8,000	0.0
58	Rurichu Town	335	**213**	0.64	0.963	170	138			
59	Zhemgang Town	3,007	**2,711**	0.90	***1.000***	2,711	2,711	0		
60	Panbang Town	379	**800**	2.11	1.064	1,162	1,651	851	8,000	0.1
(i)	Total	196,111	274,967	—	—	331,771	412,543	137,740		**17.2**
(ii)	exclude 6Towns	—	−572			−471	−410			
(i)+(ii)	Urban Population	196,111	274,395			331,300	412,133			

Legend

Dzongkhag Thromde
Yenlag Thromde
Towns of Commercial Centre
Non-Urban Area(2017)

(a) Identifying Candidate Thromde/towns for establishing UMA

The Thromdes/towns where UMA are recommended to be established shall be those having approx. 0.3km^2 or more of required residential land in 2030, which are 11 Thromde/town/conurbation areas as shown in Table 13.1.6, The total required residential land in the 11 areas occupies 84% of the total required residential land of all Urban Area which is 54 Thromdes/towns.

Table 13.1.6 Candidate Thromdes/Towns/Areas for Establishing UMAs

(unit：person)

	Dzongkhag	Urban Area_2017	Popln. 2005	Popln. 2017 (a)	population growth rate (12 year)	population growth rate (1 year)	Poplin. 2030 (b)	Population Change from 2017 (b)-(a)	Required Residential Land in 2030 (㎢)	conurbation	National Capital Region
1	Bumthang	Bhmthang Town	4,203	6,243	1.49	1.034	9,157	2,914	0.4		
2	Chhukha	Phuntsholing Thromde	20,537	27,658	1.35	1.025	36,622	8,964	1.1		
3	Mongar	Mongar Town	5,793	7,646	1.32	1.023	10,002	2,356	0.3		
4	Paro	Paro Town	2,932	11,448	3.90	1.057	21,894	10,446	1.3		⑤
5	Pemagatshel	Nganglam Town	1,018	5,418	5.32	1.085	14,006	8,588	1.1		
6	Punakha	Punakha Town (Khuruthang)	2,292	6,262	2.73	1.087	16,609	10,347	1.3	①	⑤
		Lobesa Town	—	784	—	1.027	1,067	283	0.0		
7	Sandrupjongkhar	Sandrupjongkhar Tromde	8,595	9,325	1.08	1.007	12,449	3,124	0.4		
8	Sarpang	Gelephu Thromde	9,199	9,858	1.07	1.006	20,850	10,992	1.4	②	
		Sarpang Town	2,619	3,152	1.20	1.016	3,771	619	0.1		
9	Thimphu	Thimphu Thromde	79,185	114,551	1.45	1.031	161,243	46,692	5.8	③	⑤
		Khasadrapchu Town	—	966	—	1.027	1,315	349	0.0		
10	Trashigang	Trashigang Town	2,383	3,037	1.27	1.020	3,840	803	0.1	④	
		Rangiung Town	633	2,024	3.20	1.102	6,258	4,234	0.5		
		Kanglung Town	1,717	3,223	1.88	1.054	5,933	2,710	0.3		
11	Wangduephodrang	Wangdue Phodrang Town	6,714	8,954	1.33	1.024	11,831	2,877	0.4		⑤
	Total		147,820	220,549			336,848	116,299	14.5		

Note: Punakha-Lobesa, Gelephu-Sarpang, Thimphu-Khasadrapchu and Trashigang-Rangiung-Kanglung are regarded as conurbation areas.

2) Urbanization of Thimphu Thromde

Establishing a UCA: the case study of Thimphu

<Estimation>

As shown in Table 13.1.4, the required residential land in Thimphu Thromde in 2030 is estimated at 5.8 km^2 on the assumption of 80 persons/ha of the population density.

The developable land in Thimphu Thromde and UCA is calculated using GIS under the following premise, which is shown in Table 13.1.5.

- State-Reserved Forest Land (SRFL) should be excluded for developments thus private lands (agriculture land, etc.) shall be allotted for the potential developable land.
- The land slope for development is set below 50% as is currently practised, although 30% is desirable in view of the building safety.
- The areas within 30 m from the river edge and 15 m from the stream edge should be excluded due to flooding considerations, while 15 m from the road centre should also be excluded, in light of possible road widening.

Table 13.1.7 Potential Developable Land in Thimphu/UCA

(Unit: km^2)

	Thromde	UCA	Total
Thimphu	1.7	1.5	3.2
Khasadrapchu	0.7	2.6	3.2
Total	2.4	4.1	6.5

<Results>

The potential developable land within UCA is 1.5km^2 which is far below the required 5.8km^2.

Even if expanding the study area to UCA of Khasadrapchu as a conurbation, the developable land is totalled 4.1km^2, still requiring 1.7 km^2 to suffice 5.8$km^{2.}$

The deficient.1.7km^2 may possibly be covered if utilizing all the developable land in Thimphu, however, it is not desirable nor realistically possible to convert all agriculture land to the residential land.

Therefore, it is necessary to study the possibilities of raising the density from 80 persons/ha to 120 persons/ha and improving the land use efficiency in urban-core precincts by adopting urban renewal development in a grey field. As the land requirement cannot be met from the agricultural land, an alternative proposal is to densify the towns. The building heights will be allowed up to 10 floors.

Figure 13.1.6 shows possible area for UMA of Thimphu Thromde and Khasadrapchu, which is indicated with a blue envelope.

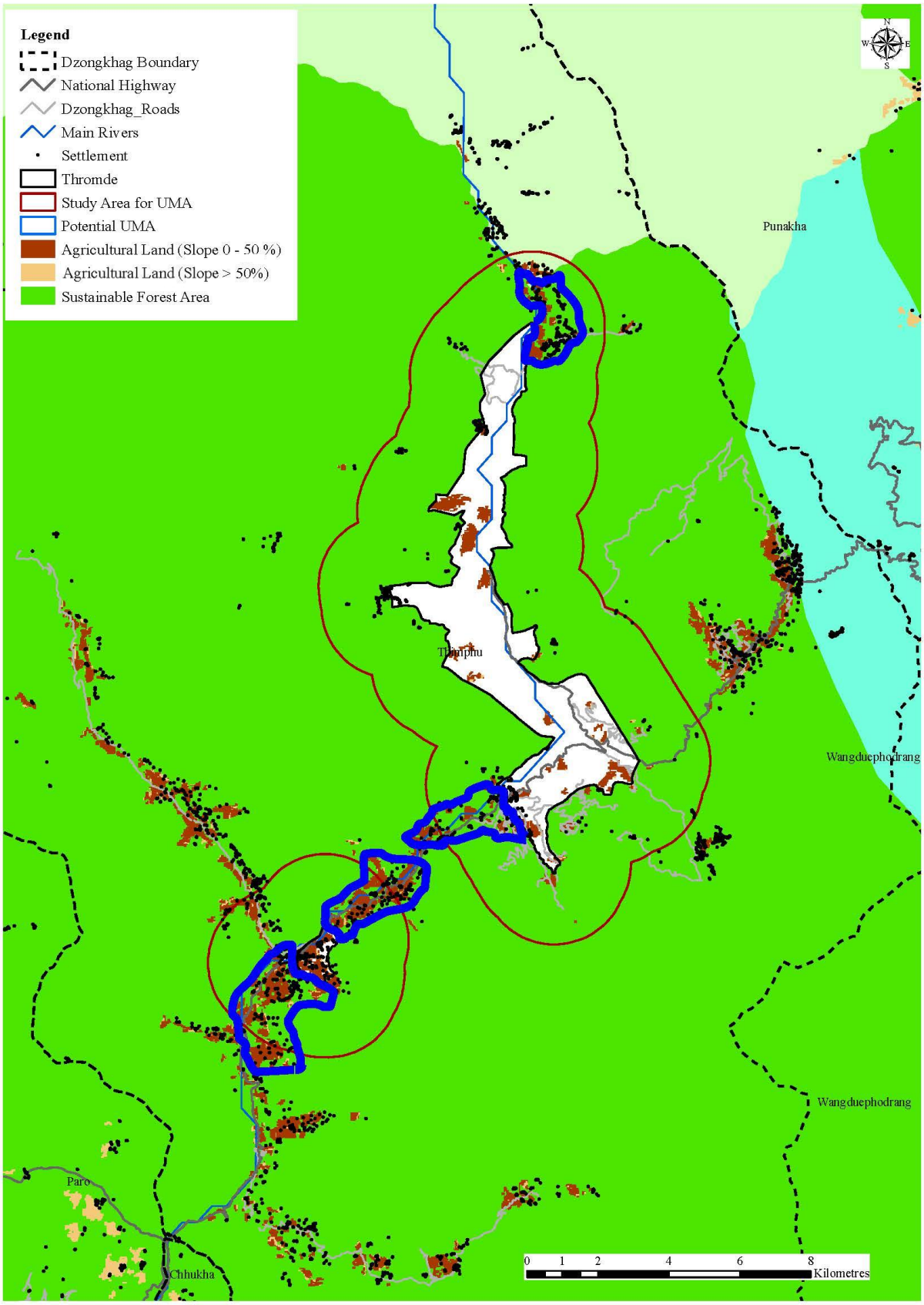


Figure 13.1.6 UMA Establishment in Thimphu

Efficient land use and urban renewal in inner area

As describe in the case study as above, the developable land is very scarce in UCA of Thimphu. It is still insufficient even including UCA of Khasadrapchu, conurbation of Thimphu. Therefore, it is necessary to enhance an effective use of existing core area including urban renewal in Thimphu Thromde.

It may be worth trying to implement a model urban redevelopment project in a core area with an urban design which maintains the traditional Bhutanese streets and urban landscape. The problem in a core area is often a lack of transportation infrastructure, such as roads and parking spaces. As it is difficult to expand the existing roads in a short period within a limited urban space, a formulation of a traffic management plan is suggested, by which an inflow of automobiles may be restricted by providing "fringe parking" around Thromde gate area.

3) Land use plan from a conurbation/regional perspective

For nationwide land use planning, it is important to take a broader view considering linkages with adjacent towns, as opposed to each individual thromde/town. A conurbation may sometimes foster an urban sprawl along highways. To prevent sprawl, it is appropriate to consider creating an UMA around the concerned area. Towns consisting a conurbation must have a land use plan comprising all towns concerned.

Administrations responsible for the development and the implementation of the plan are:

(a) When conurbation towns are located within one dzongkhag
   i) The specialized section of a dzongkhag should develop and implement the plan
   ii) If the conurbation includes Dzongkhag Thromde, Dzongkhag and the thromde should jointly develop a plan which is implemented respectively by Dzongkhag (outside the thromde) and the thromde (within the thromde)

(b) When the conurbation cuts across two or more dzongkhags:
   iii) The concerned dzongkhags should jointly develop the plan or the competent ministry should develop a plan, which is implemented by each dzongkhag
   iv) If the conurbation includes Dzongkhag Thromde, the thromde shall be involved in the plan development and implementation

Conurbation plans may be developed as a Regional Plan or a Valley Development Plan stipulated in the Spatial Planning Bill.

The followings are examples of potential conurbation areas:

(a) Khaling-Wamgrong-Resarbu (-Trashigang-Rangiung-Kanglung)
(b) Tsimasham/Thimalakha/Chhukha-Gedu
(c) Phunakha-Lobesa-Wandhu (-Thimphu-Paro)

Khaling-Wamgrong-Resarbu (-Trashigang-Kanglung-Rangiung)

These three towns may be regarded as one conurbation located along the highway. When it is extended to the north to include Trashigang, Rangiung and Kanglung, a district selected as a Regional Hub in Bhutan, the area will form a broader linkage and strengthen its potential. Furthermore, if including the east of Rangiung, an agricultural area including Radi Village, it will become a "linked Urban/Rural Area". This area has an advantage of being an educational centre, having a college in Kanglung and an international facility for the disabled (i.e., blind people) in Khaling, which is located close to Yongphulla Airport. When seeking a connection with Duksm Town, the potential will expand to the linkage with Trashiyangtse.

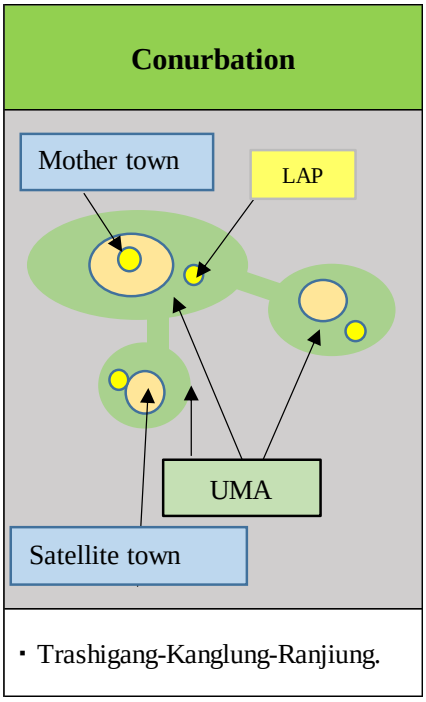


Figure 13.1.7 Image of the Khaling-Wamgrong-Resarbu Conurbation

Tsimasham/Thimalakha/Chhukha-Gedu

According to the population movement in Chhukha Dzongkhag in the PHCB 2017, there has been remarkable growth in the population in Phuntsholing Thromde, whereas, in other towns, the numbers show considerable declines, which indicates the conspicuous over-centralization within the dzongkhag. To avoid this tendency to continue, a linkage of Tsimasham/Thimalakha-Chhukha-Gedu as a conurbation is proposed. These towns are current/previous yenlag thromdes with potential powers whose synergistic effect is greatly expected. It is also advantageous to have the dzongkhag administration office close to Tsimasham/Thimalakha and Chhukha.

Recently a bypass highway has been completed between Thimphu and Phuntsholing, which skips Tsimasham/Thimalakha. It is necessary to take measures to prevent the area from hollowing out.

Phunakha-Lobesa-Wangdue (-Thimphu-Paro)

Phunakha (Khuruthang-Lobesa-Wangdue) is already a united Urban Area across two dzongkhags which will be economically managed under the concept of conurbation.

When further broadening the scope of the conurbation, it leads to the concept of a "National Capital Region", which is represented by the Paro-Thimphu-Phunakha/Lobesa/Wangdue region. This aims at mitigating the population growth in Thimphu by dispersing the pressures of the migration to Paro and Phunakha/Lobesa/Wangdue, which in turn will eventually restrain the over-centralization of population and various functions in the thromde capital. An organization for coordinating and implementing the overall plan is required to realize the conurbation.

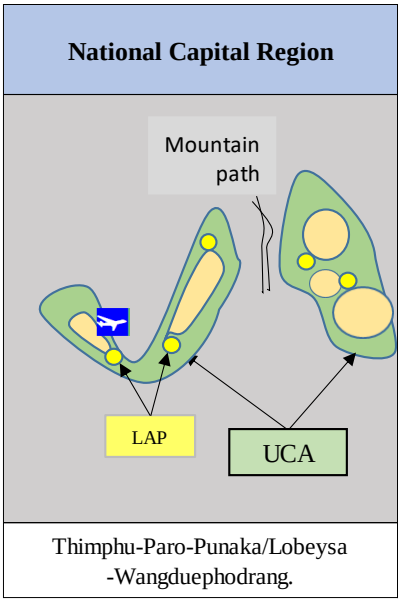


Figure 13.1.8 Image of Conurbation Around the National Capital Region

4) Rural Area

Rationalization of land conversions of wetland and dryland

It is naturally important to strictly regulate the conversion of wetland (chhuzhing) to secure improvements in the self-sufficiency of rice as a staple food. However, the difference in the level of stringencies concerning the regulations imposed on conversions of wetland and dryland (kamzhing and orchard) seems exceedingly large, and it should be noted that some adverse reactions to the difference may be observed.

For example, wetland conversion to residential land is currently permitted only in the case of inherited chhuzhing with a maximum of 50 decimals. It should be necessary to look into the possibility of a more flexible enactment of regulations within a UMA to permit and streamline the wetland conversion to residential land.

There are many drylands, on the other hand, which should be protected as farms producing important cash crops such as potatoes in Bumthang. Some of the farmlands offer beautiful scenery, which should also be evaluated as cultural heritage.

Measures to address abandoned farmlands and vermin

Abandoned land for agriculture has been on the increase because of the migration of people to large commercial towns, which has reduced the availability of labour for farming in Rural Areas. In addition, damage by animals to agriculture has recently become very serious. Realizing land use which enables the aggregation of dispersed farmlands should be explored, so that neighbouring farmers can cooperatively work towards efficient cultivation and vermin prevention.

As stated, in the section on the principle of land use, it may be necessary to study the possibility of converting land use, such as restoring abandoned farmlands to forests, in places where the potential for agriculture is scarce, e.g., in very remote areas, land with low productivity and areas with lack of labourers.

Revaluation of village landscape

Not only the provision of foods, many other functions are expected in Rural Area such as preservation of land and water resource. In addition, scenic landscapes of rural villages may also be valued as important local resources for tourism in the future. It is an effective approach to designate and preserve some selected rural scenic sites as the valuable cultural resources, which will be prescribed in 4-2) Cultural Protection Area.

5) Sustainable Forest Area

Maintaining the forest area

The multiple functions of forests provide a great deal of blessings to the globe, not only to Bhutan. It is stipulated in the Constitution to maintain a minimum of 60% of land as forest cover for all time. Considering the above facts, it is appropriate to maintain, in the future, the current level of forest area, which equates to 70% of the land according to the Land Cover documentation. It should be noted that it takes 100 years to restore and revitalize forest once it is felled and developed.

Coordination with Protection Areas

Although Sustainable Forest Areas and Protection Areas are derived from "primary nature/culture conservation" land, the conflicts between them are often observed in the actual state. In determining the boundary of Resource Utilization Forest under the LFMP, coordination between Protection Areas and FMU should become indispensable especially because the latter's expansion is being proposed.

Utilizing forest resources

Forest has played an important role in the socio-economy of Bhutan, for example, by providing hydropower generations using the water retaining capacity and serving as a valuable element of tourism. Forestry, especially, has been one of the indispensable industries in Bhutan for the last 60 years; indeed, there is still sustainable forestry and its improvement is crucial to the land use plan of Bhutan.

The FMU is the main forestry scheme in Bhutan, by which felling, thinning and reforestation are implemented according to an authorized plan. However, it is not practically possible to cover the vast forest area only by the FMU management scheme; indeed, other forest management programmes, such as Community Forest, are encouraged in the satoyama area.

To vitalize the forest industry, diversification of the downstream market is most important. Examples include increasing the use of wood for housing and other buildings, as well as for biomass power generation systems.

As wood is a totally eco-friendly material, compared to other building materials, with no CO_2 emission, its use for buildings should especially be encouraged by realizing a joint effort by actors responsible for building regulations and traditional culture policy.

6) Protection Areas

Nature Protection Area

In Bhutan, 51% of the land is designated as Protected Area (PA) which is considerably extensive compared to an international standard. However, there are some rooms for improvement in the quality of the management. It should be targeted to expand PA to cover 60% of the land by adopting the following proposed measures.

(a) Formation of a nation-wide PA network

Linkages of PAs do not continue in north-west, south-west and north-east areas of the land. It is recommended that Biological Corridors be newly designated in these areas to complete a nation-across Nature protection network.

(b) Precise zoning for coordination with human activities

Within PAs, there are many existing settlements and some activities such as grazing and tourism are taking place. Existing settlements areas in PAs are zoned as "multiple-use zone" according to the Forest and Nature Conservation Rules and Regulations (FNCRR) where the restrictions are less stringent and allow for a certain level of human interventions. To further this concept, it is proposed to formulate more precise PA zoning system in order to pursue flexible coordination of the rights of existing residents and administrative measures, which may also facilitate designation of the new PAs. Recognizing eco-tourism is one of the promising industries in Bhutan, establishment of an intermediate zone is also recommended which is expected to be used for tourism promotion.

(c) Revising intricate Biological Corridors to National Parks

As mentioned in 12.1.9 Conservation of PAs, Biological Corridors and Forests for Sustainable Livelihoods, Biological Corridors in Lhuntse and Wangduephodrang are intricate with urban and rural areas to makes it look mosaic, which should be urgently re-structured. It is suggested that the northern National Parks be expanded to comprise these settlement areas to have them overlapped with existing rural/urban areas and then the management method be thought out for each overlapped area. Management for Biological Corridor may be referred to in establishing the management method of each overlapped area.

(d) Designation of Ramsar Convention sites as PA

As for the utilization of the wetlands registered under Ramsar Convention, an appropriate land use regulation is indispensable under the "wise use" thought, an important concept proposed in of the Ramsar Convention. At present, FNCA 1995 and FNCRR 2017 stipulate Critical Watershed as a part of PA. It is recommendable to designate the Ramsar sites as Critical Watershed and apply the existing regulations to them.

Further, the registration of Ramsar Convention sites has only started recently, and three areas have been registered so far. More areas should be put forward for registration when suitable wetlands are found.

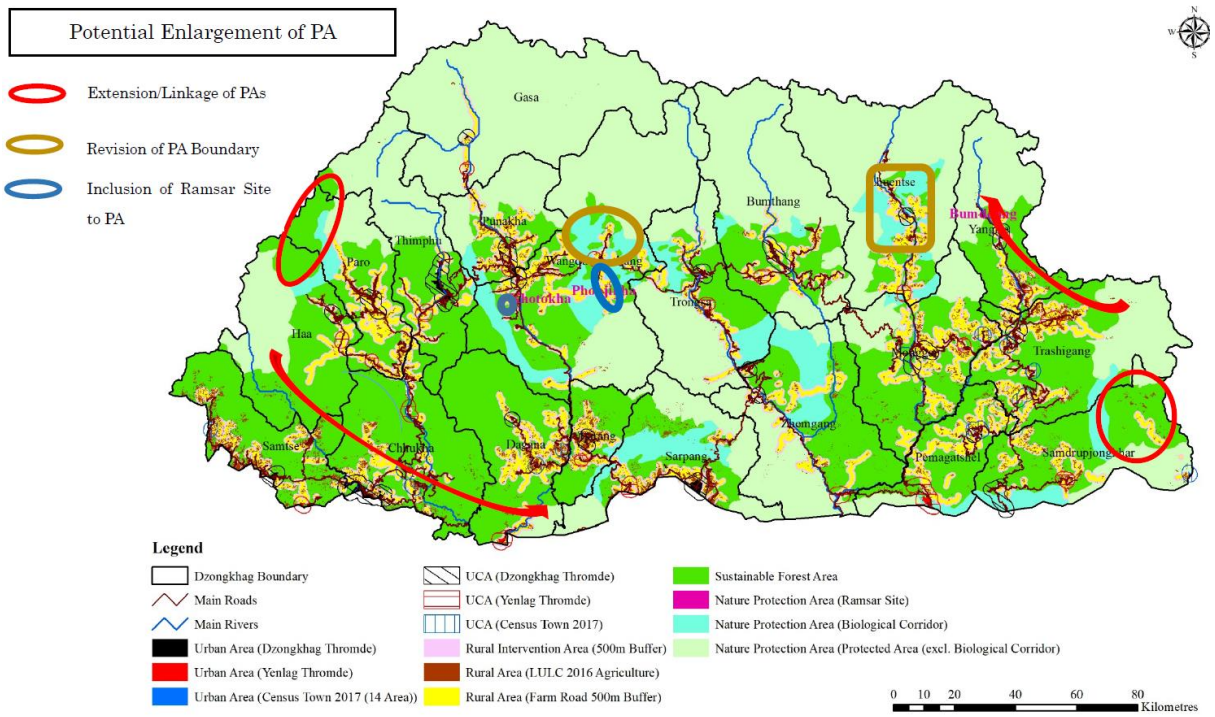


Figure 13.1.9 Formation of PA Network and PA Review

Cultural Protection Area

Cultural Protection Area is an attempt to find out and protect special values of landscape focusing on, for example, architectural style, settlement patterns, land-use patterns and natural settings, not only on individual cultural facility. In Figure 13.1.2 Outline of Land Use Category, it is proposed to include Rural Heritage Village as an element of Cultural Protection Area, one of the sub-categories of Protection Area. MoHC has listed up more than 50 villages as candidates of Rural Heritage Villages based on which JPT proposes the following villages to be reflected in NLUP

Table 13.1.8 List of Rural Heritage Villages

Location	Dzongkhag	Note
Shingkhar Village	Bumthang	1
Shingner Village	Bumthang	(J)
Ura Village	Bumthang	2
Lobnekha Village	Chukha	(J)
Laya Village	Gasa	1
Damji Village	Gasa	2
Takchu Goenpa Village	Haa	1
Khoma Village	Lhuntse	1
Sengor Village	Mongar	3

Location	Dzongkhag	Note
Paro Valley	Paro	(J)
Sakten Village	Trashigang	1
MerakVillage	Trashigang	2
Radi Village	Trashigang	(J)
Khenye Village	Tashi Yangtse	1
Korphu Village	Tongsa	1
Rukubji Village	Wangdi	1
Rinchengang Village	Wangdi	1
Phobjiikha Valley	Wangdi	(J)

Note 1: 1st rank in the MoHC list. All 1st ranked villages are listed in the above.
Note 2: 2nd rank in the MoHC list. Selected ones are listed in the above.
Note 3: 3rd rank in the MoHC list. Selected ones are listed in the above.
Note (j): selected by JPT by its discretion

7) Coordination of Infrastructure development and land use – Redundancy of land use

Land use and infrastructure are inseparably related each other. For example, infrastructure is one of the indispensable elements of urban development and the urban development is further proceeded by the infrastructure. At the national land use level, coordination between impacts given by the nation-wide road system development to the environment and protection of the ecosystem in PA must be a crucial issue. It must be achieved at the same time securing land use redundancy while evading negative impacts on environment.

From the land use perspective, disaster prevention is a fundamental requirement and it must definitely be avoided the situation such as a damage of major transportation system delays the rescue operations and restoration activities when a serious disaster occurs. Particularly in the western region (include. The capital area) where population and various functions are accumulated and the eastern region where 1/4 of the national population resides, it is urgently required to secure redundancy to cope with natural disasters.

Table 13.1.9 Population by Regions

Total Population 2017

Total	Western	Central Western	Central Eastern	Eastern
727,145	330,263	122,219	101,547	173,116
100%	45%	17%	14%	24%

Most of highways in Bhutan are located in difficult terrain which often cases blockings even in normal conditions. In view of this fact and required time and financial burden, widening the existing roads may not be a recommendable way to provide a redundancy of the road. Another way is to prepare an alternative transportation route which, however, will have a high potential of passing through Nature Protection Area which occupies more than 51% of the total land. In order to determine the propriety, a thorough environment assessment shall at first be conducted, based on which the negative impact on ecosystem and other factors, such as contribution to disaster prevention and economic effects, shall comprehensively be studied. Some of the items to be studied for proprietary judgement are suggested below.

(a) The level of hindrance to the rescue and restoration activities when major transportation system is damaged by disasters such as earthquakes
(b) The level of negative effect on the environment and the ecosystem
(c) Possible measures to mitigate the negative effect on the environment and the ecosystem
(d) Whether to newly construct or utilize existing roads (farm roads, mule tracks, etc.)
(e) Positive effect on the regional economy to contribute the balanced land development

In the western region, there are multiple access roads to/from Thimphu which may secure a certain level of redundancy. In the eastern region, however, there is only one access road to connect from the middle region, Bumthang, which passes through Thrumshingla National Park and then to Mongar. The road condition between them is extremely difficult and therefore, it is vitally important to prepare an alternative route between them. It should also be noted that one of the three national major hospitals is located in Mongar. As the alternative, the new road must be located in the area where no damage is expected when the main road is hit by some disaster, such as the one passes through Lhuntse.

One of the objectives of NLUP is the balanced development between the west and the east regions. It may be an effective support to the eastern region, although indirectly, to prepare a

measure to avoid a crucial damage by a serious disaster occurred in the eastern region.

(3) National Land Use Plan (map)

A map of National Land Use Plan for 2030 is shown in Figure 13.1.10, incorporating the policies of land use which are previously prescribed. The map indicates the following items in addition to Figure 13.1.4 Land Use Map with Four Categories

(a) UMA (Urbanization Management Area): for 11 Thomdes/towns/conurbations
(b) RIA (Rural Intervention Area/SATOYAMA)
(c) Rural Heritage Village
(d) Proposed area for establishing/expanding Nature Protection Area

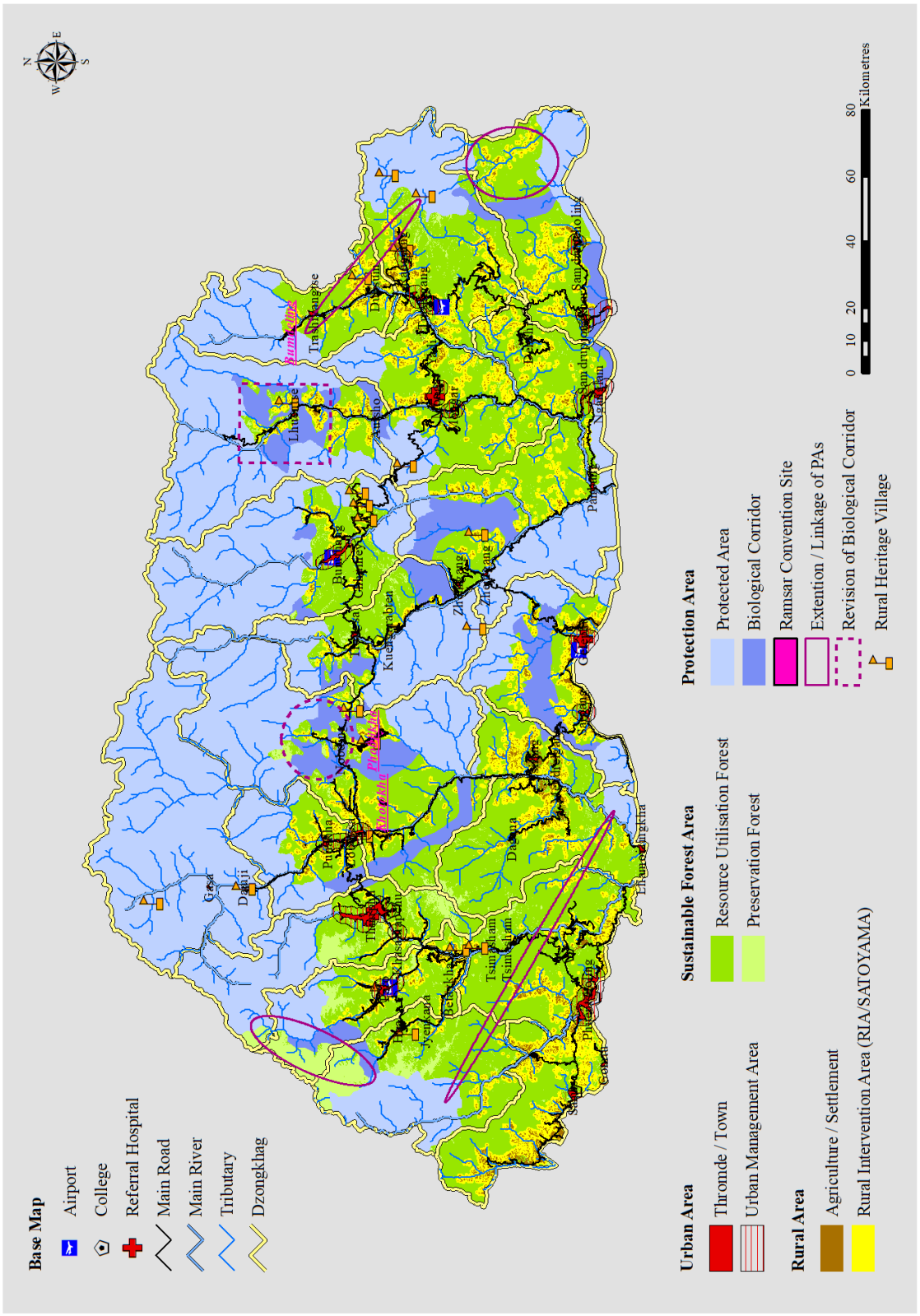


Figure 13.1.10 NLUP (Map)

13.2 Specifications of Holistic Service Delivery System

13.2.1 Specifications and Function for Hierarchy

(1) Specifications for Each Class of Hierarchy

Regarding the Holistic Service Delivery System proposed in Chapter 12.1.13, the hierarchy consists of a regional centre (RC), a district centre (DC), a sub-district centre (SDC), a Gewog centre (GC) and an outreach centre (OC). The specifications and function of each hierarchy are shown as follows.

The role of the RC, at the top of hierarchy, should be to distribute advanced service facilities, such as tertiary institutes and regional hospitals, as a hub of each region. For achieving this objective, a balanced location in region is the prioritized selection criterion. However, it is difficult to determine only one RC for each region in actuality. In each region other than the Western Region, education and medical services are not concentrated in one big city. Thus, various cities could be candidates for the RC for each service function. Therefore, it is suggested that the six proposed linked urban centres (including the National Capital Region), as mentioned in 12.2.1, could be RCs.

Second, the DC is generally a Dzongkhag Thromde. Distributing urban standard service facilities, as shown in Figure 13.2.1, as an urban hub is the objective of the DC. In Bhutan, each Dzongkhag Thromde is located within six hours' driving distance from its neighbour in general. To maintain accessibility between each other and to improve the road network are the priorities for the DC.

Third, the special objective of the SDC is to deliver roadside services in lieu of the DC. Roadside services include amenities, such as public toilets, a cafeteria, a farm shop, a fuel station and automobile workshop. For travellers who go back and forth between each DC, the SDC should be located every 1 to 1.5 hours' driving distance on the national highway. Existing Yenlag Thromdes, census towns (PHCB, 2017), commercial centres, as defined in the National Human Settlement Strategy (MoWHS, 2017) and road maintenance centres under the remit of the Department of Roads are taken into consideration as candidates. It is proposed to give Yenlag Thromdes the additional role as SDCs.

Next, in terms of rural service distribution, the GC should be the distribution base for rural standard services or essential services, as shown in Figure 13.2.1, needed for daily life. However, as analysed in 9.2.7, the accessibility of a GC is classified into three types.

- A GC Type 1 (GC1) is located within one hour's driving distance (commuting distance) from the nearest DC. This means that GC1 residents can receive urban services. Thus, in a GC1, only essential service facilities are needed.
- A GC Type 2 (GC2) is located within three hours' driving distance (day trip distance) from the nearest DC. Rural standard service facilities should be distributed in GC2s as a rural hub (*small base*).
- A GC Type 3 (GC3) is located beyond three hours' driving distance from the nearest DC. Regarding GC3s, because of limited budgets, it is hard to offer standard service facilities. Nevertheless, essential service facilities should be distributed among surrounding villages.

Depending on the existing road network, 80 out of the 205 GCs are regarded as GC1s, 72 are regarded as GC2s and the rest are regarded as GC3s.

Finally, if some remote villages are located beyond three hours' driving distance from the

nearest GC, establishing an OC beside a farm road as a substitute for a GC should be taken into consideration. Of course, building a new facility in an OC is not realistic. Thus, an OC needs to be located where a primary school, an extended classroom or an outreach clinic is already located. Then, essential services for the surrounding remote villages can be delivered on demand or by using ICT.

Note that the Holistic Service Delivery System proposes a hierarchical structure of service facility distribution only. In other words, it does not refer to the structural reform of the government, including the location of regional offices of ministries and local government, to realize it. The Comprehensive Development Plan focuses on spatial structure, while the structural reform of the government needs to be considered separately.

Table 13.2.1 provides a summary of the above information.

Table 13.2.1 Specifications for Each Class of Hierarchy

	Urban			Rural			
	Regional Centre (RC)	District Centre (DC)	Sub-district Centre (SDC)	Gewog Centre Type 1 (GC1)	Gewog Centre Type 2 (GC2)	Gewog Centre Type 3 (GC3)	Outreach Centre (OC)
Objective	To distribute advanced service facilities as a hub of each region	To distribute urban standard service facilities as an urban hub	To deliver roadside services as a Sub-DC	To distribute essential service facilities as a peri-urban settlement	To distribute rural standard service facilities as a rural hub	To distribute essential service facilities as a remote village hub	To deliver essential services for remote villages as a Sub-GC
Accessibility Criterion	Balanced location in the region	Within 6 hours' drive from the neighbouring DC	Beside the national highway (every 1-1.5 hours)	Within 1 hour's drive from the nearest DC *	Within 3 hours' drive from the nearest DC *	Beyond 3 hours' drive from the nearest DC *	Beside a farm road (every 2-3 hours)
Candidates	Proposed Linked Urban Centres **	Existing Dzongkhag Throndes	Existing Yenlag Thromdes, towns (based on census) or commercial centres ***	Existing Gewog Centres (205 in total)			Where a PS, an ECR or an ORC is located
Numbers Nationwide	1 (or 2) by region	20	Around 30-40	Around 80	Around 70	Around 50-60	Around 100-200

Abbreviations: ECR = extended classroom; PS = primary school; ORC = outreach clinic.
Note: * Accessibility analysis based on '9.2.7 Traffic Demands and Transport Conditions'; ** linked urban centre based on '12.2.1 Future National Spatial Structure'; *** commercial centres proposed in 'Bhutan National Human Settlement Strategy' (MoWHS, 2017)

(2) Proposed Service Delivery System by Function

Regarding each hierarchy, the service facility distribution requirement by function is described here. By 2030, it will be necessary to promote service facility distribution in order to meet the minimum requirements of each function, such as education, health, transport, commercial, recreation and civic services.

First of all, in the process of modernization, which began in the 1960s, facility distribution was preferentially carried out with regard to education, health and transport services. In line with the objective for Bhutan 2030, education, health and transport services should be sustained, commercial and recreation services should be expanded, and all citizens should be encouraged to seek physical and spiritual well-being. In addition, civic services such as administrative and community services should be available to 100% of Bhutanese citizens.

An overview of this section is shown in Figure 13.2.1. This figure shows that each class of hierarchy is advised to be distributed listed service facilities by function.

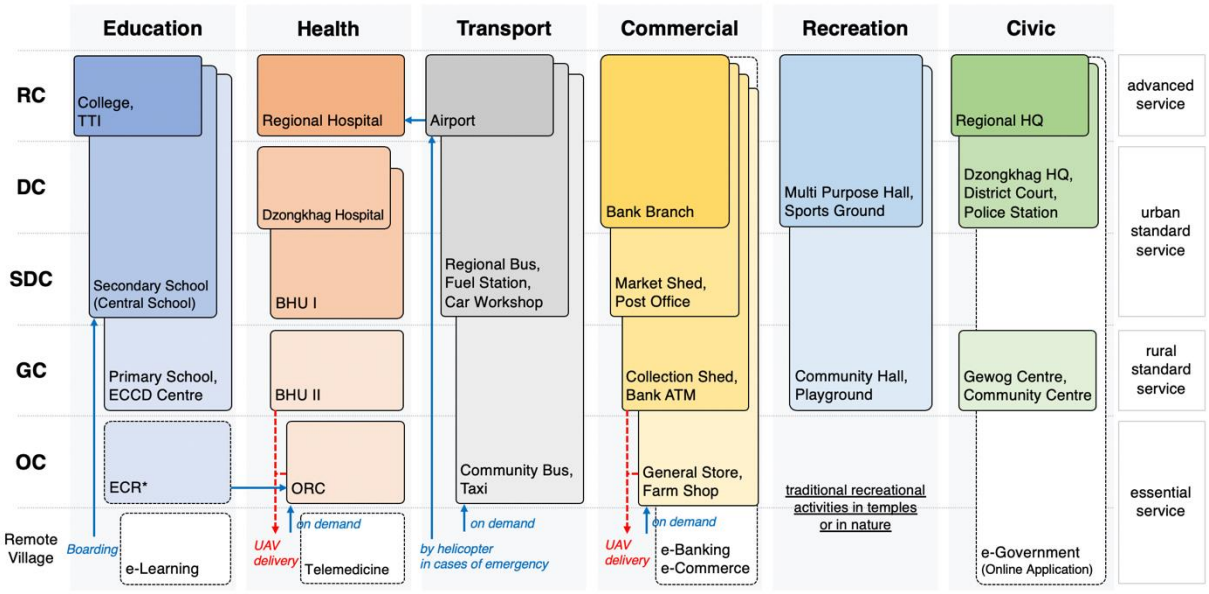


Figure 13.2.1 Proposed Service Delivery System by Function

1) Education:

According to 6.3.1, there are 18 colleges, i.e., tertiary educational institutes, nationwide. As of 2018, among the RCs, no college exists in the Sarpang-Gelephu Linked Urban Centre. In terms of secondary education, there are 61 higher secondary schools, 72 middle secondary schools, and 72 lower secondary schools. As of 2018, there are 205 secondary schools run by the government and private sectors. This number is consistent with the number of GCs; but, of course, schools are concentrated in urban areas with a high population. Thus, secondary schools do not cover all GCs. There are also 310 primary schools nationwide. In addition, some secondary schools include primary education. Thus, there are more than 400 primary educational institutes, such that almost all GCs are covered.

The school education system contains 60 central schools. Central schools accept boarding students from remote villages where there is no school or where the school is closed due to depopulation. As shown in Table 13.2.2, secondary education facilities such as LSS, MSS, and HSS are located far from the settlement. So, cantral school could be the one solution for providing secondary education nationwide. Even in the 12th Five Year Plan (FYP), the student enrolment ratio in central schools will be promoted by policy.

However, a primary education, as bases for essential education service, should be secured for each GC at a minimum. Table 13.2.2 shows that around 80% of settlement is located within 3km radius of PS (includes secondary schools providing primary education), but only 30% of settlement is located within 1km radius of PS. It is obvious that 3km is not close for 6-7 years old boys and girls. There is still room for improvement. Regarding an ECCD centre, the enrolment ratio is still 21.8%. So, the additional distribution of ECCD centre in each GC and

the promotion of ECCD enrolment will be the minimum goal by 2030. Furthermore, in OCs and remote villages, community education, such as Extended Class Room (ECR) or Non Formal Education (NFE) facilities, should be sustained, and e-learning systems for providing educational opportunities should be promoted.

2) Health:

It is desirable that health services are offered in the form of face-to-face medical treatment as much as possible, on the basis that the whole country is covered by appropriate medical facilities. According to 6.3.2, the national health service hierarchy consists of three regional referral hospitals (including the National Referral Hospital), 27 Dzongkhag hospitals, 25 BHU-I, 185 BHU-II and 476 ORCs. And more than 80% of settlement is located within 3km radius of any health facility as shown in Table 13.2.2. However, in Bhutan, it is obvious that providing adequate health services in remote areas is difficult. For example, ORCs are operated once in a month by visiting health personnel.

In order to provide appropriate services, it is necessary to utilize next-generation technology, including ICT, in solving the problems in OCs or remote villages. Telemedicine-based, continuous online regular medical examinations and UAV-based (e.g., drone-based) medicine transport systems from the neighbouring BHU-II or ORC should be promoted. Meanwhile, establishing an air transport system in emergency situations is urgently needed, especially for newborn babies and elderly people. The expansion of transport opportunities by helicopter and the construction of appropriate management system are also required.

Table 13.2.2 Accessibility from Education and Health Facility

	PS (ClassPP-6)		LSS (Class7-8)		MSS (Class9-10)		HSS (Class11-12)		Health	
	1km	3km	1km	3km	1km	3km	1km	3km	1km	3km
Western	27.3%	72.7%	17.4%	57.4%	11.6%	42.7%	4.0%	17.6%	21.1%	66.4%
Central Western	28.7%	77.6%	14.3%	46.4%	8.7%	34.1%	3.6%	16.3%	32.9%	84.3%
Central Eastern	30.1%	74.8%	13.0%	39.1%	7.2%	25.0%	1.4%	9.8%	36.2%	82.6%
Eastern	39.0%	87.7%	16.9%	53.8%	10.0%	39.1%	3.4%	15.4%	44.2%	90.1%
BHUTAN	32.2%	79.4%	15.7%	50.2%	9.5%	36.2%	3.2%	15.1%	34.6%	81.7%

Abbreviations: PS = primary school (includes LSS, MSS, HSS with class PP-6); LSS = Lower Secondary School (includes MSS, HSS with class 7-8); MSS = Middle Secondary School (includes HSS with class 9-10); HSS = Higher Secondary School.
Note: Accessibility = proportion of settlement within 1km/3km radius of education/health facility.

3) Transport:

Needless to say, it is essential to provide physical facilities and a network for transport services, which is difficult to resolve by ICT. Everyday public transport networks, including intercity traffic and regional traffic, should be connected by bus or taxi. And, in order to ensure the convenience of citizens, urban service facilities will be appropriately concentrated in each terminal of public transport such as inter-regional bus, community bus, and taxi.

On the other hand, despite the increase in private cars, sufficient roadside services are not provided, even on the highway between DCs. Therefore, in order to enrich the transport service, it is essential to establish an SDC as soon as possible and prepare amenities, including a fuel station, a charging station for electric cars, and an automobile workshop.

4) Commercial:

Typically, commercial business facilities, such as farm shops and general stores, are managed by farmers and retailers themselves. However, especially in rural areas in Bhutan, due to their small-scale markets, individual shops/stores cannot survive on their own. Nevertheless, agro-products and daily necessities are indispensable. Thus, it is necessary to establish one or more collection sheds in each GC and one or more farm shops and general stores in each OC or higher as a policy. On the other hand, it is also important to secure financial services by installing one or more bank branches in each DC and one or more bank ATMs in each GC.

Furthermore, the above-mentioned retail and financial services can also be provided to remote villages via online services (e-banking, e-commerce). However, when delivering the actual product, physical transport networks are necessary. To solve this problem, a UAV-based delivery system needs to be considered. For example, it is conceivable that the Post Office could start a UAV delivery service from neighbouring shops/stores. In recent years, along with the spread of mobile phones, postal services are only used by public offices and institutions. Therefore, the establishment of an air delivery service would represent the beginning of a new era for postal services in Bhutan.

5) Recreation:

Although recreation services are often seen as just entertainment, they are indispensable activities for sustaining a healthy life. There are expected to not only contribute to the psycological wellbeing of individuals but also improve community vitality.

As a concrete effort, the establishment of a multipurpose hall and sports ground of a sufficient size in each DC should be promoted. These recreation facilities are useful as a countermeasure to deal with lifestyle-related diseases or as a part of health promotion activities. In addition, in each GC, community halls without political or religious purposes and playgrounds for children should be set up.

6) Civic Services:

Civic services, including government to citizens (G2C) services, security services and judicial services, are considered to embody the rights of citizens.

G2C services, such as birth registrations and passport issuances, are provided by community centres attached to GCs. According to the Bhutan Development Bank Limited, the operator of community centres, 200 Gewogs out of 205, except for Laya and Lunana in Gasa Dzongkhag and Soe, Naro, Lingzhi in Thimphu Dzongkhag, have community centres as of 2018, of which 188 are connected to the Internet. In the near future, an e-government system should be implemented and online applications should be available from anywhere in the country including OCs and remote villages

Regarding judicial services, a Supreme Court and a High Court are only located in Thimphu, as each Dzongkhag has its own Dzongkhag court. In addition, 15 dungkhag courts support the regional jurisdiction of the Dzongkhag court. Security services are provided by the Royal Bhutan Police (RBP). The RBP is divided into 13 divisions nationwide, and 38 police stations and their outposts are operated by divisional headquarters.

(3) Hierarchical National Service Network

A map of the hierarchical service network on a nationwide scale is shown in Figure 12.4.2. Since details cannot be drawn finely on this scale, only the location of top-level facilities (airports, colleges and regional hospitals) for each function are mapped.

In this figure, existing yenlag Thromdes are shown as SDCs. In addition, the temporary candidates for SDCs are marked with a triangle. However, these candidates should be examined and specified by the appropriate department.

For reference, the Capital City Area, Economic Hub and Growth Centre, as defined in SGNH (2008), and the Regional Hub defined in the 11th FYP (2013) are respectively shown under the existing strategic category.

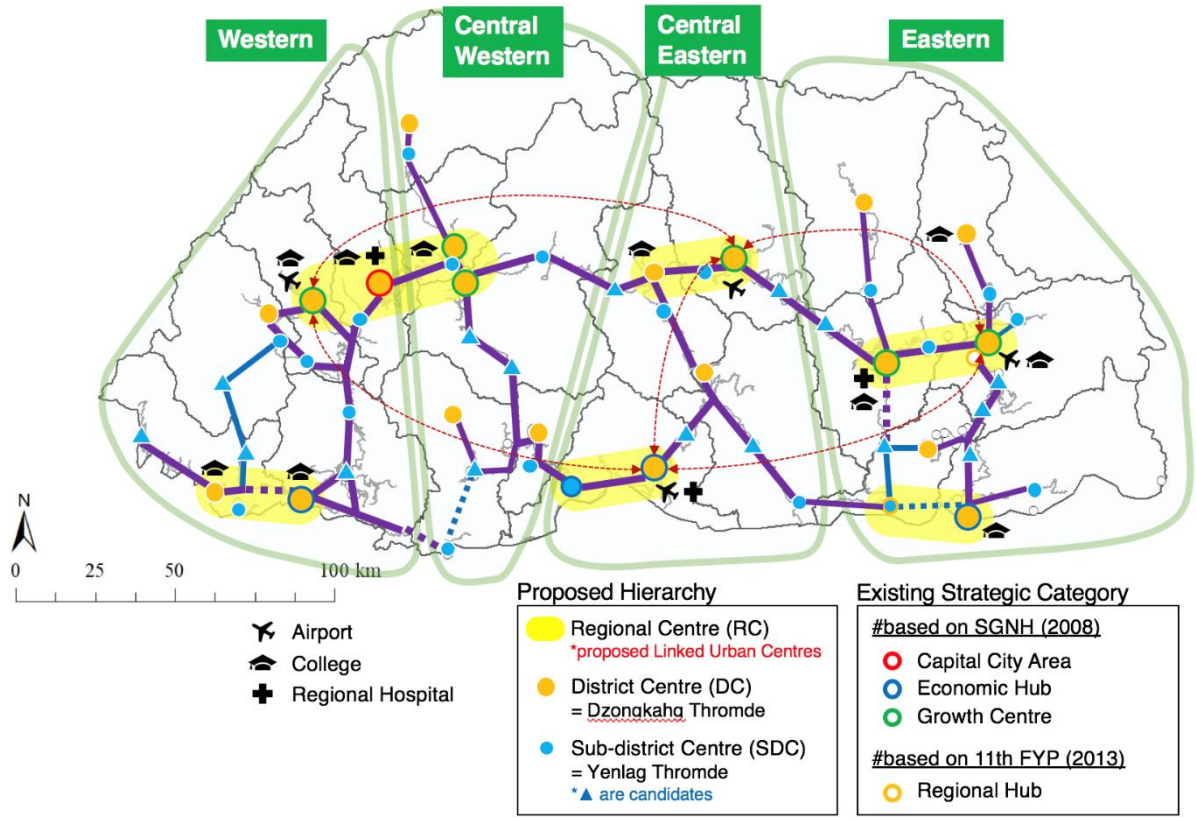


Figure 13.2.2 Hierarchical National Service Network

13.2.2 Service Delivery Network by Region

(1) Western Region

In the Western Region, there are two RCs (National capital Region and the Phuentsholing-Samtse Linked Urban Centre) and five DCs (Haa, Paro, Phuentsholing, Samtse and Thimphu). As mentioned in 13.1.3, the characteristic of the Western Region is that of a 'Business and Commercial Region'.

The National Capital Region includes Paro, Thimphu and part of the Central Western Region (Punakha and Wangduephodrang). Thimphu, the national capital, has the most advanced urban facilities, such as the headquarters of the Royal University of Bhutan, the National Referral Hospital, the National Stadium and the Supreme Court. The only international airport is located in Paro, the neighbouring city of Thimphu. Thus, in the National Capital Region, the service facilities are good enough. On the other hand, service delivery problems are caused by overpopulation. Especially in the centre of Thimphu Thromde, problems related to transport services, such as traffic jams and parking shortages, are serious.

The Southern Linked Urban Centre consists of Phuentsholing and Samtse. Phuentsholing has the second-largest population in Bhutan, and the most developed road connectivity with India. Although Samtse is also located next to the Indian border, it is only recently that Samtse has

been connected with the neighbouring Dzongkhags via the national highway.

The Primary Objective for 2025:

- The vision of the National Capital Region will be that of the 'Innovative and Green Capital Region', showcasing green technology. To achieve this goal, green technology-based facilities such as an electric public transport system should be installed.
- To improve roadside services, besides the existing yenlag Thromde, Gedu in Chhukha Dzongkhag and Sipsu in Samtse Dzongkhag can be specified as SDCs. In addition, two candidate towns for SDCs on the Haa-Samtse Highway should be taken into consideration.
- Interregional transport with the Central Western region depends on the only route available bypassing Dochula. Given the poor service delivery network, it is important to complete the Southern Highway between Chhukha and Dagana.
- The Gewogs of Soe, Naro and Lingzhi, located in the northern part of Thimphu Dzongkhag, are among the most isolated areas despite neighbouring the national capital. However, in order to minimize the environmental impact, the construction of the road in the protected area must be done sensitively. In the meantime, essential services based on existing GC should be sustained.

The Secondary Objective for 2030:

- If an adequate population is accumulated in the SDCs specified on the Haa-Samtse Highway, education and medical services, such as secondary school and BHU I facilities, should be located.
- In the above-mentioned Gewogs of Thimphu Dzongkhag and upstream areas of Haa and Paro Dzongkhag, OCs should be specified at appropriate sites. Furthermore, the transport of medicine and daily necessities by a UAV delivery system based at Paro Airport should be installed.

(2) Central Western Region

The Central Western region consists of one RC shared with the Western Region and five DCs (Dagana, Gasa, Punakha, Tsirang and Wangduephodrang). This region will be the 'Agro-production and R&D Region', as stated in 13.1.3.

Punakha and Wangduephodrang are included in the National Capital Region, as mentioned above. These two Dzongkhags are accessible from Thimphu via the national highway, and both of them are favoured for agriculture in geographical terms. Thus, agricultural R&D is taking place in collaboration with the College of Natural Resources in Punakha.

Regarding the other DCs in the Western Region, Gasa is the most challenging area, especially in terms of transport services. The Gewogs of Laya and Lunana have fragmented settlements and nomad people are isolated from service facilities. Dagana is also isolated because it is located in a dead end. The construction of highway leading to Chhukha is ongoing. On the other hand, Tsirang has a warm climate and good road connectivity between Wangduephodrang and Sarpang.

The Primary Objective for 2025:

- Punakha, Wangduephodrang and Lobeysa can be commuting towns for Thimphu, after advanced public transport systems, such as the Bus Rapid Transit with electric buses, are installed.

- The improvement in roadside services is necessary. The candidate towns for SDCs, including yenlag Thromdes, such as Damji in Gasa and Nobding in Wangduephodrang, must be developed.
- The highway from Dagana to Chhukha via Lhamoyzingkha should be completed. Then, Dagapela will be improved as one of the most important SDCs in this section.
- To break the dysconnectivity in Laya and Lunana Gewog in Gasa, a UAV transport system should be considered as one of the solutions. A pilot project for the proof of concept should be launched.

The Secondary Objective for 2030:

- The age group of 65+ years is increasing rapidly nationwide. Thus, Tsirang will be a suitable location for a healthcare centre for the retired elderly.
- Gasa will be also an appropriate site for a healthcare centre by exploiting the nationally famous hot spring there.
- If the pilot project for UAV delivery in Gasa succeeds, installing aviation transport by UAV should be completed as soon as possible.

(3) Central Eastern Region

The Central Eastern region has two RCs (Trongsa-Bumthang Linked Urban Centre and Sarpang-Gelephu Linked Urban Centre) and four DCs (Bumthang, Sarpang, Trongsa, and Zhemgang). This region is considered as the 'Tradition and Interaction Region'.

The Trongsa-Bumthang Linked Urban Centre is located on the East-West National Highway, and these two Dzongkhags are important in terms of traffic. Meanwhile, as the vision of the 'Interaction Tourism Destination' states in 13.1.3, Bumthang is one of the most attractive sites for tourism because of its historic religious temples/monasteries. Bathpalathang Airport in Bumthang is used as the gateway for international tourists at present.

The Sarpang-Gelephu Linked Urban Centre will be 'logistics hub for import/export products. Gelephu, the third-largest city in Bhutan, already has advanced urban functions and infrastructure, such as regional referral hospitals, direct road access to India and a domestic airport. In addition, Sarpang and Gelephu are connected by the most straight and flat highway in Bhutan. Residents can commute and cooperate with each other.

Zhemgang is not included in the linked urban centres mentioned above. In Zhemgang, there are still some isolated villages beyond the road network.

The Primary Objective for 2025:

- Ura in Bumthang can be a candidate town for the SDC, as well as Chendebji or another suitable site between Trongsa and Nobding (Wangduephodrang).
- An SDC on both the Gelephu-Zhemgang Highway and the Zhemgang-Panbang Highway should be specified and developed.
- The missing piece in the southern part of this region is a high-level education service such as a college. To sustain the rich nature and agricultural lifestyle there, an appropriately specialized college should be established in Sarpang or Zhemgang Dzongkhag.
- The northern part of Bumthang is found to be lacking in service facilities. The possibility of a UAV delivery system bas at Bathpalathang Airport should be taken into consideration.

The Secondary Objective for 2030:

- International flights from/to Gelephu Airport will be launched from perspective of regionally balanced development. Then, this region will be the only place that can access foreign countries both by land and by air.
- UAV delivery in collaboration with Bathpalathang Airport will be launched.

(4) Eastern Region

There are two RCs (Monggar-Trashigang Linked Urban Centre and Nganglam-Samdrupjongkhar Linked Urban Centre) and six DCs (Lhuentse, Monggar, Pemagatshel, Samdrupjongkhar, Trashigang, and Yangtse) in the Eastern Region. The vision of this region is that of the 'Science and Incubation Region', as mentioned in 13.1.3.

The Monggar-Trashigang Linked Urban Centre will be a 'centre of academic/science city with incubation facilities'.

Monggar has one regional referral hospital and one college, while Trashigang has one domestic airport, two colleges and one technical training institute. In Trashigang Thromde, Kanglung, a college-based town, was designated as a regional hub in the 11th FYP in 2013.

Regarding the Nganglam-Samdrupjongkhar Linked Urban Centre, Nganglam, a designated regional hub, is a representative town, where cement and related industries have accumulated. The rapid population growth has led to service supply shortages. Meanwhile, Samdrupjongkhar has direct road access to India, with roads to the western border area under construction.

The other DCs, Denchi (Pemagatshel), Lhuentse and Yangtse, have essential but insufficient service facilities. Denchi, the new Pemagatshel Dzongkhag Thromde, was established with a hydropower project. Although Lhuentse is famous for its textile and religious heritage, it is difficult for it to become a tourist destination because of poor accessibility. Meanwhile, Yantse has only one technical training institute called the Institute for Zorig Chusum.

The Primary Objective for 2025:

- After the construction of the Monggar-Nganglam Highway and Nganglam-Dewathang (Samdrupjongkhar) Highway is completed, the currently poor service delivery is expected to see remarkable improvements. Nganglam should be not only be associated as the centre of the mining industry but also become the service delivery hub in this region.
- The student capacity of Gyalpozhing College of Information Technology should be expanded, not only to extend learning opportunities, but also for implementing an ICT industry.
- By using Yongphula Airport, an experimental trial for UAV delivery in the highlands should be launched.

The Secondary Objective for 2030:

- Except for the Western Region, this region is considered as an accumulated area of tertiary education. Its colleges should be able to enter into a strong bond with each other. Interdisciplinary activities such as a student exchange programme can develop the sense of creativity and diversity.
- A practical UAV delivery service will be started as an international showcase of highlands transport.

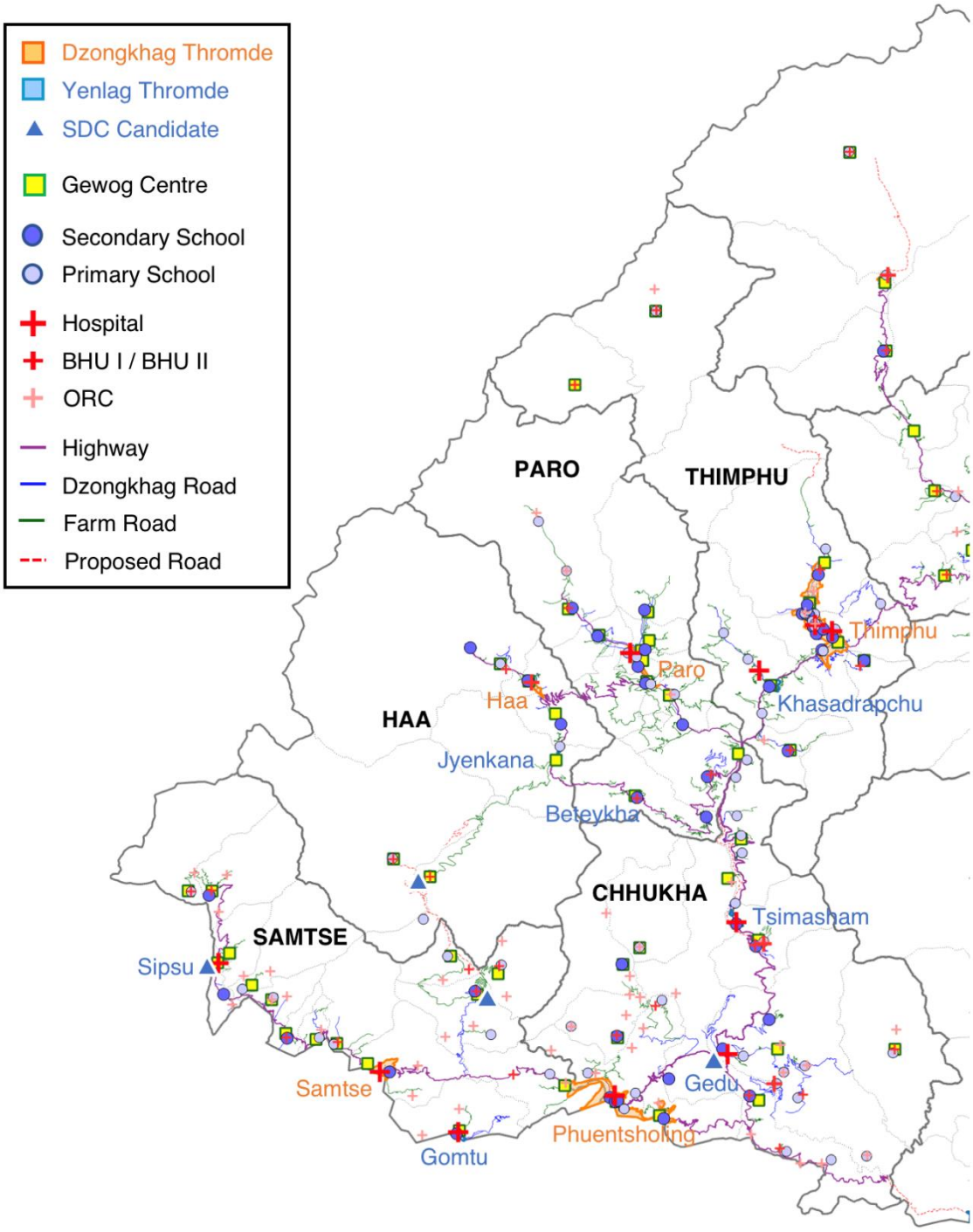


Figure 13.2.3 Service Delivery Network in the Western Region

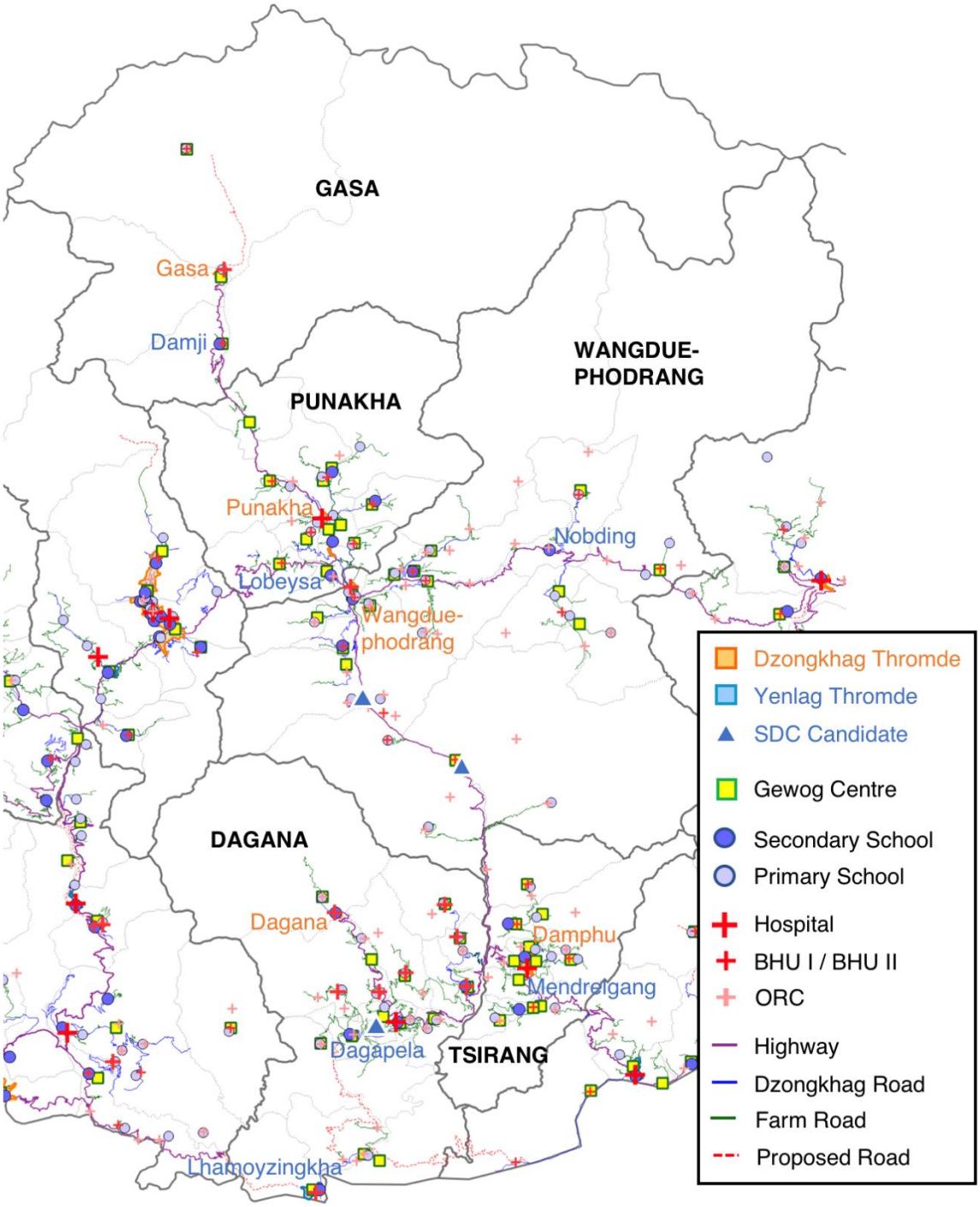


Figure 13.2.4 Service Delivery Network in the Central Western Region

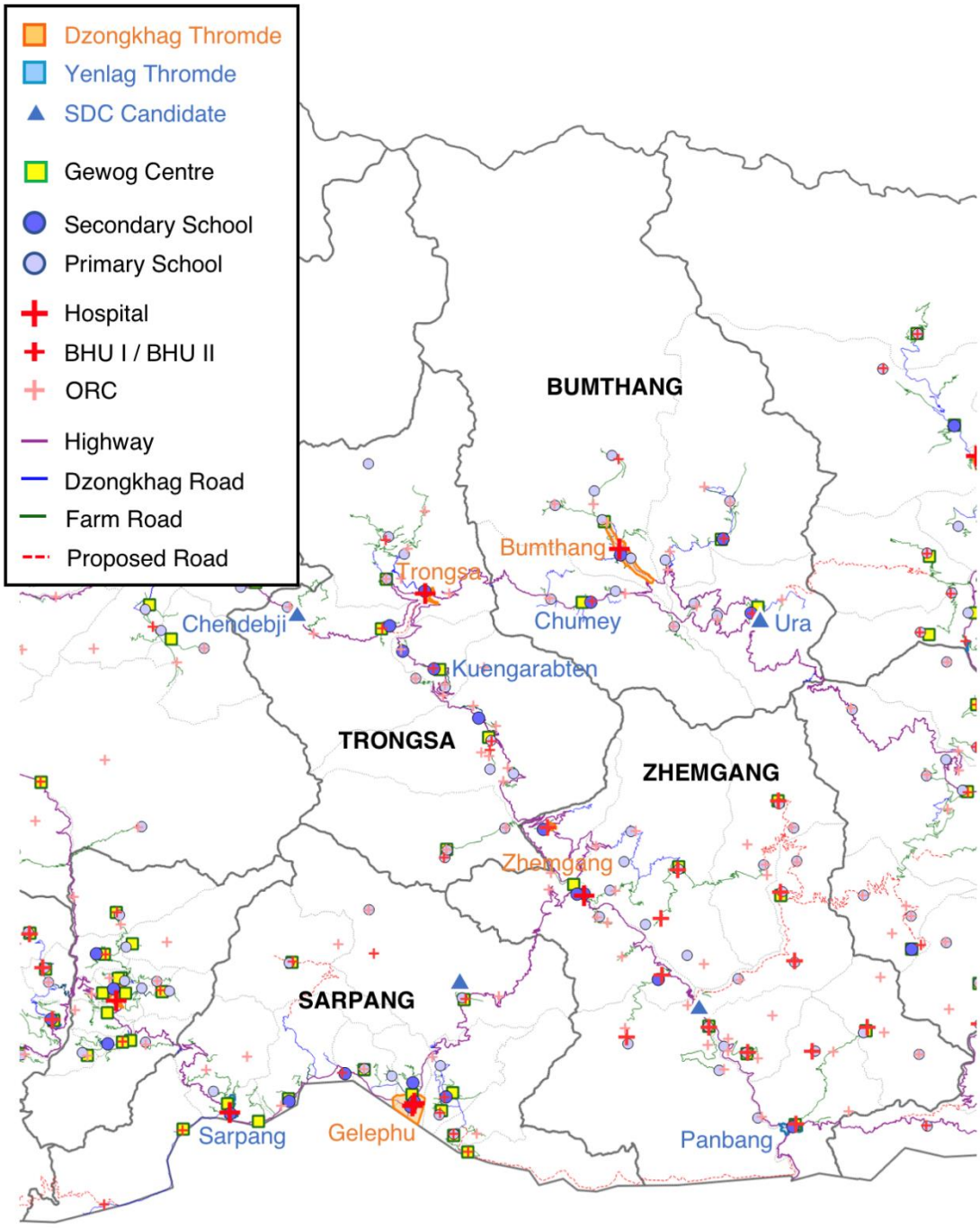


Figure 13.2.5 Service Delivery Network in the Central Eastern Region

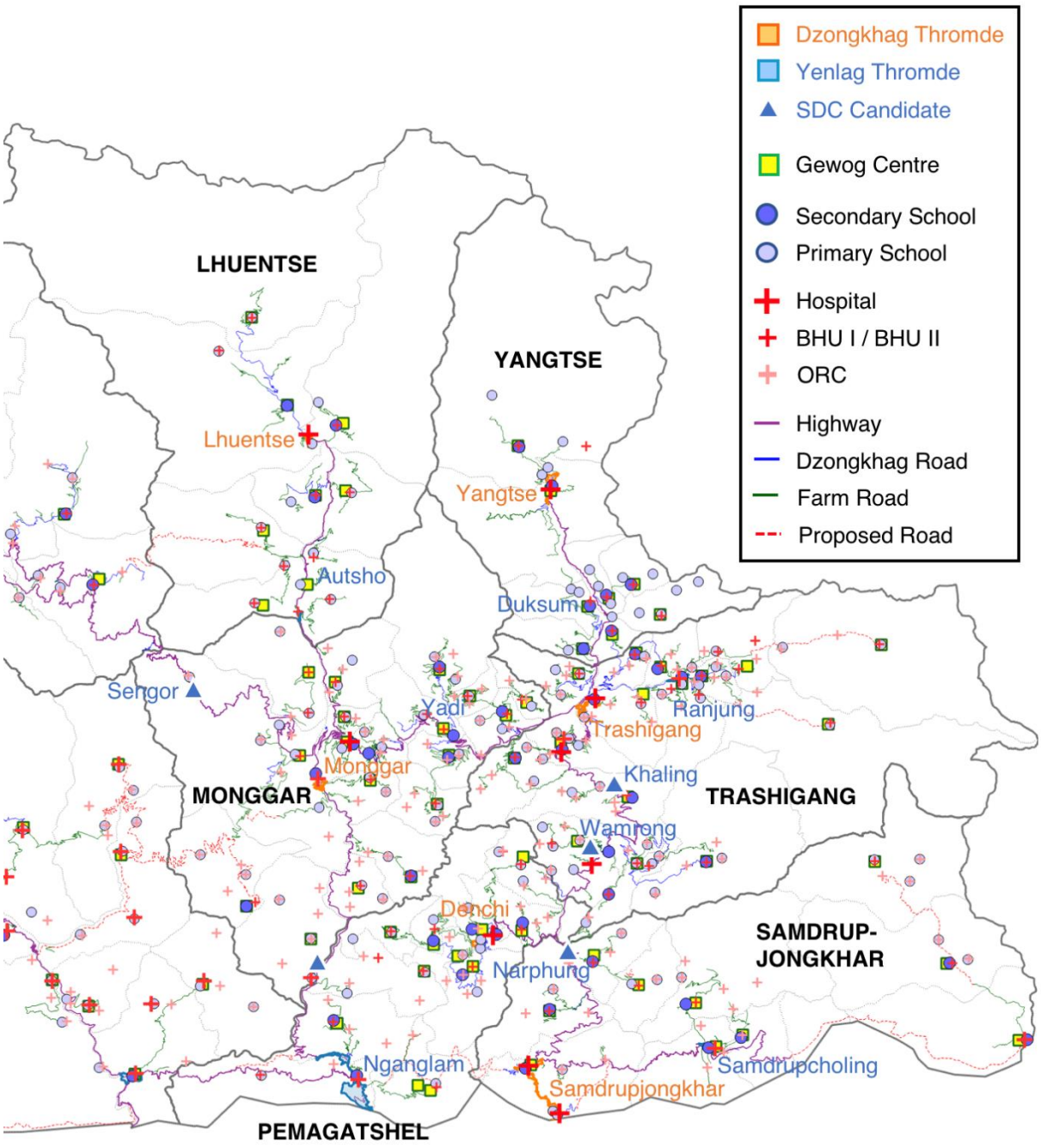


Figure 13.2.6 Service Delivery Network in the Eastern Region

CHAPTER 14 GENERAL GUIDANCE FOR URBAN AND RURAL DEVELOPMENT

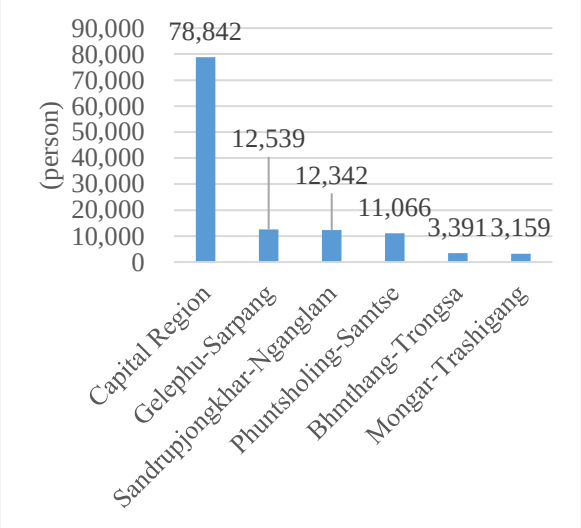
14.1 Creation of Livable and Vibrant Urban Area

14.1.1 Aims of Town Development

More than half of the total population will live in urban areas by 2030. Despite the government's attempt to vitalize the Rural Area, addressing issue of rural-urban migration will be challenging task. Figure 14.1.1 shows the estimated incremental population of the National Capital Region (NCR) and the Linked Urban Centres (LUCs) between 2017 and 2030. The Capital Region will receive the population increase of 78,842 persons. The LUCs will have population increase more than 3,100 persons in the same period. Thus the urban areas will need to prepare for increase in in-migrants and population expansion. The necessary preparation in the Urban Area includes providing good living places with well-organized public services and employment opportunities.

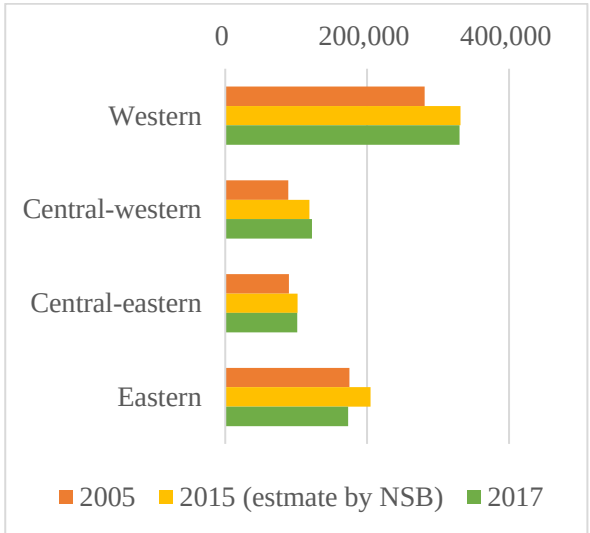
Figure 14.1.2 shows the estimated population by region in 2017 and 2030. The population in eastern region is estimated to decrease. Promotion of regions is required to enhance rural areas in the Eastern Region. This will reduce development pressure in towns.

The creation of the National Capital Region, the LUCs and the towns with the urbanization control area is recommended to manage the urban growth. The spatial plan for the NCR and the LUCs will be considered as the regional plan specified in the draft Spatial Planning Act, though the existing statutory system for the spatial plans does not specify the spatial plan of the regional level encompassing multiple towns. The urbanization control area will be integrated into a structure plan of thromdes and towns.



Source: NSB

Figure 14.1.1 Estimated Incremental Population of Capital Region and Linked Urban Centres between 2017 and 2030



Source: NSB

Figure 14.1.2 Population of each Region in 2005, 2017 and 2017

14.1.2 Approach for Town Development

The spatial plans for the National Capital Region, the linked urban centres and the towns with an urbanization management area will be formulated to reflect the local conditions of each planning area.

(1) Identification of Envisaged Function of Town

The main economic activities for each town should be determined by local government, local people and private companies. They should pursue comparative benefits for each town utilizing local resources. Since local people know the culture, tradition, available resources and local conditions, they must act as the driving forces for economic activities in their towns.

In the Project, the envisaged function of each LUC is examined in Section 12.2. At the Dzongkhag level, one of nine domains representing the characters of Dzongkhag is identified. The assessment is based on the SWOT analysis conducted by representatives of each Dzongkhag and during the 2nd stakeholder meeting of CNDP. Those results can be used to materialize the comparative advantages in each town.

(2) Study to Identify a Suitable Design for New Settlement Area

It is important to identify areas suitable for settlement in an urban area based on its requirement. Based on the requirement, agriculture areas may need to be converted to settlement area. However, the landscape should be designed based on the Bhutanese and its local context. The figure below shows typical forms of existing settlement areas. Among the typical forms, the top-left shows a settlement with small number of houses aggregated together beside a serviced road. The top-right shows individual houses scattered all over on a sloped area. The bottom-left shows mid-rise buildings allocated in a district with a grid-like road network. The bottom-right shows houses located along a road.

The landscape in and around the urban area is a critical aspect to present the local characters. The suitable form of new settlement area should be identified in each town. In the study for designing the settlement area, the elements representing the local landscape should be identified. Those elements may include the cultural assets, the agriculture lands and topography.

Small Settlement beside Main Road in Punakha
(Cluster Settlement)

Scattered Houses on Slope Area in Paro
(Scattered Settlement)

Planned Development in Bajo
(Grid)

Settlement along Main Road in Paro
(Linear Settlement)

Source: GoogleEarth for Imagery

Figure 14.1.3 Forms of Settlement in and around Urban Area

(3) Study to Establish the Service System

Each town will be the core of service system with administrative functions and will cater to its surrounding areas. Due to the small population size, the interlinks between towns are essential in order to create an efficient service system in Bhutan. The LUCs will be in line with this concept. The LUCs will be expected to serve the public services in surrounding areas. It is important to formulate a holistic service system at the regional level.

(4) Powers and Functions of Dzongkhag

Dzongkhag will be responsible for the Regional Spatial Plan and Local Spatial Plans within its jurisdiction, except those areas for which Dzongkhag Thromde is responsible. As specified in the Spatial Planning Bill of Bhutan, the Local Spatial Plans comprise of Valley Development Plans, Structure Plans, Local Area Plans and Action Area Plans. The local government including Dzongkhag and Thromde will be prepare the Local Spatial Plans and administer the procedures for their approval.

14.1.3 Projects for Urban Area and Regional Promotion

The candidate project for the Urban Area and regional promotion is listed below. The projects for the Urban Areas aim to counter the issues of the rapid population increase in a town and the rapid out-migration of a region.

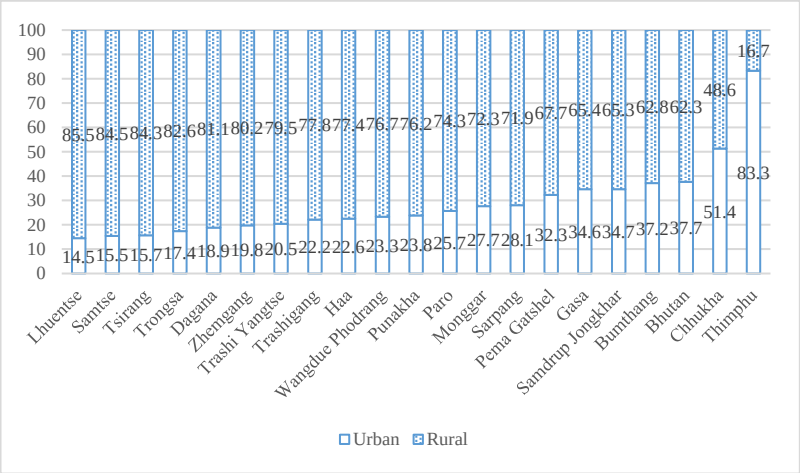
- Capital Region Development Programme (including inland transport improvement)
- Eastern Region Development Programme
- Formulation of the Structural Plan to Apply Urbanization Management Areas

- Project for Development of Linked Urban Centres including Public Service and Infrastructure Improvement in Gelephu and Sarpang
- Development of LUCs
- Project of Land Use Zoning and Instructional Improvement in Thimphu, Phuentsholling and Gelephu

14.2 Creation of Livable Rural Area

Although the land of Bhutan is not vast, its natural environmental conditions are highly diverse because its territory ranges between 100 m and 7,570m a.s.l. The rural area dominates the country in terms of surface area size, with more than 62% of population living there (2017 PHCB). Although the rural area is still dominant in terms of demography and physical area, urbanization has been rapidly progressing.

Demographic distributions vary by dzongkhag. Thimphu has the largest population, with over 138,000 people, or a 19.1% share. This population is 35 times larger than that of Gasa, with 4,000 people, or a 0.5% share. As 55% of the urban population is concentrated in the two dzongkhags of Thimphu and Chhukha (2017 PHCB), their distribution of urban and rural populations is different from that of the other 18 dzongkhags.



Source: 2017 Population & Housing Census of Bhutan

Figure 14.2.1 Percentage of Population by Area and Dzongkhag, Bhutan 2017

Agricultural and livestock activities are the major employment sources in the rural area. This means that the rural area is indispensable for food production.

The rural area also plays an important role in maintaining and conserving renewable natural resources including vegetation, wildlife and rivers. In addition, a broad range of cultural and religious events and heritage is rooted in rural communities; hence, the rural area is crucially important for Bhutanese society.

14.2.1 Envisaged Lifestyle in the Rural Area

(1) Recent Situations

As early as 2005, the rural-urban migration issue was reported by the Ministry of Agriculture , but the rural population decline indicates that rural-urban migration, particularly involving young people, is continuing. About 62% of the national population still lives in the rural area (2017 PHCB), as compared to 2005 PHCB data which stands at 69%.

In addition, prices for some farm produce are greater than those of produce imported from India because of the duty-free policy between the two countries. Hence, cheaper Indian farm produce is flowing into Bhutan and are becoming more popular than domestic produce. This is one of the major explanations for the decrease in income levels of domestic farmers.

Therefore, many farmers do not want their children to take over their farming occupation. (Civil service is still the most preferred professional choice due to its stability.)

As a result, (1) there are increase in abandoned farmlands due to labour shortages and migration of the whole household from the rural to urban and (2) the population is rapidly ageing in rural communities, hence (3) human vitality in the rural area has become weaker than before. If this situation continues, some rural settlements may not be able to maintain their communities, which in turn may force administrative bodies to reorganise chiwogs/gewogs. The chart below indicates various possible negative consequences derived from further rural-urban migration.

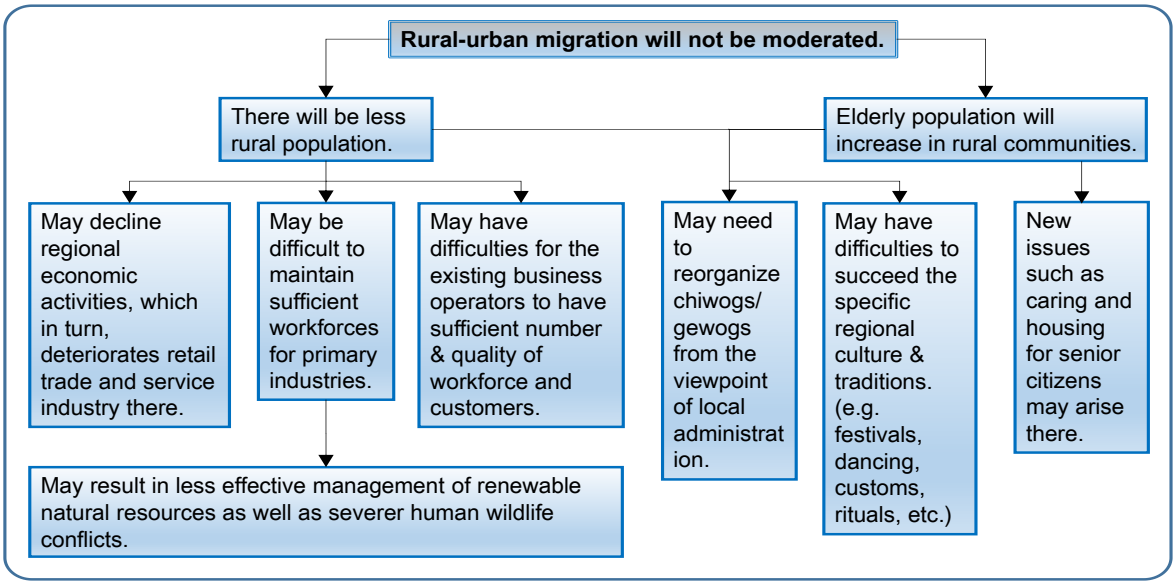


Figure 14.2.2 Possible Negative Consequences by Further Rural-Urban Migration

(2) Envisaged Lifestyle in the Rural Area

In Japan, where secondary industries started to develop in the 1960s, the mainly young workforce moved from the Rural to the Urban Area in order to take up jobs in these industries including manufacturing and construction. The rural-urban migration issue has become increasingly serious ever since, along with rapidly ageing society, which remains unresolved in many rural villages. In Bhutan, the development of secondary industries is happening at a relatively lower pace and there are limited job opportunities in the industrial sector. Hence, high youth unemployment in the Urban Area is one of the key concerns in the country.

Although rapid rural-urban migration had been focused as an important issue in Bhutan, issue of desirable lifestyle in rural area under the recent economic development has not been discussed elaborately. It is assumed that the desirable lifestyle in rural area is likely to be different from the one in urban area on various aspects. Ultimately, either in urban or rural area, the desirable lifestyle depends on individual value and/or personal perspective. It is also assumed that it varies according to location and altitude. The desirable life style in rural highland is probably different from the one in rural lowland. To realise the desirable lifestyle in rural area in future, it is important to firstly define what a desirable lifestyle in rural area is in accordance to different classification.

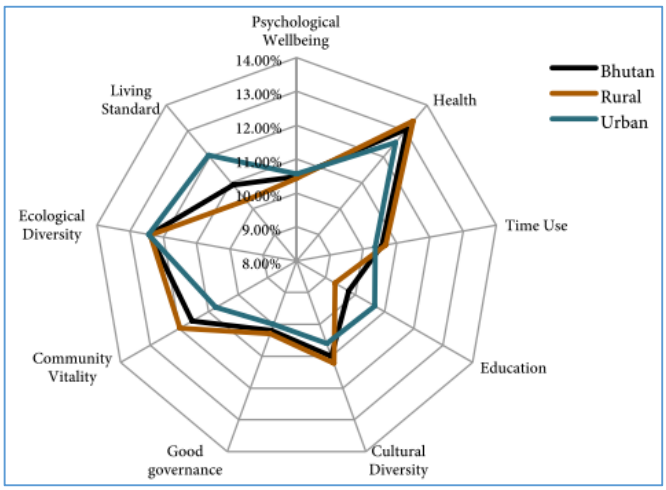
A desirable lifestyle in the Rural Area can be defined as “living in a reasonable house located in a rich natural environment and with a decent household income which is enough to purchase of necessary daily goods and food”. Further discussions should be conducted by the government, but the living conditions in the Rural Area, comparatively to those in the Urban

Area, are regarded as an important parameter which needs improvement in order to realize a desirable lifestyle for rural residents, as highlighted in the 2015 GNH Survey Report. As shown in Box 14.2.1, as well as in Chapter 3, differences in the GNH Index between the Urban and the Rural Areas are found in two specific domains, namely, living standards and education[1].

From the latest statistical data (2017 Population & Housing Census of Bhutan and others), clarification on the gaps between rural and urban areas are shown (Box 14.2.2).

Box 14.2.1 GNH Index by area

The GNH Index is a comprehensive and holistic index derived from nine domains with 33 indicators. It provides a good indicator of whether or not certain groups are satisfied with many aspects of their life; hence, it can be used to improve various conditions in the rural area in comparison to data on the urban area.



Source: 2015 GNH Survey Report

Figure 14.2.3 Percentage Contribution of Sufficiency of Each Domain to Overall GNH Index, by Area

Figure 14.2.3 indicates the percentage contribution of sufficiency of each domain to overall the GNH index by area. Among the nine domains, the difference between the urban and the rural areas is distinct in two domains, namely, living standards and education. The average GNH index in the rural area is 0.731 while it is 0.811 in the urban area (national average: 0.756). Therefore, it can be stated that the fairly large difference between the urban and the rural areas mainly results from the domains of living standards and education.

[1] The education domain comprises literacy (3/10), schooling (3/10), knowledge (1/5) and value (1/5); and the living standard domain comprises income (1/3), assets (1/3) and housing (1/3).

Box 14.2.2 Gaps between the Rural and the Urban Areas

Utilities

In general, Bhutan produces its own electricity from hydropower plants, due to abundant water resources. Electricity is widely used for lighting in both rural (95%) and urban (99%) areas. The main source of energy for cooking is also electricity in both rural (93%) and urban (98%) areas. There is very minimal gap in terms of usage of electricity between the urban and rural areas (2017 PHCB).

In both the Rural and the Urban Areas, piped water is the main source of drinking water (97-99%). But in-house piped water is available in 76% of the Urban Area, but only 32% of the rural area. Piped water outside a dwelling is available in 66% of the rural area but only 24% of the Urban Area. Even in the rural area, where two thirds of households have access to piped water outside their dwelling, 98% of them can access these piped water facilities within 30 minutes, which imply that accessibility to water is quite good across the country (2017 PHCB).

Housing conditions

In the rural area, nearly three quarters of households have their own house, while 50% of urban households live in rented houses. The situation regarding house occupancy seems to be better in the rural area (2017 PHCB).

A flush toilet is used in nearly 77% of total households. In the Urban Area, 89% of households use a flush toilet. A flush toilet, where as it is available to about 70% of rural residents, which is 19% lower than the urban figure. (However, the national average, 77%, is much better than that of Nepal, i.e., 44%, shown in the Nepal Annual Household Survey 2015/16.) Latrines are still used by 7% of urban dwellers and 22% of rural residents (2017 PHCB).

As for external wall materials, cement and reinforced concrete construction (RCC) are majorly used (58% of all materials) in the Urban Area. In the rural area, only 17% of the houses are constructed using cement and RCC, whereby stone and bamboo wall houses are still dominant at 57%. Cement and RCC have been mostly used in recently constructed houses or apartments in both the Urban and the rural areas, while there are still many traditional houses made of stone and bamboo which are inherited from ancestors in the rural area. In the Urban Area, cement, concrete and terrazzo are mainly used (53% of all floor materials), but these are used in only 31% of households in the rural area. Planks and shingles are common materials used in the rural area (50%). In terms of roof material, more than 90% of houses in both the Urban and the rural areas are roofed with metal sheets. Very few houses are roofed with other materials, and there are no significant differences between the urban and the rural areas (2017 PHCB).

Health services

About 90% of households in both the Rural and the Urban Areas visited a health facility during the last 12 months. Due to the steep geographical features and poor road conditions, rural residents take more time, i.e., 84 minutes, to reach their nearest healthcare centre, compared to urban residents, i.e., a 26-minute journey, according to the 2015 GNH Survey Report, though 90% of rural households visited a health facility in the last 12 months (2017 PHCB).

Indicators of child mortality show that this is still higher in the rural area compared to the Urban Area. For instance, mortality rate of children under five in the rural area is

61-75% higher than in the urban area (2017 PHCB).

Transportation

Road accessibility, which is measured by time taken to reach the nearest road, seems to be good in both the urban and the rural areas: with less than 30 minutes in 99% of the Urban Area and 87% of the rural areas. There are still 13% of rural households which take more than 30 minutes to reach the nearest road head (2017 PHCB).

In the 2017 Bhutan Living Standards Survey (2017 BLSS), accessibility to various facilities is shown as per facility type. Only about 20% of the rural residents can access a bus station, police station, petrol station and post office within 30 minutes, compared to 78-83% of urban residents. Access to the nearest road is almost the same in the Rural and Urban Areas, but access to various public facilities is still far behind in the rural area.

Asset ownership

The ownership rates for common assets, such as land (72%), housing (58%) and livestock (49%), are much higher in the rural area, while ownership rates for common assets, such as a fridge (73%), a sofa (62%), a washing machine (38%) and a vehicle (33%), are much higher in the Urban Area. In general, the ownership rates for individual assets (including a wristwatch, a camera, a silk gho/kira) are significantly higher in the Urban Area than in the rural area. A probable reason for the low ownership rates of electrical appliances and individual assets in the rural area could be that rural residents cannot easily buy these products due to their high prices (2017 PHCB).

Education and environment

Accessibility to various education facilities in the rural area is still lower than in the Urban Area. Nearly 90% of urban residents can reach the nearest school/extended classroom within 30 minutes, but, in the rural area, those who can access the nearest school/extended classroom within 30 minutes represent less than 60%. Similar tendencies are observed in relation to early childhood care and development or day care and non-formal education centres (2017 BLSS).

Environmental issues are different in the Rural and Urban Areas. As expected, 61% of the rural population are affected by wild animals. In the Urban Area, most people are affected by waste disposal and air pollution because of the concentration of urban dwellers (2015 GNH Survey Report).

14.2.2 Approach for Rural Development

Two approaches proposed for rural development are: 1) improvements in living conditions and 2) intangible (non-structural) measures.

(1) Improvements in Living Conditions (Public Facility Development)

In general, the standard of living in Bhutan has improved over time. Accessibility to fundamental facilities, such as water supply, electricity and roads, is relatively high in both urban and rural areas with no significant differences.

However, as observed above, many indicators in the rural area are inferior to those in the Urban Area. There are still some gaps, such as in terms of accessibility to various facilities such as medical/health services, housing conditions, asset ownership and environmental issues which indicate that further improvements are necessary to realize a liveable rural area

in Bhutan. In addition, improvements in living conditions are considered as a practical approach to improve the GNH Index levels in the rural area. In the next section, some dzongkhags and gewogs are prioritized for development interventions according to items.

1) Electrification

According to the 2017 PHCB, rural electrification is progressing by and large. However, there are two dzongkhags where the non-electrification rate is significantly higher than in others, i.e., Gasa and Zhemgang, as shown below.

Table 14.2.1 Mean Rate of Non-electrification Households for Lighting by Dzongkhag and Area

Dzongkhag	Bumthang	Chhukha	Dagana	Gasa	Haa	Lhuentse	Monggar
Total	2.5%	3.3%	4.1%	24.8%	5.8%	2.5%	3.8%
Urban	1.5%	1.4%	1.1%	0.7%	1.7%	0.6%	0.8%
Rural	3.2%	5.4%	4.6%	35.5%	6.9%	2.8%	4.6%
Dzongkhag	Paro	Pemagatshel	Punakha	Samdrupjongkhar	Samtse	Sarpang	Thimphu
Total	1.4%	3.0%	1.7%	5.3%	5.0%	3.4%	1.7%
Urban	1.3%	1.3%	1.5%	1.4%	1.0%	1.2%	1.0%
Rural	1.4%	3.6%	1.8%	7.2%	5.8%	4.3%	5.4%
Dzongkhag	Trashigang	Yangtse	Trongsa	Tsirang	Wangdueph odrang	Zhemgang	Bhutan
Total	3.0%	2.4%	0.8%	2.9%	2.8%	11.6%	3.4%
Urban	0.7%	1.5%	4.2%	0.5%	1.1%	0.8%	1.1%
Rural	3.5%	2.5%	2.9%	3.3%	3.4%	14.3%	4.7%

Source: 2017 Population & Housing Census of Bhutan

In Gasa, Lunana Gewog is considered to be the highest target area for electrification, since only one household out of 177 has electricity for lighting as of 2017. The second target area is Laya Gewog, where 41 households out of 241 have no access to electricity for lighting.

In Zhemgang, there are six gewogs where the non-electrification rate for lighting is over 10%: Bardo, Shingkhar, Bjoka, Goshing, Ngangla and Phangkhar. Among them, Phangkhar Gewog is the highest priority area since the non-electrification rate for lighting exceeds 30%, with 90 households living without electricity, followed by Ngangla Gewog with 79 non-electrification households, representing 18% of the total number of families.

In addition, there are more than 20 gewogs with a non-electrified household rate of over 10% for lighting, as summarized in the table below. Even though the non-electrification rates of these dzongkhags are relatively low, electrification development in them is considered as urgent if living conditions are to be improved there.

Table 14.2.2 List of Gewogs Where the Non-electrification Household Rate for Lighting Is Over 10%

Dzongkhag	Gewog
Chhukha	Geling (19.3%), Getana (13.4%)
Dagana	Nichula (20.1%), Dorona (11.3%)
Gasa	Lunana (99.4%), Laya (17.0%)
Haa	Gakiling (33.0%), Sangbay (10.2%)
Monggar	Gongdue (14.2%), Na-Rang (12.1%), Shermuhoong (11.4%), Silambi (11.0%)
Pemagatshel	Zobel (15.2%)
Samdrupjongkhar	Wangphu (18.5%), Lauri (13.1%)
Samtse	Dophuchen (13.6%), Norgaygang (13.6%)
Sarpang	Senggey (12.2%), Chhudzom (10.9%)
Thimphu	Naro (97.7%), Lingzhi (96.7%), Soe (13.5%)
Wangduephodrang	Kazhi (15.6%), Darkar (12.4%)
Zhemgang	Phangkhar (31.4), Bjoka (23.2%) Ngangla (17.8%), Bardo (12.1%), Shingkhar (11.9%), Goshing (11.6%)

Source: Calculated based on the 2017 Population & Housing Census of Bhutan

2) Water supply

Drinking water is basically supplied by pipes in most of the rural area. The availability of piped water, either inside or outside the dwelling, was nearly 97% for the rural area in 2017. This means that, except for those who live in very remote places, drinking water supplied by pipes is available across the country.

Table 14.2.3 Rate of Piped Water Accessibility by Dzongkhag and Area

Dzongkhag	Bumthang	Chhukha	Dagana	Gasa	Haa	Lhuentse	Monggar
Total	98.7%	97.3%	97.2%	95.0%	97.2%	98.8%	97.1%
Urban	99.1%	99.4%	98.8%	99.6%	99.3%	99.7%	99.6%
Rural	98.4%	94.9%	96.9%	93.0%	96.7%	98.7%	96.4%
Dzongkhag	Paro	Pemagatshel	Punakha	Samdrupjongkhar	Samtse	Sarpang	Thimphu
Total	98.3%	97.5%	97.3%	97.6%	97.6%	98.7%	99.2%
Urban	99.3%	99.0%	99.1%	99.1%	99.9%	99.7%	99.5%
Rural	97.9%	96.9%	96.8%	96.9%	97.2%	98.3%	97.6%
Dzongkhag	Trashigang	Yangtse	Trongsa	Tsirang	Wangduephodrang	Zhemgang	Bhutan
Total	98.3%	98.3%	97.7%	97.2%	97.4%	96.5%	98.0%
Urban	99.7%	99.7%	99.1%	99.2%	99.6%	99.7%	99.4%
Rural	98.0%	98.0%	97.4%	96.9%	96.6%	95.7%	97.1%

Source: 2017 Population & Housing Census of Bhutan

The piped water accessibility rate in the rural area is only below 95% in Chhukha and Gasa. In Chhukha, six out of its 11 rural gewogs recorded less than 95% availability, namely, Chapchha, Doongna, Geling, Loggchina, Maedtabkha and Phuentshogling. Chapchha Gewog had the lowest rate at 87%, meaning water supply works should be prioritized for this gewog. In Gasa, Lunana Gewog is again considered to be the highest target area for water supply with lowest accessibility rate at 82%.

Furthermore, in 12 dzongkhags, there are 26 gewogs (including Mongling Town in Pemagatshel) where the piped water accessibility rate is below 95%, as shown below. The mean dzongkhag piped water accessibility rate for these dzongkhags is high, but there are still some households that cannot access piped water in these specific gewogs. The development of a piped water system in these gewogs is important to improve living conditions in the rural area.

Table 14.2.4 List of Gewogs Where the Piped Water Accessibility Rate Is Less Than 95%

Dzongkhag	Town and Gewog
Chhukha	Chapchha (86.8%), Phuentshogling (93.4%), Maedtabkha (93.6%), Geling (93.6%), Doongna (94.6%), Loggchina (94.9%)
Dagana	Lhamoi Dzingkha (88.1%), Nichula (91.0%), Drukjeygang (92.3%)
Gasa	Lunana (81.9%)
Haa	Gakiling (89.9%)
Monggar	Jurmed (73.6%), Na-Rang (87.9%), Kengkhar (89.2%)
Pemagatshel	Mongling Town (18.2%), Zobel (92.0%), Chongshing (93.6%)
Punakha	Guma (90.1%), Chhubu (93.9%)
Samdrupjongkhar	Gomdar (92.6%)
Samtse	Phuentshogpelri (93.1%), Tading (93.4%), Yoeseltse (94.2%)
Sarpang	Chhuzanggang (94.5%)
Thimphu	Naro (40.9%), Lingzhi (82.6%), Soe (89.2%)
Tsirang	Sergithang (89.7%), Tsirang Toed (94.8%)
Wangduephodrang	Kazhi (85.0%), Darkar (93.3%)
Zhemgang	Ngangla (93.7%), Phangkhar (94.8%)

Source: Estimated based on the 2017 Population & Housing Census of Bhutan

3) Toilet

Flush toilet is regarded as one of the barometers of a modern society. Based on the data from the 2017 PHCB, the number of households with a flush toilet has been counted and the usage rate of a flush toilet has been calculated from the number of total households by dzongkhag and area of residence. Among the 20 dzongkhags, Monggar has the highest rate at 90%, followed by Samdrup Jongkhar (88%) and Thimphu (87%). On the other hand, Bumthang records the lowest rate with 18%, followed by Gasa (31%) and Trashiyangtse (59%).

Table 14.2.5 Flush Toilet Usage Rate by Dzongkhag and Area

Dzongkhag	Bumthang	Chhukha	Dagana	Gasa	Haa	Lhuentse	Monggar
Total	18.0%	76.7%	61.8%	31.1%	69.1%	78.8%	90.3%
Urban	19.7%	92.1%	83.7%	65.4%	92.1%	82.5%	95.4%
Rural	16.9%	59.4%	57.9%	15.9%	63.2%	78.3%	88.8%
Dzongkhag	Paro	Pemagatshel	Punakha	Samdrupjongkhar	Samtse	Sarpang	Thimphu
Total	75.8%	83.1%	62.2%	88.1%	80.9%	81.9%	87.1%
Urban	89.2%	92.8%	88.8%	93.0%	94.1%	92.1%	89.9%
Rural	71.0%	79.2%	55.3%	85.6%	78.3%	77.8%	72.7%
Dzongkhag	Trashigang	Yangtse	Trongsa	Tsirang	Wangduephodrang	Zhemgang	Bhutan
Total	73.6%	59.4%	63.3%	73.7%	79.3%	60.9%	76.8%
Urban	93.3%	90.0%	87.7%	94.7%	92.0%	85.8%	89.0%
Rural	69.7%	52.6%	56.9%	70.7%	74.7%	54.9%	69.6%

Source: 2017 Population & Housing Census of Bhutan

In the rural area, the flush toilet usage rate is lower than in the Urban Area for all dzongkhags. The lowest usage rate was found in Gasa at 16%, followed by Bumthang (17%) and Trashiyangtse (53%). As the national average for the flush toilet usage rate in the rural area is nearly 70%, the low rates in the latter two dzongkhags represent less than one quarter of the national average. The introduction of the flush toilet in the rural area in these two dzongkhags is important to improve the living conditions there, which will contribute to improvement in the GNH Index in the rural area.

In Gasa, Lunana Gewog is considered as a priority area for intervention as the flush toilet

usage rate is merely 1% as of 2017. Laya Gewog is the second target area where the usage rate is only 10%. These two gewogs are hometowns of highlanders.

In Bumthang, the usage rate is lower than 20% in three out of its four rural gewogs, namely, Chhoekhor (15%), Ura (16%) and Tang (17%). The usage rate in Tang Gewog is slightly higher at 21%, but this is still far below the national average. In addition, the usage rates in the two urban towns in Bumthang (Bumthang Town and Chhumig Town) are only 20% and 15%, respectively. As a whole, flush toilet introduction should be pursued in all gewogs and towns in Bumthang.

In addition to the areas in Gasa and Bumthang, there are three gewogs with low flush toilet usage rates (less than 20%), as clarified in the table below. The introduction of the flush toilet in these gewogs is important development activity to improve the sanitary conditions.

Table 14.2.6 List of Gewogs with a Low Flush Toilet Usage Rate

Dzongkhag	Gewog
Bumthang	Chhoekhor (15.0%), Chhumig Town (15.3%), Ura (16.1%), Chhumig (17.0%), Bumthang Town (19.3%)
Chhukha	Getana (6.4%)
Gasa	Lunana (1.1%), Laya (10.4%)
Haa	Gakiling (19.8%)
Thimphu	Naro (6.8%)

Source: Estimated based on the 2017 Population & Housing Census of Bhutan

4) Health facilities

Good health services are among the most important public services to foster a healthy and happy life in both the Urban and the rural areas. The 2017 PHCB data reveal that Tsirang (5%) has the lowest portion of households that have not visited a health facility during the past year, followed by Bumthang (6%) and Sarpang (7%); the national average is 10%. This can be explained by the fact that a health facility is highly accessible to most people in these dzongkhags. On the other hand, Gasa (16%) has the highest portion of households that have not visited a health facility during the past year, followed by Haa, Samdrupjongkhar, Chhukha, Trongsa and Trashiyangtse (all at 12%).

Table 14.2.7 Proportion of Households that Did Not Visit a Health Facility During the Past Year by Dzongkhag and Area

Dzongkhag	Bumthang	Chhukha	Dagana	Gasa	Haa	Lhuentse	Monggar
Total	6.1%	11.6%	8.8%	16.0%	12.2%	9.4%	9.1%
Urban	7.0%	10.7%	12.7%	24.6%	11.7%	5.8%	7.3%
Rural	5.5%	12.6%	8.1%	12.1%	12.3%	9.9%	9.6%
Dzongkhag	Paro	Pemagatshel	Punakha	Samdrupjongkhar	Samtse	Sarpang	Thimphu
Total	10.0%	11.0%	9.0%	11.8%	10.8%	6.6%	10.3%
Urban	8.1%	9.5%	9.7%	9.1%	8.1%	7.1%	10.2%
Rural	10.6%	11.7%	8.9%	13.2%	11.3%	6.3%	10.6%
Dzongkhag	Trashigang	Yangtse	Trongsa	Tsirang	Wangdueph odrang	Zhemgang	Bhutan
Total	9.1%	11.5%	11.5%	5.4%	11.4%	8.1%	9.9%
Urban	8.2%	9.7%	9.2%	6.0%	9.2%	6.1%	9.6%
Rural	9.3%	11.9%	12.2%	5.3%	12.2%	8.6%	10.2%

Source: 2017 Population & Housing Census of Bhutan

In the rural area, the national average is 10%, while the range is from 5% in Tsirang to 13% in Samdrupjongkhar. In comparison with the data on flush toilet usage, the differences between

dzongkhags are relatively small. This may mean that the health services in the rural area are evenly distributed, to a great extent, at the dzongkhag level.

But the detailed data at the town and gewog level seem to be slightly different. There are three towns and 12 Gewogs that record a rate of over 20%, as shown in the table below. The highest proportion (35%) is recorded in Tangsibji, Trongsa, followed by Yadi Town, Monggar, at 33%.

Table 14.2.8 List of Towns and Gewogs with a High Proportion of Households that Did Not Visit a Health Facility During the Past Year

Dzongkhag	Town and Gewog
Chhukha	Chapchha (23.5%)
Dagana	Nichula (20.9%)
Gasa	Gasa Town (27.9%), Lunana (22.5%)
Haa	Gakiling (28.8%), Jyenkana Town (20.9%)
Monggar	Yadi Town (32.9%), Silambi (22.7%), Chhaling (20.9%)
Pemagatshel	Zobel (27.0%)
Samtse	Phuentshogpelri (22.1%), Namgyalchhoeling (20.7%)
Samdrupjongkhar	Samrang (25.5%)
Thimphu	Naro (25.0%)
Trongsa	Tangsibji (34.9%)

Source: Estimated based on the 2017 Population & Housing Census of Bhutan

As a dzongkhag, Monggar records 9%, lower than the national average, but there is a town and two Gewogs with relatively high proportions (21-33%). There are also three dzongkhags, namely, Gasa, Haa and Samtse, which have two areas where the discussed proportion of household that did not visit health facility during past year is more than 20%. Therefore, development of health services should be prioritized in the high proportion areas within these dzongkhags.

Lastly, when the average figure in the rural area is compared with that in the Urban Area in each dzongkhag, it is not always higher than in the Urban Area. For instance, the Urban Area in Gasa records 25%, but the figure in the rural area is less than half of that, at 12%. The differences are not so large but there are five other dzongkhags where the urban data show higher rates than in the case of the rural data. This may imply that there are other reasons why people there do not visit a health facility (e.g., people are healthier than those in other gewogs or the nearest health facility is too far to visit). In fact, the 2015 GNH Survey results indicate that the average walking time to reach a health centre in the rural area was 84 minutes, while it was only 26 minutes in the Urban Area. As detailed data at the dzongkhag and gewog level are not available from the 2015 GNH Survey, therefore it is difficult to perform further analysis.

5) Road accessibility

According to the 2017 PHCB, accessibility to the nearest road head is quite good at the national level, since 92% of households take around 30 minutes to reach it. However, there are large differences between dzongkhags. People in Gasa are worse off, as 46% of people take more than 30 minutes to reach the nearest road head, followed by Zhemgang at 22%, and Trashiyangtse at 21%. These three dzongkhags are prioritized for road accessibility improvements.

Table 14.2.9 Proportion of Households that Take More Than 30 Minutes to Reach the Nearest Road Head by Dzongkhag and Area

Dzongkhag	Bumthang	Chhukha	Dagana	Gasa	Haa	Lhuentse	Monggar
Total	1.4%	9.2%	9.2%	46.0%	12.4%	11.4%	7.7%
Urban	0.3%	1.8%	2.0%	0.0%	0.0%	0.0%	0.4%
Rural	2.1%	17.5%	10.5%	66.5%	15.5%	12.9%	9.8%
Dzongkhag	Paro	Pemagatshel	Punakha	Samdrupjongkhar	Samtse	Sarpang	Thimphu
Total	3.8%	7.6%	3.9%	14.0%	16.1%	7.8%	2.1%
Urban	0.9%	1.2%	0.2%	0.0%	0.6%	0.5%	0.7%
Rural	4.8%	10.1%	4.9%	20.9%	19.2%	10.8%	9.3%
Dzongkhag	Trashigang	Yangtse	Trongsa	Tsirang	Wangduephodrang	Zhemgang	Bhutan
Total	9.2%	21.1%	7.7%	9.7%	5.5%	21.8%	8.4%
Urban	0.3%	0.6%	1.0%	0.2%	0.2%	0.7%	0.8%
Rural	10.9%	25.7%	9.4%	11.1%	7.4%	26.8%	12.9%

Source: 2017 Population & Housing Census of Bhutan

In Gasa, both Laya and Lunana Gewogs are considered as priority areas for accessibility improvements because of their high figures, 99% and 98%, respectively, as of 2017. In Zhemgang, there are two gewogs (Bardo and Bjoka) where more than 50% of households take more than 30 minutes to reach the nearest road head. Yalang is a target gewog for accessibility improvements in Trashiyangtse.

Furthermore, in other eight dzongkhags, there are 10 gewogs with more than 50% of households having poor accessibility to the nearest road head, as shown in the table below. In Thimphu, all households in both Naro and Soe Gewogs take more than 30 minutes to reach the road. Eighty-five percent of people in Lingzhi are in the same situation. As the total household number is less than 100 in all of these three gewogs, the calculated Thimphu Dzongkhag average remains low. The average figures for these eight dzongkhags are not as high, but improvement in road connectivity in these 10 gewogs is regarded as crucial in order to improve their living conditions.

Table 14.2.10 List of Gewogs Where More Than Half of Households Take More Than 30 Minutes to Reach the Nearest Road Head

Dzongkhag	Gewog
Chhukha	Getana (63.1%)
Dagana	Nichula (76.9%)
Gasa	Laya (99.2%), Lunana (98.3%)
Haa	Sangbay (72.5%)
Samdrupjongkhar	Lauri (65.9%)
Samtse	Norgaygang (51.5%)
Thimphu	Naro (100.0%), Soe (100.0%), Lingzhi (84.8%)
Trashigang	Sagteng (70.5%)
Trashiyangtse	Yalang (56.4%)
Wangduephodrang	Athang (61.3%)
Zhemgang	Bardo (55.7%), Bjoka (54.6%)

Source: Estimated based on the 2017 Population & Housing Census of Bhutan

6) Discussions on standard of facility development

The standard levels of several facilities in the less populated rural area are not necessarily the same as those in the highly populated Urban Area. For instance, piped water inside a dwelling is available to nearly three quarters of urban residents, but this facility is only used by 32% of

rural residents. On the other hand, piped water outside a dwelling is widely used by 65% of rural residents, but only 24% of urban people. In the Urban Area, the population is concentrated within a limited area, which in turn allows for piped water to be provided on the inside of a dwelling to many households with moderate construction works. However, in the rural area, houses are normally scattered, which results in the need for more complex construction works as well as greater financial resources in order to provide piped water inside a dwelling. Therefore, piped water outside a dwelling is considered to be the main means of supplying water in the rural area as a standard facility, although it imposes some inconvenience on the beneficiaries when fetching water.

It is an urgent task for the ministries/agencies concerned to decide on appropriate standards by facility and locality in consideration of the number of beneficiaries, outlay, technological applicability, cost-effectiveness, location-specific conditions etc. Bhutan is not vast, but its natural and cultural conditions are highly diversified at the dzongkhag and gewog level. Thus, it is necessary to set the appropriate standards based on the needs of local people and other factors.

Box 14.2.3 Sewage system in rural areas of Japan

In Japan, subsidized sewage system development can be implemented in a rural community where more than 20 households are beneficiaries. However, the minimum number of beneficiaries can be reduced to 10 households for certain remote rural areas as designated by the central government.

In addition, the hierarchical service delivery system proposed in Chapter 13 should also be considered in order to provide effective public services, particularly health/medical and education services. After the establishment of appropriate official standards, facility construction works based on them should be gradually implemented in the rural area.

Box 14.2.4 Improvements in the education domain in the rural area

While the education domain in the GNH Index is crucial for making improvements in the rural area, there are some obstacles in this regard due to the reasons below.

- Literacy rates and years of schooling are assessed and included in the education domain of the GNH Index. In the rural area, the distribution of older people (11.1%) is higher than in the urban area (4.9%, 2017 PHCB), most of whom did not attend school because the formal/standard school education system did not start in Bhutan until the 1960s; hence, their years of schooling were zero or very short.
- This means that many of older people in the rural area are considered to be illiterate unless they learn Dzongkha/English at any non-formal education centres.

As a result, making improvements in these two components of the education domain in the rural area seems to be a difficult task.

(2) Intangible (Non-structural) Measures

The 2015 GNH Survey Report includes a section of "income and financial security" as the first topic in the living standard domain. Mean annual total household income by source and area of residence is indicated below. It is quite right to state that people in the Urban Area mostly receive income from salaries/wages (53%) and non-primary economic sources (45%); but, surprisingly, salaries/wages occupy the largest proportion of annual total household income, even in the rural area (39%). In addition, the average income level in the rural area is

substantially lower than that in the Urban Area; hence, income generation (creation of job opportunities) is very important for rural residents.

Table 14.2.11 Mean Annual Total Household Income by Source and Area of Residence

(Unit: BTN)

Area	Income from Salaries/Wages	Income from Agri./Liv./Forestry	Income from Non-agri.	Annual Total HH Income
Rural	60,912	49,545	45,667	156,124
Urban	209,661	6,538	178,407	394,606
Bhutan	107,928	35,952	87,623	231,502

Source: 2015 GNH Survey Report

According to the Bhutan Poverty Analysis Report 2017, households (and their members) earning (in real terms) below the total poverty line, i.e., BTN 2,195.95 per person per month, are considered poor. Hence, the above mean annual total household income in the rural area, i.e., BTN 156,124, is 35% larger than the poor household income standard (BTN 115,946 = Nu 2,195.95 x 12 months x 4.4 persons/family). Although the mean income level in the rural area is higher than that of the poor, the lower household income level, as compared with urban dwellers, is assumed to be one of the major reasons for the lower percentages for the ownership of various assets among rural residents as indicated above.

Income generation (creation of job opportunities) is not an easy task, because most of the rural area in Bhutan is only engaged in primary economic activities (agriculture, livestock and forestry). Accordingly, a practical approach is necessary to create jobs related to primary sector activities. Jobs related to agro-processing and handicraft-making utilizing local resources are as to be prioritized, but the most important consideration is that the products must be sold by a market-in, or demand-driven, approach. Prior unsuccessful experiences often indicated that a product-out approach was adopted (in other words, a supply-driven approach), which means that products were first made with available materials before attempts were made to sell them (e.g. jams made of locally available berries). On the other hand, the market-in approach firstly involves market research into what products are in high demand, now and in the future. After completing the market research, producing commodities based on the findings can commence (e.g., highly stylish cedar cups for wine or beer found in one rural region in Japan).

Currently, human-wildlife conflict in the rural area is one of the serious issue in Bhutan; thus, new job opportunities for young people and others should be created by researching and developing equipment or tools to mitigate human-wildlife conflict. If effective solar-powered repellent-type equipment is developed, this could be extended to highland communities because many highlanders face the loss of yaks caused by wild animal attacks.

Other industries, such as tourism and old age facilities, could also create new jobs in the rural area. This is because unfrequented beautiful landscapes in the rural area could become sites for domestic and foreign tourists to visit. The old age facilities in rural areas has potential due to the rapidly ageing rural society.

Lastly from the viewpoint of the GNH Index, income level seems to be crucial. According to the 2015 GNH Survey Report, residents in Thimphu, Gasa, and Paro Dzongkhags are earning a relatively higher annual total household income, compared to those in the other dzongkhags. These top three high-income-level dzongkhags also attain high values on the GNH Index.

Table 14.2.12 Gross National Happiness Index and Mean Annual Total Household Income in Three Dzongkhags

Dzongkhag	GNH Index		Annual Total Household Income	
	Rank	Index Value	Rank	BTN
Gasa	1	0.858	2	345,390
Thimphu	3	0.803	1	400,960
Paro	4	0.792	3	333,390

Source: 2015 GNH Survey Report

On the other hand, the residents of Lhuentse earn the lowest mean annual total household income of BTN 111,500, however its GNH Index (0.773) is ranked the highest. Therefore, the annual income is considered as only a certain element of happiness.

When 1) improvements in living conditions and 2) intangible (non-structural) measures are compared, it seems that each involves advantages and disadvantages as follows.

Table 14.2.13 Advantages and Disadvantages of the Two Approaches

Approach	Improvements in living conditions	Intangible (non-structural) measures
Advantage	Quick outcome after completion	Outlay is smaller than living condition improvements
Disadvantage	Needs a certain amount of outlay	Slow outcome because of limited number of beneficiaries

(3) Proposed Programme/Project

1) Development of comfortable rural living environment

This programme aims to mitigate rural population outflow by improving the rural living environment through various measures. The table below sets out the projects necessary to achieve the development of a comfortable rural living environment.

Table 14.2.14 Projects for the Development of a Comfortable Rural Living Environment

No.	Project Description	Implementing Agencies
Approach 1. Establishment of a Rural Living Environment Comparable to That of the Urban Area (Internet access and speed, water supply and sewage, road transportation access, housing, health and medical services etc.)		
I – 1 – 1)	Prioritize the areas (dzongkhags, gewogs) where levels in the rural living environment are low according to statistics such as 2017 PHCB and 2017 BLSS	MoWHS, Ministry of Health, dzongkhag
I – 1 – 2)	Through the promotion of organizing rural residents, explore and/or refine the strengths and virtues of the area, as well as reinforce social bonds in the rural area	Ministry of Home and Cultural Affairs
Approach 2: Development of a better educational environment		
I – 2 – 1)	To enable the provision of proper education as desired by rural residents all over the country (except for Thimphu) and distribute schools/colleges impartially; or install distance learning centres with IT facilities in nearby cities and towns	Ministry of Education

2) Creation of job opportunities in the Rural Area

In the rural area, job opportunities in secondary and tertiary industries are very limited. Hence, jobs related to primary industries, which provide the main economic activities in the rural area, will be created (with support from primary industries and related businesses). The table below sets out the projects necessary to create job opportunities in the rural area.

Table 14.2.15 Projects for the Development of a Comfortable Rural Living Environment

No.	Project Description	Implementing Agencies
Approach 1: Promotion of agro-processing which leads to an expansion of local farm produce marketing		
II – 1 – 1)	Development of agro-processed commodities which can be sold in markets other than general consumer goods markets dominated by Indian products	Private firms
II – 1 – 2)	Development of handicrafts made from local materials	Private firms, MoEA
Approach 2: Research and development of equipment for human-wildlife conflicts		
II – 2 – 1)	Research and development of equipment for human-wildlife conflicts utilizing up-to-date technologies such as drones	Universities, government research institutes, MoAF
II – 2 – 2)	Research and development of repellent-type equipment	Universities, government research institutes, MoAF
Approach 3: Promotion of green tourism taking advantage of abundant natural resources		
II – 3 – 1)	Development of distinctive tours and tourist spots by location	Tourism Council of Bhutan
Approach 4: Development of care facilities for older people to cope with the ageing society in the rural area		
II – 4 – 1)	Development of nursing facilities for the old people	Ministry of Health
Approach 5: Promotion of construction and maintenance jobs to young people		
II – 5 – 1)	Development of less manual construction work and machine-based maintenance work	MoWHS

3) Transformation of jobs in primary industries into attractive offers for young people

This programme provides various forms of support to make primary industries attractive to young people. The table below sets out the projects necessary to achieve the transformation of jobs in primary industries into attractive ones for young people.

Table 14.2.16 Projects for the Transformation of Jobs in Primary Industries into Attractive Ones for Young People

No.	Project Description	Implementing Agencies
Approach 1. Agriculture-related jobs		
III – 1 – 1)	Introduction of policies to promote the consolidation of fallow and abandoned farmlands (mechanized farming on consolidated farmland)	MoAF
III – 1 – 2)	Development of cool storage warehouses to make shipping adjustments possible for farm produce	MoAF
III – 1 – 3)	Expansion of finance support for agriculture	MoAF
III – 1 – 4)	Expansion of crop insurance system (make agriculture more resilient to natural disasters)	MoAF
Approach 2: Forestry-related jobs		
III – 2 – 1)	Development of forest roads and cable cranes in order to ship timbers	MoAF
III – 2 – 2)	Support of modern sawmills, wood products and handicraft enterprises	MoAF
III – 2 – 3)	Research and development of non-wood forest products and marketing promotion (collaboration with the pharmaceutical industry)	MoAF
Approach 3: Livestock-related jobs		
III – 3 – 1)	Development of cool storage warehouses to make shipping adjustments possible for dairy products	MoAF
III – 3 – 2)	Development of slaughterhouses	MoAF
Approach 4: Income generation		
III – 4 – 1)	Project for Dzongkhag Vitalization in Eastern Region	MoEA

(4) Way Forward

1) Desirable lifestyle and the GNH Index

If the GNH Index in the rural area exceeds that in the Urban Area in the future, will it be possible to assess whether a desirable lifestyle in the rural area has materialized? The answer is probably "no", but this simply means that only qualitative data are used to determine whether rural residents feel happier than urban dwellers. However, it will possible to explain the extent to which life in the rural area has moved closer to a desirable lifestyle.

Then, is it necessary to have higher indices in all nine domains of the GNH Index in the rural area? Or is it enough to have five higher indices out of the nine domains in the rural area? Or is it better to prioritize domains to be improved in the rural area by acknowledging that some domains, such as the education domain, are difficult to improve from the viewpoint of their compositions?

To achieve a desirable lifestyle in the rural area in the future, such practical discussions should be conducted at central and local government levels. At the central government level, broader policy for rural development should be formulated and more practical procedures and measures should be planned at the local government level.

2) Refine what the Rural Area originally entails

In the rural area, it is important to pay attention to specific features which are not observed in the Urban Area. There are some disadvantages, but there are also advantages such as abundant natural resources. For rural development, it is especially important to utilize and strengthen these advantageous features. Other positive features include a lower unemployment rate with relatively balanced labour supply and demand conditions, as well as better housing conditions (higher house ownership, lower rent fees, larger house size etc.), compared to the Urban Area. In terms of daily diet, many rural households largely supply their own food and pay less for food from elsewhere. However, there is limited choice with regard to consumer goods including processed food and electrical/durable products, due to the low penetration of a commodity economy in the rural area.

Furthermore, there are still many beautiful landscapes which are not well recognized by local administrators and people in the rural area. It is extremely important to conserve these pristine rural landscapes in consideration of passing on Bhutanese culture and tradition, as well as turning them into possible attractions for both foreign and domestic tourists in the future. Therefore, local administrators and residents should work together to plan and implement conservation measures in these landscapes from a long-term perspective.

Lastly, there is no quick solution to achieve rural development. Cheaper duty-free food imported from India is available in Bhutan. As mentioned earlier, the professions in primary industries are unpopular, particularly among young people, for various reasons. Therefore, steady progress should be continued.

14.2.3 Special Measures for the Highland Area

1) Background and objective

Residents in the highland area (highlanders) are considered as custodians of the northern frontiers. In other words, they have a critical responsibility in the security of the borders, but many highlanders have left the mountainous areas for better economic opportunities in the lowlands. Therefore, the government continuously provides them with various forms of

support to continue rearing livestock there. For Bhutan, this important responsibility on the part of the highlanders remains invariable from now on.

It should be noted that the GNH Index in Gasa is the highest at 0.858 among the 20 dzongkhags, although the living conditions there seem to be relatively harsh as compared with those in the lowlands (2015 GNH Survey Report).

2) Beneficiaries

About 1,200 highlander households exist in 29 gewogs across 10 dzongkhags

Table 14.2.17 List of Gewogs Where Highlanders Live

Dzongkhag	Gewog
Bumthang	Chhoekhor, Chhumig, Tang, Ura
Gasa	Laya, Lunana
Haa	Bji, Kar-tshog, Uesu
Lhuentse	Khoma
Paro	Doteng, Loong-nyi, Tsento
Thimphu	Darkarla, Lingzhi, Naro, Soe
Trashigang	Kangpar, Merag, Sagteng, Samkhar, Shongphu
Trashiyangtse	Boomdeling
Trongsa	Nubi
Wangduephodrang	Gangteng, Kazhi, Phobji, Saephu, Thedtsho

Source: Estimated from the population statistics on the yak

3) Expected components

The measures needed to encourage highlanders to continue to live in the highlands include the following components.

- Public facility development (health, education etc.)
- Improvements in the dairy production system
- Measures to limit wildlife damage
- Non-Wood Forest Products (NWFPs)-related activities
- Improvements in the solar lighting system

CHAPTER 15 GENERAL GUIDANCE FOR INDUSTRIAL DEVELOPMENT

15.1 Agriculture Promotion

15.1.1 Issues

Issues and development guidance relating to agriculture in Bhutan can be summarized as follows.

(a) According to estimates as of 2030 by the JICA Project Team, about half of the population will reside in the rural area and 43% of working population is estimated to be engaged in agriculture sector. Appropriate improvement and development in agriculture increasingly secure better livelihoods for a large section of the population in Bhutan, as well as being conducive to improved food and nutritional security.
(b) When it comes to development guidance for agriculture in Bhutan, there are some preconditions such as the low self-sufficiency rate for rice, increasing rural-urban migration, expanding regional disparities between the Rural and the urban areas, and a long-term decrease in agriculture workers. Taking these conditions into account, the following items are proposed as major development guidance areas for agriculture: a) improvement in the self-sufficiency rate for rice, b) promotion of market-oriented farming, and c) nutritional improvement.
(c) As for the improvement in food security, increased self-sufficiency rate for rice is prioritized as the most symbolic indicator; rice is a staple food and the largest import agro-product. Production enhancement through area expansion and yield increase is the major approach. Under this approach, conventional development such as irrigation development, promotion of double cropping and the introduction of machineries should be continued. In addition, it is indispensable to propose countermeasures for major constraints that farmers in Bhutan are facing, e.g., shortage of labour and human-wildlife conflict. Introducing labour-saving technologies and ICT applications will help to mitigate these constraints.
(d) Increasing income through the promotion of market-oriented farming is one of the solutions to mitigate rural-urban migration and correct regional disparity, among the reasons behind continuous rural-urban migration. As such, the cultivation of agro-products with the domestic and/or export market in mind is required. It is important for market-oriented farming to strengthen the “Bhutan brand” and to grasp the market needs of import countries. At the same time, improving cultivation techniques to meet the requirements of import countries and introducing eco-friendly cultivation to ensure sustainable cultivation on hilly terrain, which represents the majority of agricultural land in Bhutan, are necessary.
(e) Apart from activities mentioned above, the agriculture sector can help to improve the health indicators described in the 12th FYP, such as the stunting and underweight of children under five years through nutritional improvement. First of all, integrated general guidance for nutrition in Bhutan should be prepared for an awareness campaign about nutrition by a community-based nutrition group and schools. From the viewpoint of production, nutritional improvement through the cultivation of high-nutrition foods is one of the options with the sale of these product conducive to income generation.

15.1.2 Development Guidance

(1) Improvement in the Self-sufficiency Rate for Rice

In the CNDP, the self-sufficient rate for rice in 2030 is targeted at 60%. Based on the projected population of 2030, the necessary cultivated area and yield in each Dzongkhags are estimated in Table 15.1.1 without taking double cropping into account. To achieve the target rate, problems to be addressed were enumerated and necessary actions to be made were clarified, while a holistic diagram was created as shown in Figure 15.1.1. Major issues to be addressed are 1) lack of labour, 2) increase in fallow, 3) wildlife infestation, 4) lack of irrigation, 5) land degradation, 6) weed infestation and 7) low milling ratio.

Table 15.1.1 Expected Cultivated Area, Yield and Production in 2030 in Each Dzongkhag

Dzongkhag	Cultivated Area (Ha)		Yield (Ton/Ha)		Production (Ton)	
	2015	2030	2015	2030	2015	2030
Bumthang	60	63	3.78	4.54	227	286
Chhukha	760	1,005	3.35	4.02	2,545	4,039
Dagana	1,421	1,421	3.83	5.00	5,442	7,104
Gasa	65	83	3.07	3.68	200	306
Haa	70	92	3.41	4.09	237	376
Lhuentse	732	847	4.48	5.00	3,283	4,235
Monggar	352	388	3.03	3.63	1,065	1,409
Paro	1,640	1,730	5.38	5.50	8,820	9,515
Pemagatshel	120	120	3.06	3.67	367	440
Punakha	2,612	3,357	4.58	5.00	11,971	16,785
Samdrupjongkhar	972	1,127	3.59	4.31	3,492	4,861
Samtse	2,502	3,574	3.72	5.00	9,312	17,870
Sarpang	1,747	2,737	3.82	5.00	6,671	13,685
Thimphu	219	367	5.37	5.50	1,175	2,019
Trashigang	1,226	1,226	3.70	5.00	4,539	6,130
Yangtse	800	800	3.67	4.41	2,939	3,527
Trongsa	569	657	4.19	5.00	2,381	3,285
Tsirang	1,320	1,320	3.57	5.00	4,715	6,600
Wangduephodrang	1,976	2,004	4.58	5.00	9,043	10,020
Zhemgang	568	568	3.23	3.88	1,838	2,206
Total or Average	19,730	23,486	4.07	4.88	80,261	114,696

Source: Prepared based on DoA Agriculture Statistics 2015

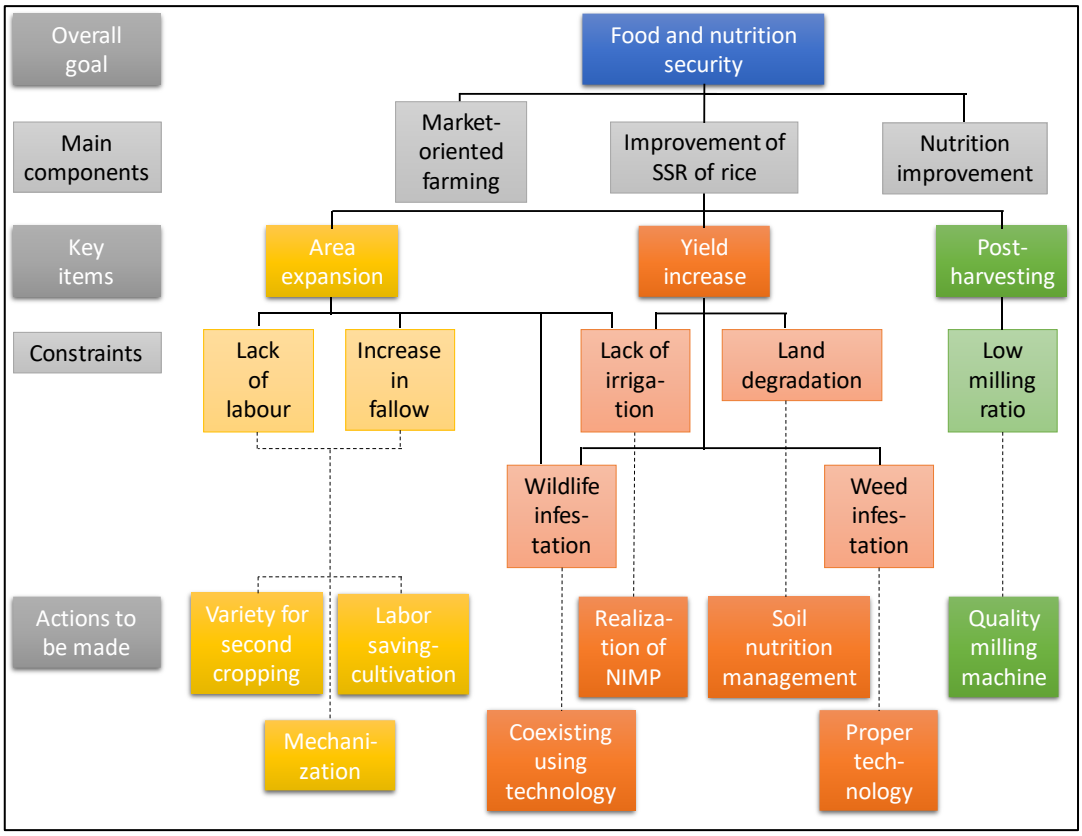


Figure 15.1.1 Problem Analysis Diagram for Improvement in the Self-sufficiency Rate for Rice

The proposed actions for each of the major issues are elaborated to formulate the projects and programmes for improving the self-sufficiency rate for rice below.

1) Project title: Rice variety improvement and area expansion for second cropping

(a) Background: To improve self-sufficiency in Bhutan, the promotion of double cropping is expected to produce more production. Although double cropping is possible in the southern part of Bhutan, crop intensity is slightly above 100%. One of the reasons for this is insufficient appropriate rice varieties for second cropping. Rice cultivation in the monsoon period normally starts in May and ends in December. This means spring paddy cultivation requires varieties with four to five months of maturity from sowing to harvesting. Currently, spring paddy varieties, such as Anand, GB-1 and GB-3, are released, but they do not fully prevail and there is a great need to find more varieties. In general, the breeding and development of new varieties take time, e.g., seven to eight years. One of the options to shorten the development period is the application of introduction breeding by using existing varietal stocks. There is a certain amount of genetic resources of rice, either in neighbouring countries or in international institution. Hence, the project aims to select appropriate varieties for second cropping and disseminate a sufficient quantity of quality seeds.

(b) Proposed activities:

i) Selection of appropriate short-maturity varieties based on field performance and people's preference.

ii) Preparation of a seed multiplication plan and quality seed production.

iii) Improvement in cultivation techniques for second cropping through the preparation of a cropping calendar; a spring paddy normally requires more intensive cultivation along with a shorter maturity period.

(c) Proposed locations: Chhukha, Dagana, Samdrupjongkhar, Samtse, Sarpang, Tsirang.

(d) Additional comment: Paddy fields where cultivation of a spring paddy is available are relatively flat, and there is room to expand mechanized farming including a power tiller, a transplanter and a harvester. To fully utilize the potentiality of second cropping, contract farming, land lease and an aggregation scheme should be taken into account.

2) Project title: Improvement in cultivation techniques for labour saving

(a) Background: Currently, 53% of households face difficulties in securing labourers for their farming activities. Mechanization is one of the major countermeasures to cope with the labour shortage. Mechanization is available through hiring services, but agricultural machines do not fully prevail. Therefore, the development of labour saving is indispensable while agricultural machines are generalized. Short-term countermeasures are necessary to address labour shortages, some of which could also lead to conservation farming.

(b) Proposed activities:

i) Selection of working items to be reduced; it is said that, among several farming activities, land preparation, transplanting, weeding and harvesting are the major costly activities in Bhutan due to high labour requirements.

ii) Introduction and preliminary testing of newly developed cultivation techniques, such as non-tillage cultivation, dry-seeded rice cultivation, and wet-seeded rice cultivation with iron-coating seed. They are applicable using locally available material and equipment.

iii) Dissemination of cultivation techniques.

(c) Proposed locations: Lhuentse, Monggar, Paro, Punakha, Thimphu, Trashigang, Yangtse, Trongsa, Wangduephodrang, Zhemgang.

3) Project title: Promotion of mechanization

(a) Background: The shortage of labour is one of the biggest issues for farmers. Currently, power tillers are being distributed through support from Japan to all the gewogs to ease land preparation. However, there are some constraints on further promotion; the number of machines is limited, fields are located in terrain area, the size of plots is relatively small and there is poor accessibility to fields. Hence, the introduction of portable and/or small-scale machinery is required.

(b) Proposed activities:

i) Selection of small-scale machinery to be introduced such as mini-harvesters (Figure 15.1.2), mobile threshers, weeding robots and drones (Figure 15.1.3).

ii) Preliminary testing for small-scale machinery.

iii) Dissemination of small-scale machinery through the Agriculture Machinery Centre (AMC) or the private sector.

(c) Proposed locations: Lhuentse, Monggar, Paro, Punakha, Thimphu, Trashigang, Yangtse, Trongsa, Wangduephodrang, Zhemgang.

(d) Additional comment: Prior to dissemination, it is important to establish the quality standard for the products and for them to be authorized by the Bhutan Standard Bureau (BSB). In doing so, the quality of the product for end users will be ensured.

Note: It looks like grass cutter but is less expensive. As it is portable, it can even be used in the terrain area.

Figure 15.1.2 Mini-harvester

Note: There are several usages such as sowing, providing countermeasures for human-wildlife conflict and growth surveys.
Source: MAFF

Figure 15.1.3 Drone

4) Project title: Establishment of community-wildlife coexistence

(a) Background: According to the statistics, 43% of households suffer from crop damage caused by wild animals. Wild animals damage 4-7% of the cultivated area for major cereals and potatoes. The affected production value of rice and maize is estimated at BTN 150 million in total. Farmers spend an average of 53 days and 63 nights per year protecting against damage caused by wild animals. The MoAF has introduced electric fencing as the most effective solution to mitigate the impact of the human-wildlife conflict. However, it is not reasonable to entirely encircle fields with electric fencing, as the areas to be covered are vast. Hence, the introduction of new knowledge and technologies is required to cope with human-wildlife conflict.

(b) Proposed activities:
   i) Data collection relating to the ecology of wild animals; using a drone with infrared thermography is one of the options to survey wild animals.
   ii) Research on human-wildlife conflict countermeasures, such as drones with a speaker or flashlight, drones with an airgun or firecracker, monkey dogs, and speakers or flash lights with a motion sensor.
   iii) Dissemination of techniques for human-wildlife conflict.

(c) Proposed location: Nationwide.

(d) Additional comment: Establishing a buffer zone with industrial crops, such as oil seeds, tea and medicinal plants, and introducing a safe system approach by the WWF to identify the root causes are other options.

5) Project title: Realization of the National Irrigation Master Plan

(a) Background: DoA Agriculture Statistics indicate that 28% of households have difficulties with an insufficient irrigation supply. Irrigation is also the key to increasing the self-sufficiency rate for rice. Increasing the cropping intensity of the existing irrigation scheme through the construction of ponds, the rehabilitation of canals and the introduction of water-saving irrigation is one of the options to be considered. The development of a new irrigation scheme is another option to expand the area being irrigated. The general orientation of irrigation development is described in the National Irrigation Master Plan (NIMP). Now, it is necessary to materialize the NIMP.

(b) Proposed activities:

i) Reconsideration of the appropriate irrigation development area; it is necessary to reconsider how much area needs to be irrigated to achieve 60% self-sufficiency.

ii) Existing irrigation improvement and new irrigation development based on categorization. Irrigation schemes can be roughly divided into three categories as follows.

Irrigation Scheme	Major Characteristics			
	Location	Slope	Area	Volume of Water Resources
Hill scheme	Hilly area	Steep	Small	Low
Valley bottom scheme	Valley bottom along river	Gentle	Medium	Medium
Foot hill scheme	Southern part of Bhutan	Flat	Large	High

iii) While lift irrigation facilities, pond construction and the water-harvesting structure are applicable for hill and valley bottom schemes, a bank protection and water diversion structure for flooding needs to be introduced for the foot hill scheme. For the hill scheme, other measures, such as the construction of drainage canals, the plantation of cover crops, contour line cultivation to protect water sources and agricultural lands from gully erosion and slope failure, and drip irrigation to economize water usage, should also be considered.

iv) Reinforcement of the operation and maintenance (O&M) system

(c) Proposed locations: Chhukha, Dagana, Samdrupjongkhar, Samtse, Sarpang, Tsirang.

6) Project title: Development of soil nutrition management

(a) Background: There are some studies on soil in Bhutan, but no comprehensive information and national maps concerning soils are available. Farmers mainly manage their farmland in traditional ways without knowledge of soil fertilities. To increase the production of agro-products and to manage the soil more effectively, information on soil fertility is indispensable. This information could also be utilized as decision-making tools. Hence, a preliminary analysis of soils and the development of soil nutrition management are expected to support food and nutritional security in Bhutan.

Figure 15.1.4 A Series of Pot Trials

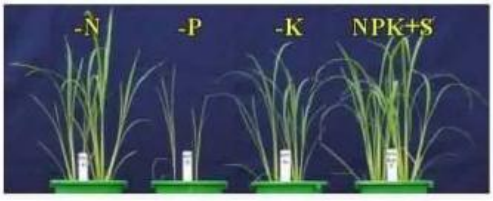


Figure 15.1.5 A Series of Pot Trials for Laboratory Analysis

(b) Proposed activities:

i) Preliminary analysis of soils through a series of pot trials and laboratory testing (Figure 15.1.4 and Figure 15.1.5).

ii) On-site trial of soil management techniques, such as appropriate fertilizer application dosage with a focus on deficit nutrients and application techniques.

iii) Dissemination of soil management techniques.

(c) Proposed location: Nationwide.

7) Project title: Development of weed control methodology

   (a) Background: Weed infestation is one of the biggest issues for farmers, as weeding is the most costly farming activity per unit area. Once weed infests in the fields, it has a negative effect on rice growth and results in decreasing yield. Thus, periodical weeding is indispensable; however, it requires considerable labour input. The development of weed control methods contributes to a reduction in labour input for weeding.

   (b) Proposed activities:
      i) Data collection concerning the ecology of weed species and selection of target weeds.
      ii) Research on weed control methods through pot experiments and field trials using cultural, biological, mechanical and chemical control methods.
      iii) Dissemination of weed control methods.

   (c) Proposed locations: Chhukha, Dagana, Samdrupjongkhar, Samtse, Sarpang, Tsirang.

8) Project title: Improvement in rice milling ratio

   (a) Background: It is obvious that increasing production, by an enhancement of yield and an expansion of the area cultivated, ensures food and nutritional security. At the same time, a reduction in harvest losses helps to increase actual production of white rice to be consumed. In Bhutan, it is estimated that the milling ratio is approximately 60%. It is rather low compared to the international average. It is claimed that quality milling machines allow users to achieve a better milling ratio, as high as 70%. When the milling ratio increases by 10%, it is equivalent to 8,000 ton of milled rice while self-sufficiency increases 8% automatically.

   (b) Proposed activities:
      i) Data collection on post-harvest losses at the stage of threshing, winnowing, drying, transportation, storage and processing.
      ii) Introduction and preliminary testing of improved rice mills.
      iii) Rice mills are disseminated either by the AMC or by private companies.

   (c) Proposed locations: Chhukha, Dagana, Samdrupjongkhar, Samtse, Sarpang, Tsirang.

   (d) Additional comment: Prior to dissemination, it is important to establish the quality standard for the products and for them to be authorized by the BSB. In doing so, the quality of the product for end users is secured.

(2) Promotion of Market-oriented Agriculture

As seen in 11.3.4, there is a diversity of potential agricultural products at the local level in Bhutan. However, there are challenges to be addressed for the promotion of market-oriented agriculture. Major challenges are: 1) a lack of safe and traceable crops, 2) poor post-harvesting, 3) a lack of promotion, 4) land degradation, 5) a lack of techniques, 6) wildlife infestation, 7) poor access to markets and 8) poorly timed sales (Figure 15.1.6). To cope with these challenges, four actions are proposed for future projects.

Box 15.1.1 Good Practice of Market-oriented Farming

The results of the previous JICA project related to market-oriented agriculture implemented in the world could be utilized on future projects. One example is summarized as follows. The Smallholder Horticulture Empowerment Project (SHEP) developed an innovative approach to address the challenges of stagnant subsistence-based smallholder horticulture in Kenya. The innovation, subsequently entitled "the SHEP approach", shows farmers the effectiveness of practising market-oriented horticultural farming in order to improve their livelihoods. Inspired by the approach, smallholder farmers have taken action to practise "farming as a business" by establishing linkages with business service providers through interactive forums, identifying the market demand through market surveys conducted by themselves, producing what the market requires, and finally selling quality horticultural crops to their target market. The farmers who took part in the SHEP have significantly increased their income from horticulture farming. After two years of project activities, the average income for the 2,500 smallholder-farmers concerned doubled from USD 273 to USD 560. Their living standards have subsequently improved after their participation in the SHEP.

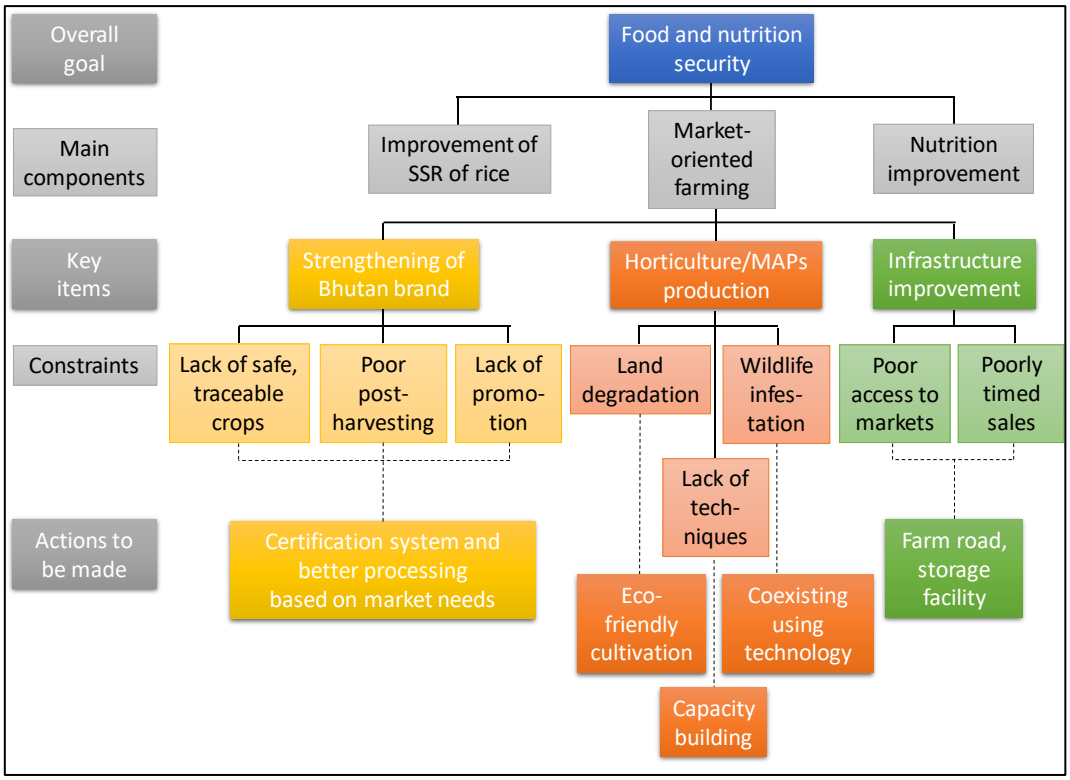


Figure 15.1.6 Problem Analysis Diagram for Market-oriented Farming

The proposed actions for each of the major issues in order to formulate the projects and programmes for market-oriented farming are elaborated below.

1) Project title: Strengthening of the Bhutan brand

(a) Background: Nowadays, producers need to produce safe and traceable agro-products as consumers are highly conscious of food provenance. There are several approaches to ensure food safety such as Good Agriculture Practices (GAP) and laboratory analyses. These take some time, but they allow farmers to expand their business opportunities. For example, organic product certification is applied to carrots, garlic and potatoes in Gasa, which are sold to five-star hotels in Thimphu at good prices. As there is a growing demand for these products, and a certification system can create high added value, an expansion of the certification system is one of the best solutions to help farmers improve their livelihood.

(b) Proposed activities:

i) Selection of target crops to be certified. It is reasonable to begin with potential crops as mentioned in Figure 11.3.4, given that there are experienced farmers who can meet cultivation and market needs. In doing so, it is expected to consolidate production areas and formulate a wide-scale production area.

ii) Data collection concerning the export product requirements; in the case of cardamom, information to be collected could include on grading according to size, colour and weight of the pod.

iii) Establishment of grading standards based on market needs; in India, for instance, there are five different grades for cardamom, based on different sizes and weights. In addition, cardamom with the biggest pods is preferable in some countries as importers believe they carry the most flavour and fragrance. In other countries, the contrary view applies.

iv) Development of market-oriented post-harvesting machinery such as hullers, milling machines, driers and sorters.

v) Training on certification and marketing, e.g., production protocols, operation of farmers' organizations, record keeping and accounting.

vi) Formulation of farmers interest groups (FIGs) and a farmers producer organization (FPO) and their implementation. While an FPO, which consists of several FIGs, is expected to explore marketing channels and fix the sales price before production, FIGs will concentrate on the production of target crops based on information provided by the FPO.

(c) Proposed locations: Gasa, Monggar, Pemagatshel, Trashigang, Yangtse, Trongsa, Zhemgang.

(d) Additional comment: When processing machines are installed, the FPO will also function as a processing centre to add more value. Thus, a wide-scale production area will become a cluster area covering all aspects of the agro-industry including production, processing and marketing. In doing so, more competitiveness through infrastructural improvements, strengthening bargaining power and widening the marketing network is expected. In the course of exploring marketing channels and selecting target crops, participatory decision-making tools are available to convince farmers. Learning about the organic farming and certification process as part of school education will help to foster an awareness in this regard. It will be productive to establish antenna shops, either in the border area or in India, for gathering information. Newly developed machinery will be disseminated either by the AMC and the NPHC, or by private companies. Prior to dissemination, it is important to establish the quality standard for the products and have them authorized by the BSB. In doing so, the quality of the product for end users will be ensured.

2) Project title: Promotion of environmentally balanced slope cultivation

(a) Background: A large part of Bhutanese agricultural land is dominated by steep slopes. Sloped lands with more than a 25% gradient occupy more than 80% of agricultural land. Although a market-oriented approach helps producers to generate more income, farming activities without environmental considerations, such as monocropping plantations and over-intensive usage of land, deteriorate agricultural lands. In many countries, the lack of any protection measures results in soil erosion, soil degradation and declining natural resources. As conservation of natural resources is essential in pursing GNH, it is important to promote market-oriented farming by taking environmentally balanced slope area cultivation into account.

(b) Proposed activities:
   i) Data collection on soil losses by farming activities including slope gradient, crops under cultivation, continuous cropping period and rainfall.
   ii) On-site trials on environmentally balanced low-cost slope cultivation techniques; Sloping Agricultural Land Technology (SALT) has introduced 10 steps as representative techniques as follows: 1) make an A-frame, 2) locate contour lines, 3) prepare the contour lines, 4) plant seeds of nitrogen-fixing trees, 5) cultivate alternate strips, 6) plant permanent crops, 7) plant short-term crops, 8) trim nitrogen fixing trees, 9) practise crop rotation, 10) build a green terrace. Other techniques to be considered are mulching, mixed cropping, intercropping, minimum/zero tillage, incorporation of organic matters, cover cropping by perennial plants, flagstones, water harvesting, and placement of bamboo along contour lines.
   iii) Dissemination of environmentally friendly slope cultivation techniques.

(c) Proposed locations: Chhukha, Haa, Lhuentse, Samdrupjongkhar, Thimphu.

3) Project title: Strengthening of capacity for horticulture production

(a) Background: The JICA has continuously implemented technical cooperation projects related to horticulture production. The project implemented in Bhutan succeeded in disseminating potential crops and enhancing production as well as quality. Farmers' mindset has started to change from subsistence farming to a market-oriented approach. However, there is still a need to improve productivity and marketing aspects through extension activities. Hence, the strengthening of capacity, with a greater emphasis on improving marketing, is indispensable.

(b) Proposed activities:
   i) Exploration of marketing channels and selection of target crops using participatory decision-making tools for marketing purposes; community resources and asset maps, farmer segmentation, crop calendars, product selection criteria, product ranking exercises, assessing market risks or products, market visits, and new product evaluation.
   ii) Research on the production of horticultural crops such as varietal trials, raising nurseries, planting, grafting, pruning, weed and pest management, harvesting, and seed multiplication.
   iii) Dissemination of horticulture production.

(c) Proposed locations: Bumthang, Dagana, Paro, Punakha, Samtse, Sarpang, Tsirang, Wangduephodrang.

4) Project title: Improvement in farm accessibility, transportation and storage facilities

(a) Background: The JICA has continuously implemented technical cooperation projects related to horticulture production. The project implemented in Bhutan succeeded in disseminating potential crops and enhancing production as well as quality. Farmers' mindset has started to change from subsistence farming to a market-oriented approach. However, there is still a need to improve accessibility for the market through infrastructure development. Hence, providing necessary access from the main road to farmland, facilitating the better utilization of potential land and transportation to improve agricultural inputs and outputs, and expanding storage facilities will enhance the further promotion of agricultural commercialization.

(b) Proposed activities:
i) Preparation of a development plan in consideration of production and marketing.
ii) Rehabilitation or upgrading of existing farm access roads; installation of side drains and drainage culverts.
iii) Construction of new farm access roads and storage facilities; a main focus on improvements in transportation to farmlands and improvements in connectivity between production areas and market places, while maintaining quality

(c) Proposed locations: Farm roads: nationwide; storage: Chhukha, Samdrupjongkhar, Samtse, Sarpang.

(3) Nutritional Improvement

As seen above, food security enhancements by improving the self-sufficiency rate for rice and market-oriented farming are indispensable to the future situation in Bhutan. At the same time, health concerns derived from food habits should be taken into consideration in the course of pursuing the enhancement of GNH, since nutritional improvement is also stated in national policy as well as SDG targets. As nutritional improvement is a comparatively new concept in Bhutan, activities related to 1) awareness and 2) diversification of food diet are proposed. A problem analysis diagram and development guidance are shown in Figure 15.1.7.

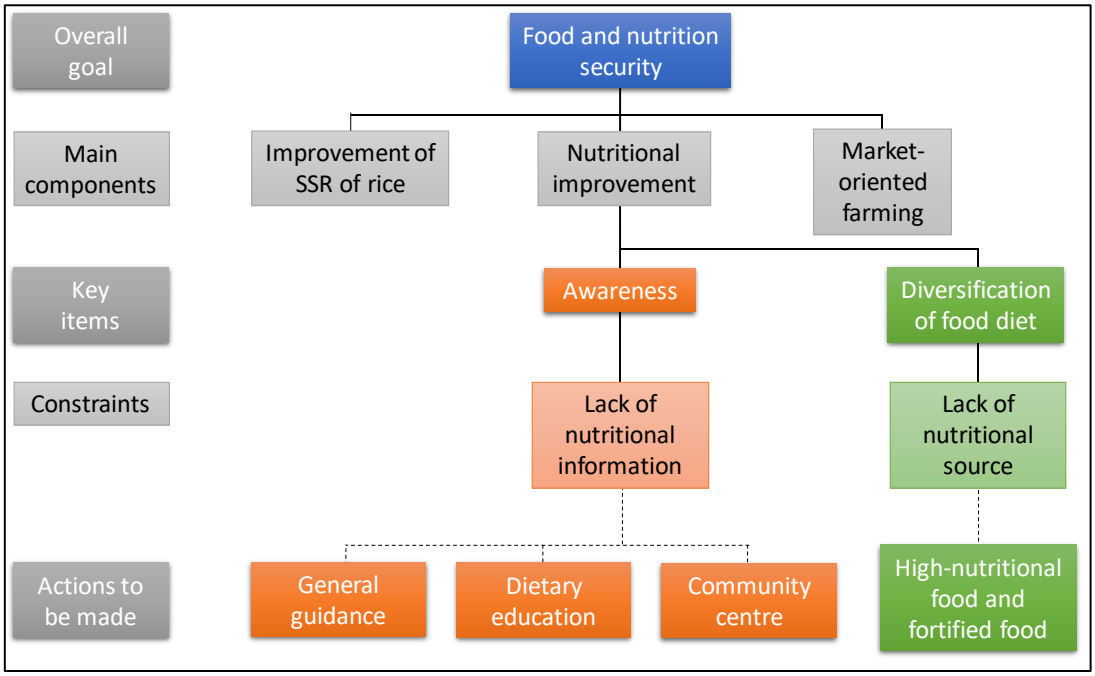


Figure 15.1.7 Problem Analysis Diagram for Nutritional Improvement

The proposed actions for each of the major issues to formulate the projects and programmes for nutritional improvement are elaborated below.

1) Project title: Preparation of general guidance for nutrition

   (a) Background: The nutritional status, such as the underweight of children under five years, infant mortality and maternal mortality, in Bhutan has been improving over recent decades. However, the daily vegetable intake per capita, as well as the daily egg intake per capita, does not come close to the minimum recommendations made by international organizations. Although traditional food habits should be respected, health concerns derived from food habits need to be taken into consideration in the course of pursuing the enhancement of GNH. Currently, there is no integrated general guidance for nutrition in Bhutan. Since nutritional improvement is also stated in national policy as well as SDG targets, it is the time to prepare these documents.

   (b) Proposed activities:
      i) Information collection and selection of documents to be prepared; some of the documents to be considered are "Standard Tables of Food Composition", "National Nutrient Database", "Dietary Guideline", "Food Balance Guide" and "Good Nutrition in the First 1,000 days".
      ii) Gathering of data on food habits.
      iii) Preparation of general guidance on nutrition.
   (c) Proposed location: Nationwide.

   (d) Additional comment: As gathering information should not involve a single survey, it will be necessary to establish a periodical information-gathering system or facilitate an alignment with existing survey schemes, such as living standards surveys or national censuses.

2) Project title: Expansion of dietary education

   (a) Background: In Bhutan, the School Agriculture Programme (SAP) has been running for nearly two decades. The SAP is a joint initiative of the MoAF and MoE. It started with six pilot schools in 2000 and has since expanded to 303 schools in the country. Schools involved with the SAP provide agricultural activities for students on the school campus with the objective to meet their nutritional requirements and also inculcate farming as an alternative livelihood option in later life. Nowadays, some young are showing an interest in working in agriculture because of these educational programmes. Taking this programme as a basis, it is time to expand dietary education on a much larger and integrated scale.

   (b) Proposed activities:
      i) Selection of content to be included in the SAP; while knowledge of production techniques is the starting point for agricultural education, it is also important to understand how to utilize harvested products effectively for a better diet and how to sell agro-products for more income.
      ii) Implementation of activities such as nutritional education with reference to existing documents and general guidance to be developed; trial marketing during sports and cultural festivals; visits to observe fields and exchange ideas with farmers; inviting farmers to act as supervisors for the SAP in order to enhance local communication.
   (c) Proposed locations: Bumthang, Chhukha, Dagana, Gasa, Samtse, Sarpang, Thimphu, Trongsa, Tsirang, Zhemgang.

3) Project title: Establishment of community centres

(a) Background: Due to Bhutan's steep geographical conditions, it is difficult for villagers to obtain agricultural technical guidance, marketing information and nutritional information in a timely and proper manner. It is important to overcome these issues for livelihood improvement in the rural area. One of the options is to establish village-level community centres where all the stakeholders, including villagers and government officers, can exchange information. In particular, nutritional information needs to be shared not only via school education, but also via a regional information-sharing system, since parents are responsible for the care of their children and normally control their food diet in the household. Hence, the establishment of community centres which all stakeholders are free to use is reasonable.

(b) Proposed activities:
   i) Preparation of a community centre utilization and management plan.
   ii) Establishment and utilization of community centres.

(c) Proposed location: Nationwide.

4) Project title: Promotion of high-nutrition food and fortified food

(a) Background: Nutritional improvement is achieved not only by awareness campaigns involving the establishment of general guidance on nutrition, school education, sharing information and using community centres, but also by diversification of the food diet. There are some highly nutritious crops, such as quinoa, glutinous wheat and chia seeds. These can help to improve the health of the population. It is also claimed that improving nutrition for mothers and children during the first 1,000 days following birth helps to ensure that children get the best start in life and the opportunity to reach their full potential. In case it is difficult to take in the full amount of nutrients from available foods, using fortified food is one of the options. Fortified food contains necessary vitamin and minerals for children's health, while the promotion of fortified food is expected to improve indices on children's health.

(b) Proposed activities:
   i) Selection of high-nutritional crops to be promoted, such as quinoa, glutinous wheat and chia seeds, and conducting cultivation trials.
   ii) Selection of items to be fortified, based on the information from food dietary experts, field interviews and children's health indices, as well as the nutritional gap between recommended amounts of nutrients and actual intake; common issues related to poor nutrition relate to vitamins, energy, micronutrients, minerals, protein, iodine and iron.
   iii) Dissemination of high-nutritional crop production and fortified food.

(c) Proposed locations: Bumthang, Chhukha, Dagana, Gasa, Samtse, Sarpang, Thimphu, Trongsa, Tsirang, Zhemgang.

(d) Additional comment:
   i) Demands for high-nutrition food have been increasing in the context of international trade, while there is potential for export of such food. Promotion of high-nutrition foods is expected to contribute to nutrition improvement as well as income generation.
   ii) Prior to fortified food dissemination, it is important to establish the quality standard for products and have them authorized by the BSB. In doing so, the quality of the products for end users will be ensured. Community centres can be utilized as distribution points.

15.1.3 Human resource Development Necessary for Implementation

Most of the projects mentioned above are under the jurisdiction of specific agencies, which are responsible for implementation. For the agriculture sector, the Rural Development Training Centre (RDTC) can be utilized for continuing professional development. The RDTC functions as a training institute and provides a variety of basic courses including on agricultural skills, farm management and farm business. Further capacity development should be conducted through technical cooperation projects (such as II-2-2, as mentioned in Table 15.1.2).

With regard to extension activities, there were 304 agricultural extension workers in 2015. This means that each extension worker needed to cover as many as 200 households or 650 agriculture workers in scattered locations. In order to further promote agriculture production with better extension services, it is necessary to increase the number of agriculture extension workers. As civil servants employed by the Royal Civil Service Commission, they can be transferred from place to place, while additional extension workers should be community-based young people who have received an education to some extent. An increased budget is required to achieve an expansion of extension staff; a necessary budget will be prepared as described in 15.1.4.

Apart from direct human resource development, it is necessary to examine how to utilize imported labourers in agriculture. Currently, the importation of labour is permitted for non-agricultural work; however, this regulation needs to be relaxed during the peak farming period.

15.1.4 Budget and Institutional Arrangement Necessary for Implementation

Most of the activities mentioned above are aligned with the 12th FYP and therefore implementation costs will be secured from the allotted budget. Activities not included in the 12th FYP will be covered by external support such as technical cooperation schemes from donor agencies.

As seen in 15.1.3, an increased budget is required to employ community-based agricultural extension workers. The estimated monthly cost for one additional community-based agricultural extension worker is BTN 12,000. The necessary annual cost per gewog is BTN 144,000; meanwhile, given the multiplying number of Gewogs, the total cost per annum is calculated at BTN 29.5 million. There are several possible budget sources for this expenditure: capital budgets for each dzongkhag (BTN 300 million), gewog development grants (BTN 5 million), and local economy and job creation programmes for local government (BTN 2 billion). As a certain budget amount is allocated for the 12th FYP, it is reasonable to utilize this money for the employment of community-based agricultural extension workers.

With regard to nutrition, it is important to ensure multisectoral communication, as it covers a wide range of activities including agriculture, health and education. For better coordination, it is recommended to establish an organization such as the Project Management Unit (PMU). A certain department should be responsible for the overall coordination with relevant departments as the executing agency. The function of the PMU is to prepare and review plans, implement and monitor the progress of the project, and provide necessary measures and advice.

15.1.5 Projects and Programmes

Projects to be proposed, based on development guidance, are summarized in Table 15.1.2, while the proposed project locations are depicted in Figure 15.1.8 to 15.1.10. Of the proposed projects, six projects were selected to meet the selection criteria necessary for implementation in the short term. The selection criteria include quality improvement, productivity improvement, and adequate investment. The selected projects are highlighted in the table below.

Table 15.1.2 List of Proposed Projects Based on Development Guidance

Target I: Improvement in the Self-sufficiency Rate of Rice		
No.	Project Title	Implementing Agencies
Approach 1. Area expansion		
I – 1 – 1)	**Rice variety improvement and area expansion for second cropping**	**DoA (ARDC, NSC), FMCL**
I – 1 – 2)	**Improvement in cultivation techniques for labour saving**	**DoA (ARDC)**
I – 1 – 3)	Promotion of mechanization	DoA (AMC), FMCL
Approach 2. Yield increase		
I – 2 – 1)	**Establishment of community-wildlife coexistence**	**DoA (NPPC)**
I – 2 – 2)	**Realization of the National Irrigation Master Plan (NIMP)**	**DoA**
I – 2 – 3)	Development of soil nutrition management	DoA (NSSC)
I – 2 – 4)	Development of weed control method	DoA (AMC, NPPC)
Approach 3. Post-harvesting		
I – 3 – 1)	**Improvement in the rice milling ratio**	**DoA (AMC), BSB**

Target II: Market-oriented Farming		
No.	Project Title	Implementing Agencies
Approach 1. Strengthening of the Bhutan brand		
II – 1 – 1)	Expansion of the certification system	DoA, DAMC, BAFRA
II – 1 – 2)	**Development of market-oriented post-harvesting skills**	**DoA (AMC, NPHC)**
Approach 2. Horticulture/medicinal and aromatic plant production		
II – 2 – 1)	Promotion of environmentally balanced slope cultivation	DoA (NSSC)
II – 2 – 2)	Strengthening of capacity for horticulture production	DoA (ARDC)
Approach 3. Infrastructure improvement		
II – 3 – 1)	**Improvement in farm accessibility, transportation and storage facilities**	**DoA, DAMC**

Target III: Nutritional Improvement		
No.	Project Title	Implementing Agencies
Approach 1. Awareness raising for nutrition		
III – 1 – 1)	Preparation of general guidance on nutrition	DoA, MoH
III – 1 – 2)	Expansion of dietary education	DoA, MoH, MoE
III – 1 – 3)	Establishment of community centres	DoA, local government
Approach 2. Diversification of food diet		
III – 2 – 1)	Promotion of high-nutrition food and fortified food	DoA, MoH

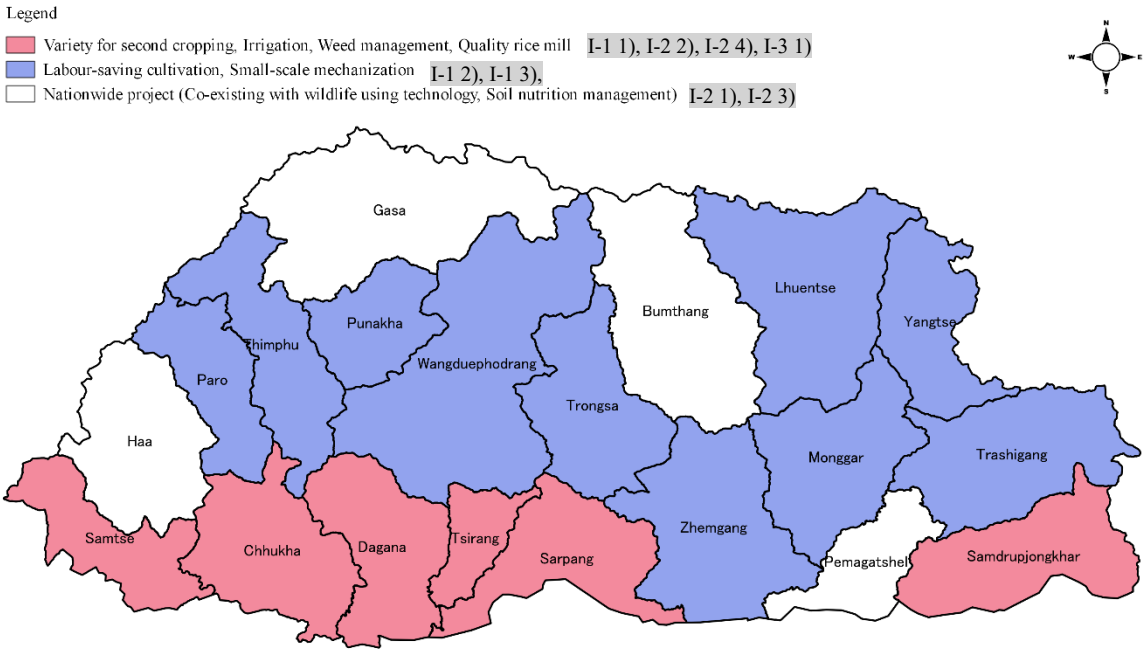


Figure 15.1.8 Proposed Project Location for Improving the Self-sufficiency Rate for Rice

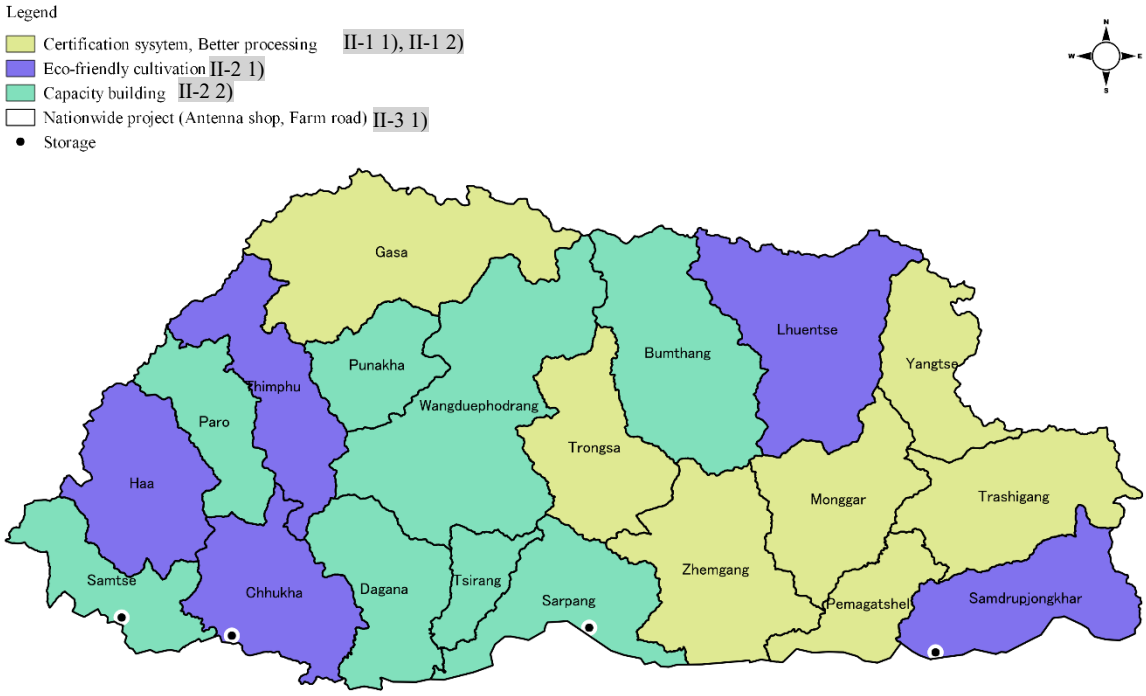


Figure 15.1.9 Proposed Project Location for Market-oriented Farming

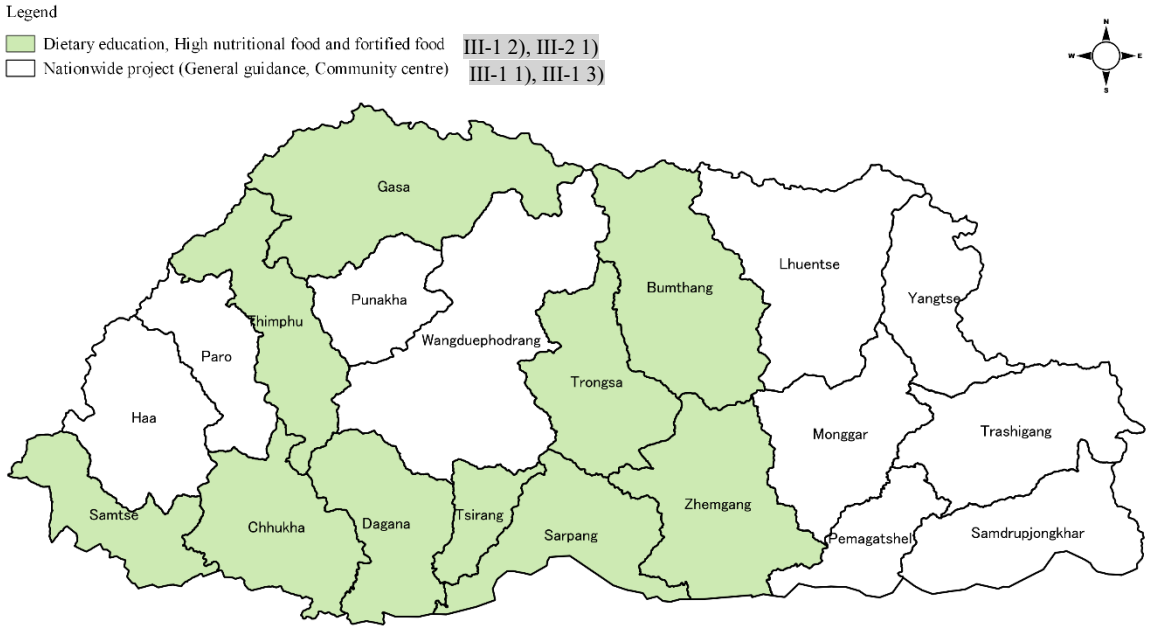


Figure 15.1.10 Proposed Project Location for Nutritional Improvement

15.2 Livestock Promotion

(1) Issues

As of 2016, milk, eggs and chicken had hit the 2018 production targets stipulated by the 11th FYP for the RNR sector (114%, 101% and 118%, respectively). Beef and pork production came close to these targets (90% and 74%, respectively), while fish production was still far lower than the target, at 25%. However, the livestock subsector has been one of the import surplus subsectors for over a decade while its export amount has been quite small, as indicated in Chapter 4.

Livestock population data for 2016 indicate that, except for poultry and goats, the populations of other livestock animals decreased as compared to the 2007 level. This implies that the self-sufficiency rates of various livestock products have stagnated at a low level. Therefore, both population increases and productivity improvements are very important, in turn requiring the promotion of import substitution for all livestock products in the future.

The regional distribution of livestock depends on animal type. Cattle and equines (including horses, mules and donkeys) are widely distributed in many dzongkhags over the country. Other livestock animals are unevenly distributed. For instance, yaks are mainly kept in Thimphu, Trashigang, Gasa, Haa and Bumthang. More than 50% of poultry is raised in Sarpang and Tsirang. It seems that the uneven livestock distribution is largely associated with suitable living conditions for each livestock animal. This indicates that livestock promotion should be planned by dzongkhag in consideration of various factors, such as natural conditions, distribution of the current animal population and market accessibility.

(2) Development Guidance

In Bhutan, livestock products are broadly categorized into two types: dairy products and meat products. They are composed of several kinds of products as follows.

- Dairy products: Milk, butter, cheese, chugo (a type of hard cheese)
- Meat products: Pork, beef, yak, chevon, chicken, fish

Eggs and honey are not included in these two categories, but they are highly important food items as well as commodities in Bhutan. A matrix for each livestock animal and commodity is shown below.

Table 15.2.1 Animal and Commodity Matrix

Commodity		Cattle	Yaks	Pig	Poultry	Chevon	Fish	Bee
Dairy	Milk	X	X					
	Butter	X	X					
	Cheese	X	X					
	Chugo	X	X					
Meat	Beef	X						
	Yak		X					
	Pork			X				
	Chicken				X			
	Chevon					X		
	Fish						X	
Egg					X			
Honey								X

Cattle produces five commodities and the four of them are very important components of the Bhutanese diet. Poultry produces two commodities, i.e chicken meat and eggs, while other animals produces one commodity each. Taking the above data and facts into account, it is assumed that cattle and poultry are the two most important livestock animals. Hence production increase for these two animals should be urgently achieved. As for cattle, promotion of dairy products takes precedence over beef in consideration of the religious sentiments about slaughter, which persist in Bhutanese society.

Among other livestock animals remaining, the production expansion of pig and fish can be prioritized after cattle and poultry since the import volumes of pork and fish meat are relatively high. Hence, their import substitution is regarded as significant. Target animals for promotion are categorized into three time frames.

- Short term: Cattle, poultry
- Medium term: Pig, fish
- Long term: Other animals

As proposed in Chapter 11, promotion areas for major livestock products are designated by dzongkhag. A detailed promotion plan for each animal/product and dzongkhag should be elaborated after conducting a more detailed survey in the selected dzongkhags/gewogs by the Department of Livestock (DoL).

Lastly, it may be worth discussing the religious sentiments concerning slaughter in Bhutan. In Bhutanese diet, dishes with meat are common, but slaughtering livestock is opposed on religious grounds by many people. As a result, a large amount of meat is currently imported from India. As this situation is based on religious faith, it is impossible to change.

If it is essential and necessary for the Bhutanese people to improve the self-sufficiency rate for meat from the viewpoint of food security, one option would be to accept immigrant butchers from other countries to process domestically raised livestock animals. However, if the imported meat is much cheaper than domestically processed meat, it is probable that most consumers will prefer purchasing the imported meat, which may result in a drop in the self-sufficiency rate. In that case, productivity improvements necessary to compete with the imported meat are inevitable in order to maintain the meat self-sufficiency rate; otherwise, the domestic livestock subsector will shrink and decline. Conversely, if it is impossible for domestically raised

livestock to compete with the imported meat, it may be more efficient and realistic to meet domestic meat demand using imports, even though this would mean abandoning self-sufficiency improvements.

(3) Human resource Development necessary for Implementation

As of 2015, the DoL dispatched 404 extension staff all over the country, i.e., more than agriculture extension staff in the gewogs (304). As there are 205 gewogs in total, the average number of livestock extension staff per gewog is almost two persons. Considering that these human resources are stationed at sites, it is considered that their number is sufficient for the implementation of livestock promotion activities.

However, it is probable that their technical skill and knowledge levels are not the same, so appropriate training programmes should be offered to extension officers who are not involved in any livestock promotion activities in order to provide useful technological skills and knowledge to local residents.

(4) Budget and Institutional Arrangement Necessary for Implementation

1) Budget

In the 11th FYP, the amount allocated for DoL under RNR sector from 2013 to 2018 was BTN 1090million, which was the second largest amount after that of the DoA (BTN 2,300 million) in the MoAF. For the National Livestock Commodity Development Programme, nearly 95% of its outlay was allocated, most of which was designated to boost production.

For the implementation of projects and programmes for livestock promotion, the DoL outlay will be the sole financial resource. Although external donors provided some of the outlay for the implementation of programmes/projects in the past, some donors have begun to cease offering assistance to Bhutan due to its recent economic development. Under current circumstances, to be on the safer side, it will be necessary not to rely on assistance from external donors. To cover the various activities related to livestock promotion, prioritizing targets and locations is highly important, because there are many target products as well as dzongkhags.

It should be noted that, under the recent decentralization policy, more outlay will be transferred to local governments from central agencies according to the 12th FYP guidelines. Thus, the total MoAF outlay between 2018 and 2023 will decrease by 34% from BTN 4,856 million to BTN 3,100 million. Accordingly, it is assumed that the DoL outlay will reduce as well.

2) Institutional arrangements

As the activities proposed above are fundamentally part of DoL responsibilities, they are expected to be carried out by the DoL. To prepare detailed promotion plans by dzongkhag or gewog, joint work is necessary with local governments because the officers working in the field tend to have more location-specific information, which will be especially useful when creating more practical and feasible plans.

Bhutan Livestock Development Corporation Limited (BLDCL) is another important stakeholder for livestock promotion. It supports the DoL in the production and supply of quality livestock inputs, including imports and coordinates closely with stakeholders on marketing livestock products. It also seeks to develop a contract farming system with livestock farmers and entrepreneurs involved in livestock production for domestic and export markets. The roles of the BLDCL seem to be more commercially oriented; thus, it will be a significant actor in the rural economy.

(5) Projects and Programmes

As indicated above, the livestock animals for promotion are summarized by dzongkhags into three time frames (short, medium and long term).,). Here, concrete development approaches are briefly proposed. Much of the livestock production system in Bhutan is still on a small scale and performed in backyards. For various reasons such as laborious daily work, harsh natural conditions, less developed distribution networks, less investment in livestock activities etc, a commercial production system is marginally practised. Under current circumstances, it is important to 1) improve the productivity of livestock animals and 2) to increase the livestock population in order to boost livestock production and substitute it with imported livestock production, as shown below.

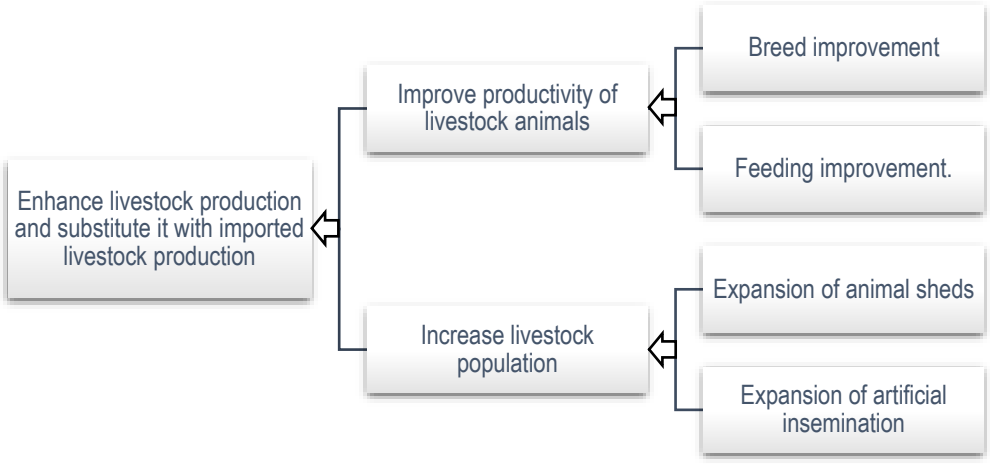


Figure 15.2.1 Approach to Boost Livestock Production

The main content for each item is as follows.

1) Productivity improvement

Cattle

To enhance productivity, there are two main measures: breed improvement and feeding improvement. Breed improvement has been implemented by the DoL over a long period, such as exotic dairy cow breed introduction. In Samtse, there is a breeding institution known as the National Jersey Breeding Centre. In 2014, the centre released a dairy breed called 'Karan Fries', which was developed in India by crossing a Holstein Friesian with a Tharparkar, an Indian breed. It offers more milk production, high disease resistance and adaptability to local conditions. These breed improvement efforts should be continued in order to tackle the low productivity rate in the dominant subsistence livestock farming in Bhutan.

Siri[1] is the predominant local cattle breed in Bhutan, which is widely kept all over the country. This breed has survived for centuries due to its adaptability to different agro-ecological systems, disease resistivity and usefulness as a draught animal. However, it produces less milk, which in turn results in less income for farmers. (The average yield is about 1.3 l per day, and 300-380 l in a lactation period of about 270-280 days.) On the other hand, pure Jersey cattle among exotic cows which was introduced and kept by farmers using improved husbandry and feeding, can produce a daily milk yield of 4-15 l per day with over 2,000 l in a lactation period of 305 days. The milk production difference is quite large. For the majority of small-scale livestock farmers,

[1] *Siri* is the broad terminology used to describe all local cattle types of the Himalayan belt.

who has experienced difficulties in introducing improved husbandry for pure Jersey breed cattle, F1 female cross-bred cattle will be suitable. The F1 female (Mithun cross-bred cattle) produces about 2-3 l of milk per day during a lactation period of 270-280 days. (The major advantage of cross-bred dairy cattle is that they exhibit the strengths of parent breeds from which they descend with an added advantage of heterosis.)

Nublang is the native cattle breed of Bhutan, with its original home tract in Sangbeykha, Haa. It is considered as the most adaptable to a wide range of agro-climatic conditions in Bhutan because it migrates to higher areas during summer (2,800 m a.s.l.) and low-lying zones during winter (250 m a.s.l.). In addition, it is disease-resistant and good foraging abilities and survives under adverse nutritional conditions. These genetically valuable breeds should be carefully conserved and utilized as materials for breed improvements in the future.

Feeding improvements are another factor affecting productivity. In Bhutan, the ordinary feed resources available to farmers are common property resources (forest and community grazing grounds around settlements). In general, the milk yield is higher in cows fed with good-quality fodder and concentrates. However, for many livestock farmers in Bhutan, the imported concentrates are still expensive; hence, they are not commonly used as feed. Feeding improvement measures through fodder and pasture enhancements such as introducing leguminous fodder seem to be more practical. Feeding improvement methods such as Fodder improvement plans by DoL, researches on high quality fodder, workshops and trainings for farmers on feeding improvements and arwareness on high quality fodder will help in high yielding. Thus high quality fodder can be produced locally to improve yielding.

Feed management improvement is another factor to affect milk productivity. If cattle produces milk lower than average, followings could be possible reasons.

- Whether the moisture content of silage is fluctuated or not. (=> Amount of dry matter and nutritional balance may change due to moisture content fluctuation.)
- Whether the length of silage is too short or not. (=> If silage length is too short, digestion efficiency may decrease due to less rumination period in rumen.)
- Whether any kinds of mould and/or toxic grasses are observed in silage or not. (=> Mould and/or toxic grasses in silage may affect microorganisms in rumen.)
- Whether the nutritional balance in silage is stable or not. (=> Lower protein content in silage may affect milk production.)

Though these items on feed qualities are difficult to monitor at a farm level, they closely relate to amount of milk production. Hence feed management improvement is considered as one of important issues over the long run.

Poultry

In the case of layers (egg-laying hens), many egg producers in Bhutan currently raise exotic breeds, Hy-line Brown and Hy-line Silver Brown, provided by the DoL. Generally, these breeds have a higher laying performance than local breeds, but they also need to be fed better-quality feed compared to local ones. In other words, local breeds are better at scavenging under free-range conditions, which are typically practised in the rural area because they require less labour and smaller feed costs. However, as exotic breeds require better feed quality, farmers have to satisfy this. Otherwise, only a few birds in production will perform up to standard level, while the rest will end up underperforming. Thus, it is necessary to feed commercial concentrates, but they are basically prohibitive in terms of cost for most farmers.

To compensate for concentrate feeding and reduce the costs of production, local resources can be utilized. For instance, sweet potato and taro are good sources of energy substitution. For

protein substitution, earthworm meal, maggot meal and concentrated leaf protein are possible alternatives. Not only crops and animals, but also organic wastes from households and by-products from local industries, such as rice mills, could be possible substitutions for commercial feed. However, substitutions should be processed properly under scientific supervision by considering the quality, hygienic aspects and availability of those substitutes in the area.

2) Population increase

To increase the livestock population, one of the effective measures is the expansion of animal sheds because livestock rearing usually needs these physical facilities. During the 11th FYP, the DoL provided various forms of support to livestock farmers, including shed construction materials for animal sheds, fish ponds and hatchery, in kind. However, except for poultry and sheep, the population of livestock animals has not increased since 2013, as reported in Chapter 4.

The stagnated livestock population may result from the fact that domestic livestock products are more expensive than imported ones, but government support, in the form of providing shed construction materials, must be continued because livestock population increases are vital to improve self-sufficiency in livestock production and reduce imports of livestock products.

According to a recent report[2], government subsidies for dairy development (purchase of improved dairy cattle breeds including transportation costs, and the construction of dairy sheds, silo pits and milk processing units) have resulted in substantial increases in production (about 45%) and sales of milk products at the household level. It is also evident that many farmers have been able to improve their living conditions and the nutritional status of farm families with subsidy support. In the table below, the subsidy support provided by the DoL during the 11th FYP is summarized by livestock animal.

Table 15.2.2 Subsidy Support for Animal Sheds by the Department of Livestock

Livestock	Maximum Level of Support	Criteria and Maximum Support Limit
Dairy	For construction of animal farm sheds (construction material): maximum of BTN 7,500/animal (30% of the cost)	Approximate calculated cost is BTN 25,000 and support to be given to a maximum of five cows/household
Poultry	For construction of animal farm sheds (construction material): maximum of BTN 7,000/100 birds (20% of the cost)	Approximate calculated cost is BTN 35,000/100 birds and support to be given to a maximum of 5,000 layers and 10,000 broilers only
Piggery (breeding farms)	For construction of animal farm sheds (construction material): a maximum of BTN 30,968/sow (70% of the cost)	Approximate calculated cost is BTN 221,202/for farmers rearing five sows only; support will be provided based on detail project proposals
Piggery (fattening farms)	For construction of animal farm sheds (construction material): a maximum of BTN 5,400/pig (30% of the cost)	Approximate calculated cost is BTN 18,000/shed; maximum support will be provided up to 100 fatteners
Fishery	For construction of fish ponds and dykes: a maximum of BTN 48/m^2 (1 acre = 4,047 m^2) (30% of the total cost is BTN 195,000)	Approximate calculated cost is BTN 455,000/acre; maximum support will be provided up to 3 acres
Goat	For construction of animal farm sheds (construction material): a maximum of BTN 1,950/goat (30% of the cost)	Approximate calculated cost is BTN 6,500/goat; maximum support will be provided for up to 50 goats

Source: Note Sheet of the DoL, 7 March 2014 (DoL/Gen-8/2013-2014/108/)

[2] Choden et al. 2017. Effects of Government Subsidy Support on Livelihood of Dairy Farmers in Bhutan. *Bhutan Journal of Animal Science*, Vol. 1(1), pp. 1-4.

A similar support framework should be continuously implemented from now on in order to improve self-sufficiency in livestock production through animal population increases.

In addition, artificial insemination technology should be expanded, alongside the provision of adequate facilities, because it is still not commonly practised in Bhutan even though it was introduced many years ago. On 22 May 2017, the MoAF issued the Livestock Rules and Regulations of Bhutan 2017, which includes a clause on artificial insemination and embryo transfer. According to this clause, an "artificial insemination out-reach centre, laboratory for semen or embryo production, and storage of semen or embryo shall be established after assessing the feasibility based on the standards developed by the Technical Department".

There are 13 breeding farms and centres under the DoL across the country for various livestock animals, as shown below. Strengthening these existing organizations in terms of both human resources and facilities is considered to be highly important to the success of artificial insemination interventions.

Table 15.2.3 Breeding Farms and Centres for Livestock

Dzongkhag	Organization
Bumthang	Brown Swiss Cattle Farm
	Horse Breeding Farm
	Brown Swiss Cattle Breeding Programme
	National Sheep Breeding Centre/Heifer Project
Chhukha	Calf Rearing Centre
Monggar	Regional Pig and Poultry Breeding Centre (Lingmenthang)
Paro	Regional Poultry Breeding Centre
Samdrupjongkhar	Regional Mithun Breeding Farm (Arong)
Samtse	National Jersey Breeding Centre
Sarpang	National Pig Breeding Centre
Thimphu	Regional Pig Breeding Centre
Trashigang	National Nublang Breeding Farm
Zhemgang	Regional Mithun Breeding Farm (Wangdigang)

Source: DoL and MoAF

The table below shows the projects necessary to achieve food security and self-sufficiency in livestock production in the context of livestock promotion.

Table 15.2.4 Projects for Food Security and Self-sufficiency in Livestock Production in Livestock Promotion

No.	Project Description	Implementing Agencies
Approach 1: Productivity improvement		
1 – 1)	Continue breeding improvements in cooperation with various breeding centres/farms under the DoL	MoAF, breeding centres/farms
1 – 2)	Better feeding through fodder and pasture improvements	MoAF
Approach 2: Population increase		
2 – 1)	Continue supporting the provision of animal shed construction materials as well as artificial insemination technology	MoAF
2 – 2)	Expand facilities to provide effective artificial insemination at a reasonable price	MoAF

15.3 Forestry Promotion

(1) Issues

In Bhutan, the government has committed itself to maintaining at least 60% of the country's land area under forest cover. According to the National Forestry Inventory Report, Vol. I (2017), the percentage of national land under forest cover is 71% (margin of error: 2%), with an estimated area of 2,730,889 ha covered by forest. The distribution of forest cover varies by dzongkhag as shown in Chapter 4.

Timber exports are banned due to the priority of meeting domestic demand first and foremost, but the export of wood products are allowed after value is added to the wood. They include 22 finished forest products (e.g., particle boards, plywood, furniture, block boards, briquettes and handicrafts). Among them, particle board is the most exported commodity in 2017, with India the sole importer of Bhutanese particle board (Bhutan Trade Statistics 2017, Department of Revenue and Customs, Ministry of Finance). Its export value in 2017 recorded BTN 175 million, followed by wood charcoal (including shell or nut charcoal) at BTN 28 million. However, the export value of overall forest products (BTN 237 million, categorized in Section IX, "Wood and Articles of Wood", in Bhutan Trade Statistics 2017) represented only 0.94% of the total commodity export value (excluding electricity) in 2017.

As for non-wood forest products (NWFPs), cordyceps' export value exceeded BTN 375 million (2.14% of the total value of commodities exported) in 2014, but decreased to BTN 192 million (0.76% of the total value of commodities exported) in 2017. Though the export value sharply dropped, it is a slightly smaller than the total export value of overall forest products, i.e., BTN 237 million, and is still one of the main and important NWFPs for earning foreign currencies. Other major exported NWFPs include mushroom (matsutake), medicinal and aromatic plants (MAPs), and incense.

In Chapter 11, a forestry and NWFP promotion area delineated from the LULC 2016 data is proposed. As more than 50% of the total land is covered by Protected Areas and Biological Corridors, the promotion area represents 31% of the country's land. It is mainly distributed on the central and southern belts in Bhutan, but a large part covering Wangduephodrang to Zhemgang is excluded since two national parks linked with the Biological Corridors are located there. The forestry and NWFP promotion area is considered as current forest cover where any restriction and plan are not applicable.

According to the National Forest Policy 2011, approximately 14% of forest area is economically accessible and available for commercial timber production. Improving accessibility is a crucial issue for the sustainable utilization of available forest resources; hence, the development of forest roads and/or cable cranes is indispensable. However, in reality, forest road construction is often deterred by extreme topography.

(2) Development Guidance

1) Importance of the Local Forest Management Plan

The keywords for forestry development are "sustainable management and utilization of natural resources". They are included in the DoFPS mission statement, as well as one of the three agency key result areas (AKRAs) in the 12th FYP of the MoAF between 2018 and 2023.

As the National Forest Policy 2011 declared, all forest should be managed sustainably under a management plan. The utilization-oriented management plans in Bhutan includes plan for Forest Management Units (FMUs) and Community Forest (CFs), as mentioned in Chapter 4.

Currently the DoFPS promotes the preparation of a Local Forest Management Plan (LFMP), which is applied to all forest areas outside the FMUs, CFs and other existing forest management schemes. This means that all State Reserve Forest in Bhutan would be covered by any management plan where gewogs will formulates its own LFMP for its own forest. This is focused on the identification of potential areas for forest production, with each gewog is encouraged to form and implement an LFMP for its jurisdiction. At the moment, there are 22 LFMPs across nine dzongkhags.

In the LFMP, gewog-wise forest management and utilization can be incorporated, which in turn enables the development of location-specific management and the utilization of forest resources including NWFPs. Renewal of old trees by effective thinning is recommended to accelerate ecological functioning and biodiversity levels of climax forest. The absorbed amount of Green House Gas (GHG) is increased in the managed forest. In the course of the decentralization process in Bhutan, it can be productive for each gewog administration to exhibit its own initiatives in the field of forestry. When the LFMP is prepared by each gewog administration, location identification of the forestry promotion area is especially important for sustainable management and utilization. Thus, close cooperation with the forest extension officers of the gewog and dzongkhag administrations as well as other DoFPS officers working in the area is indispensable.

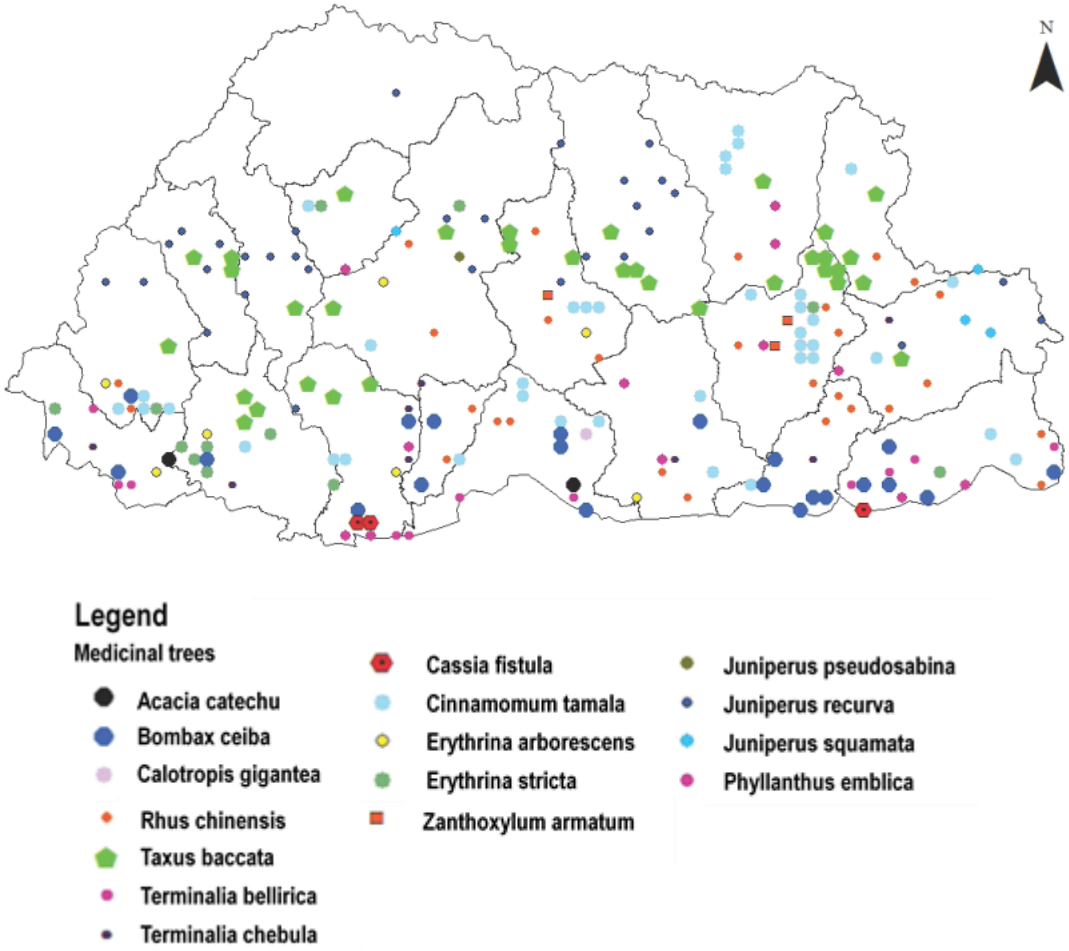
As an FAO book[3] pointed out, "Community-based forestry is a valuable forest management modality that has the potential to contribute to sustainable forest management and improve local livelihoods. Strong and effective community-based forestry regimes are also resilient and able to withstand internal and external shocks, including the uncertain impacts associated with climate change. Overall, communities and smallholders have demonstrated in a wide range of settings that they are able and willing to manage forests sustainably, generating significant economic and other benefits." Through the expansion of community-based forest management systems, such as CFs and LFMPs, in Bhutan, it would appear to be a highly important and effective measure for sustainable forest management in the future to promote the further utilization of NWFPs to incentivize for forest management by local people.

2) Short-term target

As accessibility to available forest resources is still limited, the utilization of NWFPs should be prioritized in the short term because transportation and harvesting of the NWFPs are much easier than for timber. But research and marketing related to the NWFPs should be further promoted, since much knowledge, particularly on MAPs, is not systematically organized. The sustainable management and utilization of NWFPs (including MAPs) will promote more development, as well as income generation opportunities, in the rural area.

A recently released report, National Forestry Inventory Report, Vol. II (2018), reveals that 76 medicinal plants of different life forms (trees, shrubs and herbs) grow naturally across the country. Distribution maps of recorded medicinal trees, shrubs and herbs are shown below.

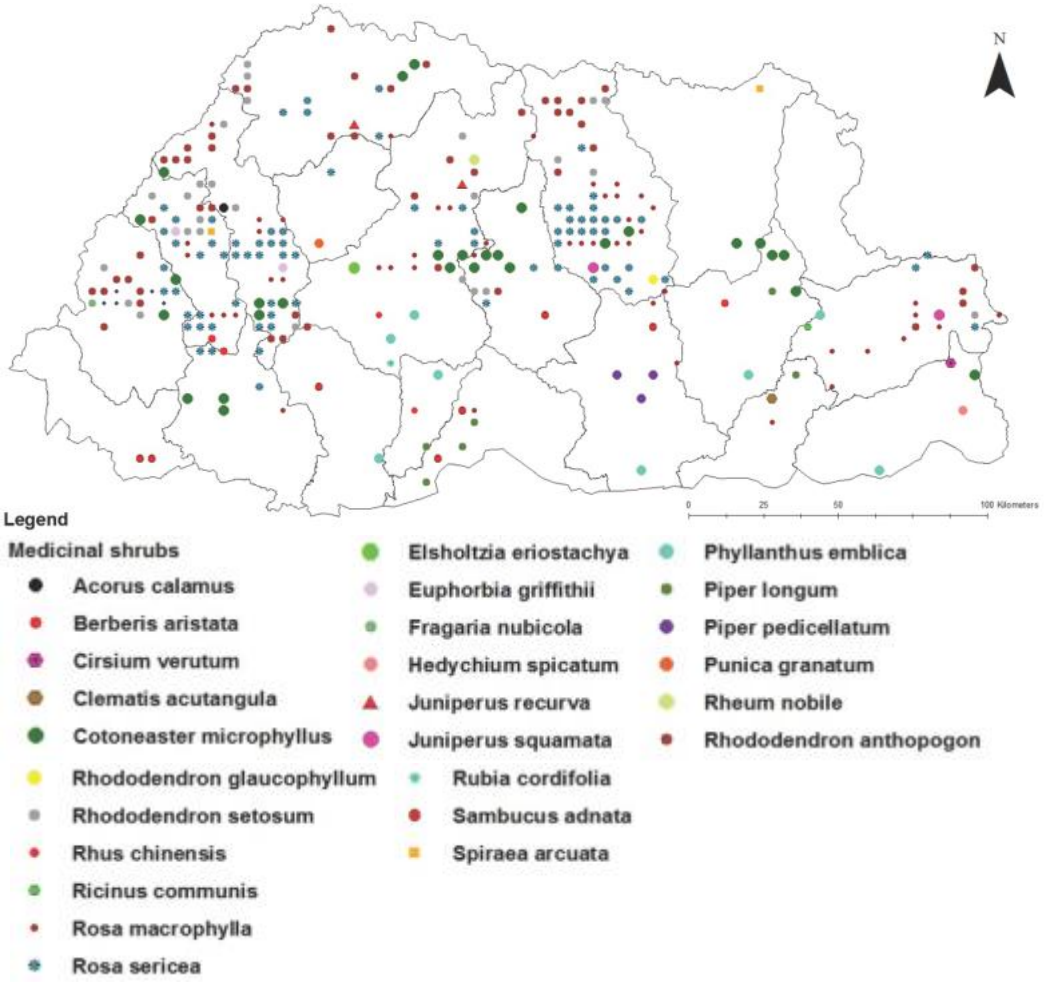
[3] Gilmour, D. 2016. Forty Years of Community-based Forestry: A Review of Its Extent and Effectiveness. *FAO Forestry Paper 176*. Rome: FAO.



Source: National Forest Inventory Report, Volume II, 2018, DoFPS, MoAF

Figure 15.3.1 Distribution of Medicinal Trees in Bhutan

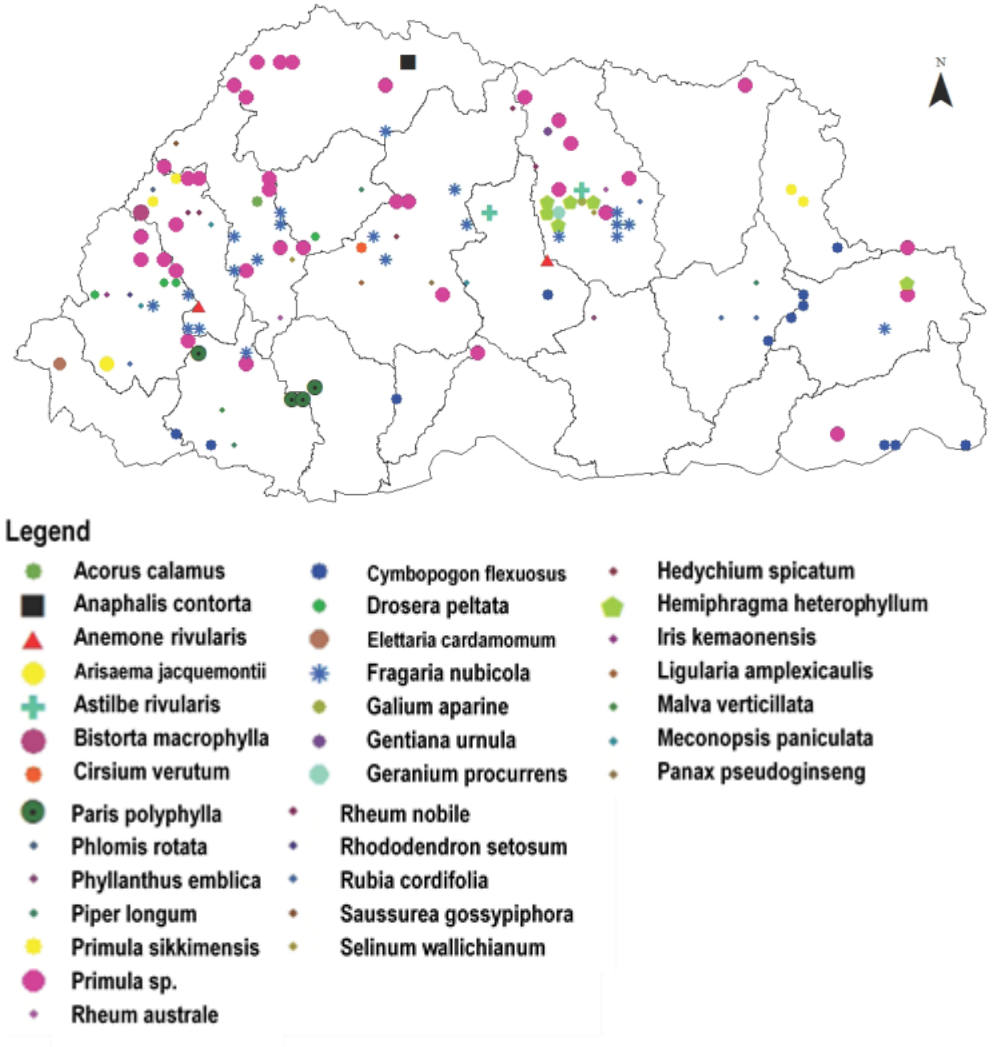
As expected, there are hardly any medicinal trees distributed in the highland area, many of which are mainly observed in the central and southern belts. On the other hand, many medicinal shrubs are grown in the northern and central belts, but less so in the southern belt. Bumthang, Thimphu, Paro and Haa seem to be hotspots for medicinal shrubs.



Source: National Forest Inventory Report, Volume II, 2018, DoFPS, MoAF

Figure 15.3.2 Distribution of Medicinal Shrubs in Bhutan

The distribution of medicinal herbs appears similar to that of medicinal shrubs. They are less grown in the southern belt.



Source: National Forest Inventory Report, Volume II, 2018, DoFPS, MoAF

Figure 15.3.3 Distribution of Medicinal Herbs in Bhutan

If these MAPs are excessively gathered on one site, this may lead to the extinction of some plant species there. Hence, the sustainable management and utilization of MAPs is crucial when the LFMP is formulated. Trial cultivation[4] of some MAPs should also be promoted in the course of carrying out research activities. If the cultivation of some valuable MAPs is successful, this may provide a new cash crop, such as Chinese liquorice, to Tajikistan[5].

In addition, the promotion of wood-based industries is also proposed. According to the DoFPS, the present demand level for timber is very high due to the construction boom, meaning there is a shortage of supplies. As the LFMPs are gradually formulated across the country from now on, more wood materials will be traded. If wood-based industries, such as sawmills, furniture workshops, plywood manufacturers and briquette factories are set up, they will use wood materials to manufacture value-added products, which in turn will lead to increased job opportunities in the rural area. The following items are also listed in the Forest and Nature

[4] Department of Agriculture, MoAF, is in charge of the domestication and cultivation of MAPs for income generation.

[5] Chinese liquorice (*Glycyrrhiza uralensis*) is a flowering plant native to Asia. It is used as a sweetener and one of the 50 fundamental herbs used in traditional Chinese medicine. Recently, its cultivation has been tested in Tajikistan because of a production decrease in China.

Conservation Rules and Regulations of Bhutan 2017 as exportable finished forest products.

Table 15.3.1 List of Exportable Finished Forest Products

Export of Finished Forest Products 218. The finished forest products with the following specification/description shall be allowed to be exported:	
(1) Particle board	(2) Plywood
(3) Broom handles	(4) Railings
(5) Furniture	(6) Packing box
(7) Photo frames	(8) Sawdust
(9) Block board	(10) Decorative bits with design profiles
(11) Skirting*	(12) Green charcoal
(13) Briquettes	(14) Ear buds, chopsticks and toothpicks
(15) Handicraft items	(16) Incense stick and powder
(17) Wooden cable drums	(18) Wooden crate
(19) Laminated beams	
(20) Timber retrieved from dismantled house but not from old heritage timbers from temples	
(21) Fabricated timber structures for exhibition and other related use	
(22) Wood parquet	

* Max. width 4", max. thickness 1", one side grooved, can be of any length
Source: Forest and Nature Conservation Rules and Regulations of Bhutan, 2017, DoFPS, MoAF

Although the exportable items above are not considered as highly value-added products, except for furniture and incense, most of them are necessary items/materials for house and other building construction and daily life (furniture and incense are regarded as consumer products). This means that their demand quantities are not small, although their price level is relatively low. If these products are attractive in terms of good design and/or competitive price, marketing opportunities may increase, both domestically and internationally. Target wood products should be selected for further promotion of wood-based industries after conducting market research.

In addition, Clause 220 in the regulations states that: "The export of other finished products and value-added items [sic] which are not listed above shall be allowed only upon approval from the Ministry on the recommendation of the Department." Based on the market research findings, other finished wood and value-added products have been selected as promising exportable items; thus, it is worth pursuing approval for the exportation of these items from the MoAF.

3) Medium- to long-term target

Timber utilization should be possible after accessibility improvements to the forest road network; as such, this activity is considered as a medium- to long-term target. With road accessibility and cable crane system improvements for the transportation and collection of logs, a higher level of timber utilization can be realized.

As timber exportation is legally banned, the expansion of domestic sawmill capacity is another important factor to support timber utilization in the future. The number of sawmills in Bhutan increased more than twofold, from 49 in 1990 to 138 in 2017, but many of them are on a small scale with only 29 of them being integrated sawmills (Forestry Facts and Figures 2017, DoFPS, MoAF). In parallel with the accessibility improvements in available forest resources, the gradual introduction of integrated sawmills, which offer multiple functions to process logs, is considered to be crucial in the long run.

The development of various wood products for exportation to India is another long-term issue. Though 22 finished forest products are legally allowed for export, only particle board is now being exported to India, according to recent trade statistics. Thorough market research should be conducted before the selection of products.

Furthermore, from the viewpoint of an advocated carbon-negative country, the renewal of old trees is important in order to maintain/increase carbon dioxide absorption amounts. In general, the growth rate of old trees in climax forest is lower than that of young trees, which in turn results in less carbon dioxide absorption. The DoFPS published the "Scientific Thinning Plan" in 2011 to carry out thinning operations in blue pine and mixed conifer forest. Hence, in accordance with this plan, the implementation of effective thinning of old trees in climax forest will be another subject to be tackled in order to sustain and improve the health and the growing stock in these forest areas.

Furthermore, the thinned timber can be processed and marketed on the market to generate income. Currently, luxury furniture is in high demand in some countries, such as the USA, Japan, China, India and EU countries. If high-quality, old big trees are thinned and transported to furniture factories, it may be possible to transform them into luxury furniture. The market for luxury and middle-class furniture could also grow, not only internationally, but also domestically, as the Bhutanese economy develops in the future.

(3) Human Resource Development Necessary for Implementation

As of 2015, the DoFPS dispatched 231 extension staff members to dzongkhags. In addition, there were 1,093 officers stationed in territorial divisions and parks across the country, which is more than four times larger than the number of forest extension staff. Considering that this large number of human resources is being distributed to the field offices, it is judged that this workforce is sufficient for the implementation of forest-related activities.

However, it is probable that their technical levels are not the same. In particular, the officers in territorial divisions and parks and extension staff may have different information on the sustainable management and utilization of forest resources, including NWFPs. Therefore, they should be provided with appropriate training programmes, which will enable them to join in forest-related activities and provide useful technological skills and knowledge to local residents.

Collaboration with related universities/colleges and the Department of Traditional Medicine, Ministry of Health, is recommended in order to produce more efficient and better research on NWFPs.

(4) Budget and Institutional Arrangements Necessary for Implementation

1) Budget

In the 11th FYP for the RNR sector between 2013 and 2018, the allocated outlay amount for the DoFPS was BTN 890 million, which represented 18% of the total MoAF outlay. For the Programme for the Sustainable Management of State Forests, which is considered to be a utilization-oriented programme, BTN 140 million was allocated. As mentioned in the previous section, under the circumstances where some foreign donors step back from providing assistance to Bhutan, to be on the safe side, there should be no reliance on such funding streams. For the implementation of forestry development projects and programmes, the DoFPS outlay will be the sole financial resource. To cover the various activities related to forest utilization, prioritizing targets as well as locations is highly important, considering that there are many targets and forest areas.

In addition, more outlay will be transferred to local governments from central agencies according to the 12th FYP guidelines. Therefore, it is assumed that the DoFPS outlay from 2018 to 2023 will decrease, compared with the amount in the 11th FYP for the RNR sector between 2013 and 2018.

2) Institutional arrangements

Basically, the activities proposed above are included in the DoFPS responsibilities; thus, the DoFPS is principally in charge of all the activities. Close cooperation with local governments is indispensable, particularly for LFMP formulation, because only forestry extension officers in each gewog possess technical knowledge on forest.

For research and marketing related to the NWFPs, universities and governmental research institutions have important roles to play in complementing DoFPS' technical knowledge. Forest road construction is currently implemented by a state-owned company, Natural Resources Development Corporation Limited (NRDCL). Thus, the DoFPS should work together with NRDCL for accessibility improvements in the case of available forest resources.

In addition, it is worth mentioning that close coordination with other organizations concerned is very important because some public organizations in Bhutan sometimes work independently rather than jointly/cooperatively. By doing so, the similar activities will not be duplicated and/or implemented at the same location but at different times. For the smooth coordination at implementation stage, joint planning works are indispensable not only at a central level but also at a local level.

(5) Projects and Programmes

1) Acceleration of LFMP formulation

For the sustainable management and utilization of forest resources including NWFPs, the LFMP formulated by each gewog will be critical because it basically prescribes how the available forest resources would be utilized in the gewog. Without appropriate contents that correspond to sustainable resource management practices, no forest resources can be tapped into by the local economy in the long run. So far, only 22 out of the 205 gewogs have completed their LFMP; hence, other gewogs should urgently formulate their own LFMP through close cooperation with the DoFPS.

2) Further research and marketing for NWFPs and MAPs

Bhutan is endowed with diverse forest resources including many MAPs. Throughout history, NWFPs such as bamboo and cane have been used by people. Recently, the utilization of NWFPs in Bhutan has been spreading, mainly due to the DoFPS initiative to organize NWFP groups. As of 2017, there are 138 NWFP groups with 4,721 beneficiary households. Among a variety of NWFPs, cordyceps is an exceptionally renowned product because of its high value in terms of price and medical effects.

The recent National Forestry Inventory results revealed that there are 76 MAPs naturally grown across the country. This should be considered as a starting point for further research and marketing of MAPs. To expand the potential of NWFPs including MAPs, more efforts should be directed at systematic research and marketing activities. By doing so, this could result in the development of the pharmaceutical industry, which manufactures and exports medicines made from MAPs, in the future. In turn, this would allow more rural people as well as NWFP group members to generate higher income levels and enhance their livelihood.

3) Improved accessibility in the case of available forest resources

In consideration of the extreme terrains, improved accessibility to forests is one of the more difficult tasks, both physically and financially. However, no logs can be transported without access roads or cable cranes from cutting sites. Considering that the neighbouring Indian states

have a huge population, their demands for wood products, such as furniture, plywood and particle board, will never reduce, but probably increase in future. Even though timber utilization is prioritized for meeting domestic demand, first and foremost, accessibility improvement should be gradually implemented for the sustainable utilization of wood resources in anticipation of the increased demand for wood products. If cable cranes are considered to be appropriate from the viewpoint of technical feasibility as well as cost-effectiveness, they can be combined with forest road networks.

The table below sets out the projects to achieve the target of the sustainable management and utilization of forest resources in forestry promotion.

Table 15.3.2 Projects for the Sustainable Management and Utilization of Forest Resources in Forestry Promotion

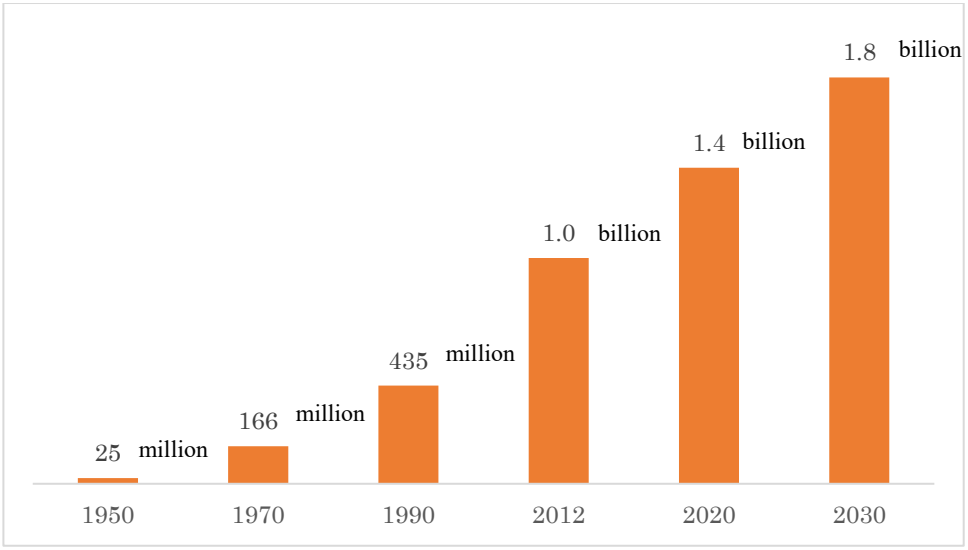
No.	Project Description	Implementing Agencies
Approach 1: Acceleration of LFMP formulation		
1 – 1)	Prioritize the Gewogs where the LFMP is significantly important to improving rural livelihoods based on statistics, e.g., 2017 BLSS and 2015 GNH Survey	MoAF, dzongkhag
1 – 2)	With close cooperation from the gewog administration, formulate the LFMP in consideration of sustainable wood resources and NWFP management based on site investigation	MoAF, gewog administration
Approach 2: Further research and marketing of NWFPs and MAPs		
2 – 1)	To enable rural residents to utilize NWFPs and MAPs and promote further research on them across the country	MoAF, universities, research institutions, Department of Traditional Medicine, Ministry of Health
2 – 2)	Based on the research results on NWFPs and MAPs, promote their marketing domestically and internationally.	MoAF, Department of Traditional Medicine, Ministry of Health
Approach 3: Improvements in accessibility to available forest resources		
3 – 1)	To facilitate better accessibility to available forest resources and improve forest road and cable crane networks.	NRDCL, MoAF

15.4 Tourism Promotion Including CSI

(1) Issues

1) Global trend

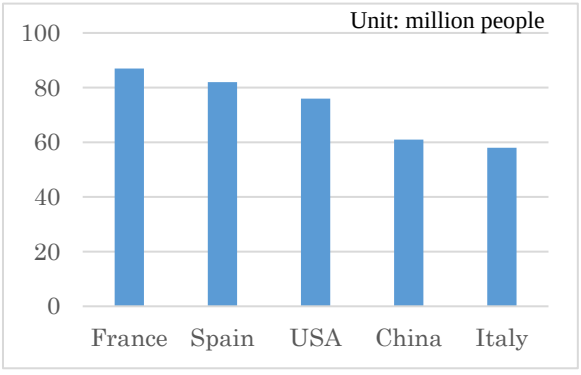
According to the UNWTO, international tourist arrivals have increased since 1950. The number of international tourist arrivals was only 25 million in 1950. That figure reached 1.0 billion in 2012 and is expected to increase up to 1.8 billion by 2030. Currently, the tourism sector accounts for 10% of global GDP. In addition, one out of 10 people in the world is working in a tourism-related job.



Source: UNWTO

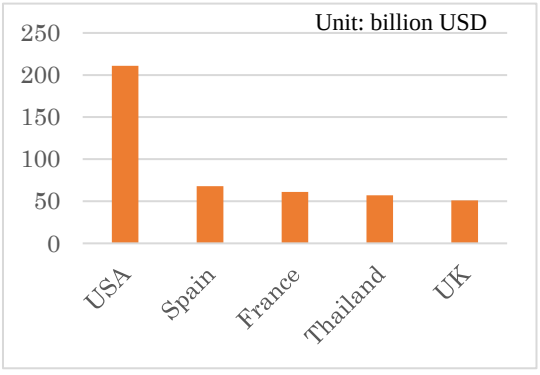
Figure 15.4.1 Trend of International Tourist Arrivals

France is the most visited country, having received 87 million international tourists in 2017. Spain, the USA, China and Italy are also ranked in the top five. As for tourism earners, the USA's tourism earnings are overwhelming and worth USD 211 billion. From the figure, there is a correlation between tourism earnings worth USD 210.7 billion and international tourist arrivals. However, it is worth noting that Thailand though ranked in 10th place in terms of international tourist arrivals is in fourth place in terms of international tourism earnings.



Source: UNWTO

Figure 15.4.2 World's Top Tourism Arrivals 2017



Source: UNWTO

Figure 15.4.3 World's Top Tourism Earners 2017

David Atkinson, special adviser with the Japan National Tourism Organization (JNTO), suggested that there are four conditions associated with becoming a tourism-oriented country: climate, nature, culture and food. The country with the most diversified climate, nature, culture and food will attract the most tourists. Top-ranked countries such as France, Spain and the USA satisfy these four conditions. The tourism sector in Bhutan has room for improvement in relation to these conditions. For instance, meals can be diversified, i.e., by providing non-Bhutanese food.

According to global trends, tourism is one of the most promising sectors for development in the future. At the same time, the competition to attract international tourists is becoming more serious around the world.

2) Background information

Fewer repeaters

The annual reports of the Bhutan Tourism Monitor for 2015 and 2016 suggest that the repeater rate for tourists is very low: 10% in 2015 and 6% in 2016. A highly limited number of tourists visit Bhutan more than once. A tourism-oriented country has many repeaters. For example, the repeater rate for the USA is around 80%.

Limited destinations

Dzongkhag-wise arrivals by bed nights in the annual report of the Bhutan Tourism Monitor for 2017 shows that 78.6% of bed nights only applied to Paro, Thimphu and Punakha. The remaining share for other dzongkhags was just 21.4%.

Seasonality

Tourists choose to visit in spring and autumn. As a result, there are fewer tourists during summer and especially winter. Disparity between seasons is one factor. It may be difficult to overcome seasonality by only considering the tourism sector itself.

3) Marketing and tourism attraction

Identification of target countries and attributes

The identification of target countries and attributes is required to increase the number of international tourists, especially that of repeaters. So far, international tourists visiting Bhutan mainly come from European countries, Asian countries and the USA. Yet, the number of tourists has fluctuated year on year, partly due to annual special tourism promotions. For instance, Japanese tourists received a special promotion in 2016 on the 30th anniversary of the establishment of diplomatic relations. As a result, the number of Japanese tourists was 4,833 in 2016, yet this decreased to 2,744 in 2017. A similar situation occurred in case of South Korea and other countries. These kinds of promotion should be transitory rather than continuous promotion, although they are important to attract first-time visitors.

Identification of tourism attractions in the eastern area

The identification and promotion of tourism attractions are required to attract tourists to areas other than the western area. Currently, 90% of international tourists visit because of cultural activities. They may be satisfied with a one-time trip to the western area only. The reason why there are only a few repeaters may be explained by the fact that international tourists do not understand the appeal of the eastern area and its differences with western area.

Development of tourism infrastructure

The lack of tourism infrastructure, such as hotels, restaurants local guide, local car rental services, tourism information centre (TIC), facilitation for meeting, incentive tour, convention/conference and exhibition/event (MICE), and transportation in the eastern area, has been highlighted. The experiences of several countries which have successfully attracted international tourists indicate that the development of tourism infrastructure should be tackled first to attract tourists. International tourists do not come to undeveloped places unless there are world-class tourism resources, such as the Pyramids of Giza in Egypt and Machu Picchu in Peru.

Linkage with livelihoods such as handicrafts and souvenirs

The Cottage & Small Industry sector in local areas, such as handicraft- and souvenir-making, should be considered alongside the tourism sector to a greater extent. Each region must have excellent tourism resources which have not yet been discovered and utilized for tourism purposes. For example, the textile techniques in the east are impressive and rare, according to a senior Japanese volunteer. Place, history, culture and food, which are not currently adopted as tourism resources by the local people, should be considered and promoted. Not only the development of tourism infrastructure but also the utilization of existing local resources are key issues. Local resources should be connected by a single narrative, which reflects the needs of the modern tourist who is looking for real culture and tradition, not mass products. As a result, non-utilized resources and facilities will have new appeal.

Enhancement of favorable treatment for specified purposes

The RGoB sets minimum selling prices for packages to the country. These must be paid in US dollars in advance to arrival in Bhutan. For instance, the minimum daily package for tourists travelling in a group of three persons or more is as follows according to Tourism Council Bhutan. These rates are applicable per tourist per night halt in Bhutan:

- USD 200 per person per night for the months of January, February, June, July, August, and December.
- USD 250 per person per night for the months of March, April, May, September, October, and November.

Although the RGoB has introduced favourable treatment in the minimum daily package to attract the tourists in the rainy season and the winter season for mitigating the seasonality, further incentive favourable treatment for the specific group is worth thinking about to meet the specified purposes as below.

- Tourists who visit in Central Eastern Region and Eastern Region to promote these regions.
- Youth who will be a repeat guest in the future.
- Elderly people who have sufficient time to visit a lot of places.

(2) Development Guidance

1) Target setting and detailed marketing with a comprehensive survey

A comprehensive survey of international tourists at present should be conducted to determine their interest, satisfaction and dissatisfaction, budget, route and purpose As the priority action, detailed marketing should be conducted at the same time. Marketing factors include the following.

Table 15.4.1 Examples of Marketing Factors

Items	Detail
Country	Which country?
Attributes	Age, job, sex, income level etc.
Target number	How many people are assumed to visit?
Highlighted tourism resources	What kinds of tourism resources to be shown?
Length of trip	How many days?
Assumed budget	What is the budget of the target group?
Promotion	What kinds of promotion activities will achieve the above?

So far, the possible targets will be "longer stays" and "spending more money" since Bhutan's tourism development approach is focused on sustainable practices in line with the "High Value, Low Impact" policy. The table below shows the average trip length and spending of inbound tourists to Japan. There are findings to show that tourists who come to Japan from afar tend to stay longer and spend more. In addition, there is a correlation between the average trip length and spending. For instance, tourists from European countries and Australia stay longer and spend more than those from Asian countries.

Table 15.4.2 Trip Length and Spending of Inbound Tourists to Japan in 2017

Country	Average Spending Per Person (USD)	Average Trip Length (Days)
Australia	2,035	9.6
UK	1,940	8.2
Spain	1,915	10.6
France	1,914	10.6
United States	1,640	7.5
Singapore	1,480	6.7
Hong Kong	1,379	4.3
South Korea	647	2.8

Source: Japan National Tourism Organization

The table below shows the average trip length of inbound tourists to Bhutan. As is the case with inbound tourists to Japan, those from European countries stay longer than those from Asian countries. Bhutan does not have spending data available, although it may be inferred from the royalty. That said, there are more opportunities to generate tourism-related income from longer-stay tourists.

Table 15.4.3 Trip Length and Spending of Inbound Tourists to Bhutan in 2017

Country	Average Length of Stay (Days)
France	9.3
Australia	8.3
UK	8.0
United States	7.4
Spain	6.5
Singapore	6.3
South Korea	5.0
Japan	4.4

Source: TCB

If Bhutan studies the survey and marketing in more detail, target countries should be identifiable more clearly. Once the target country is selected, target attributes of that country can be determined according to the marketing factors.

As for marketing and promotion activities in developed countries, the methodology is changing at a rapid rate. For instance, the promotion of destination marketing places more emphasis on

emerging concepts, such as social networking sites (SNSs), review sites, virtual reality, storytelling and conversation, rather than existing methods such as pamphlets, guidebooks and websites. For instance, the main search engine for the target country should be identified, e.g., Google, Bing or Baidu, for the purpose of current promotion activities. The analysis of keywords in a search engine has already been conducted in several countries. Thus, the findings should be applied to the tourism development plan.

2) Direction of tourism development

The direction of tourism development in Bhutan is sustainable tourism, such as nature tourism, agro-tourism, specific and special place tourism, wellness tourism, and eco-tourism, which is in line with the "High Value, Low Impact" policy. To promote the various kinds of sustainable tourism, the utilization of local resources, such as agriculture, music and storytelling, Tshechu (festival), natural resources, arts and crafts, traditional landscapes, local CSI, national parks and cultural heritage, should be recommended. In other words, the tourism sector should be clustered by making use of local resources including CSI.

Tourism for international tourists is an export industry; once local products are transformed into tourism products for international tourists, they become the outputs of an export industry. Diversified tourism could provide a variety of tourism products to international tourists. It is also important to underscore that the development projects and initiatives of other sectors should consider tourism and integrate appropriate measures to ensure a minimal negative impact on resources and tourist experiences.

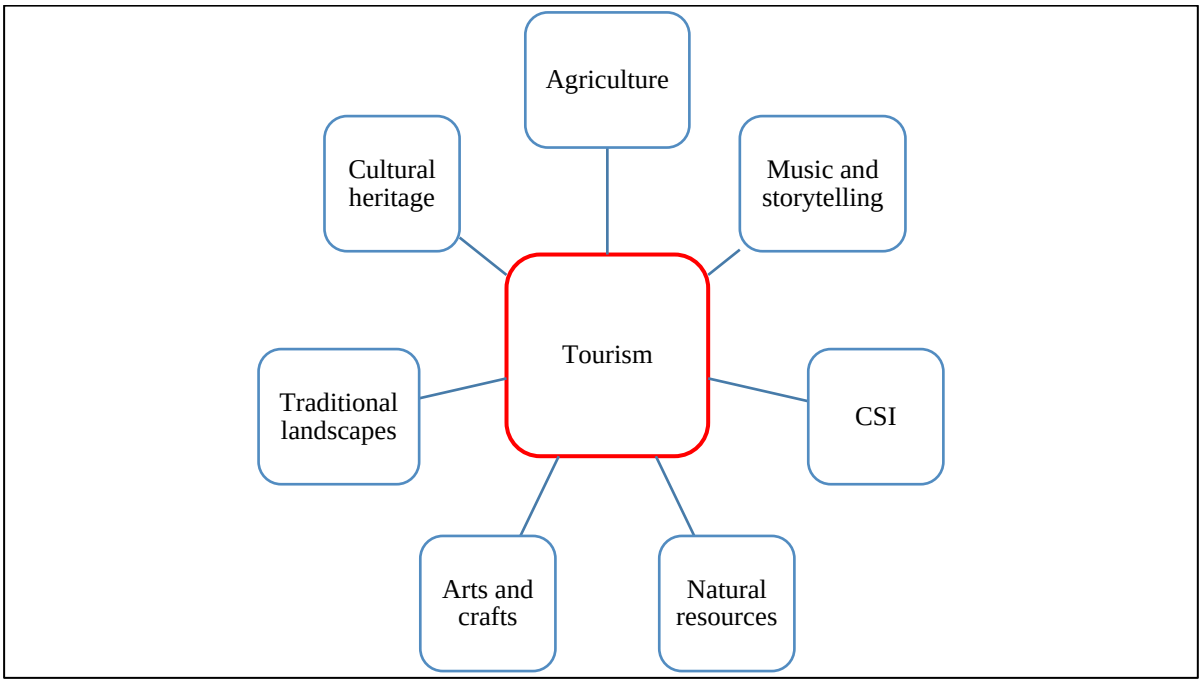


Figure 15.4.4 Relationship Between Tourism and Local Resources

3) Tourism development plan by destination

Establishing the target area for tourism development should not be by dzongkhag but by destination. For instance, Trashigang is known currently as the gateway to Eastern Bhutan. The surrounding areas, such as Yangtse and Lhuentse, however, are not acknowledged as tourism sites for international tourists. Tourism development will be implemented strategically, efficiently and effectively by developing these dzongkhags in one destination. The system will be created to entice international tourists visiting Trashigang to another dzongkhag, such as

Yangtse and Lhuentse.

It may be difficult for international tourists to identify the differences between each dzongkhag's tourism offer due to the promotion of similar types of tourism. Therefore, each destination is clearly characterized based on tourism resources and the potential to encourage international tourists to stay longer and become repeat visitors. The concept of each destination will be explained below.

Integrated tourism destination: western zone

This zone could provide diversified and integrated tourism such as urban tourism, wellness tourism, nature tourism and community-based tourism. Paro, Thimphu and Punakha could play a role as the gateway to Haa, Gasa and Phobjikha. Thimphu could enhance the image of the Capital as an urban tourism city offering an extensive range of hotels, restaurants and shopping for genuine local souvenirs from Dzongkhags as well as offer entertainment facilities keeping in line with the identity of Bhutan. Gasa may have the potential to offer wellness tourism involving MAPs, traditional medicine and hot springs. Paro is home to a well-known and typical religious site in Taktsang Monastery. Furthermore, Paro could link with Haa in addition to functioning as a gateway and offer urban tourism. Haa will focus on community-based sustainable tourism, such as the farm stays, based on the utilization of untouched nature and the traditional lifestyle of Haa. Real-life experiences in Western Bhutan, involving the renovation of old houses, should be promoted in Haa. Punakha will formulate integrated cultural tourism by highlighting not only Dzong and but also other historic spots and ancient temples. Wangdue Phodrang could provide community-based tourism as it is a typical rice-producing area. In this zone, Phobjikha Valley is one of the most obvious sites for community-based tourism owing to the landscape and the presence of rare black-necked cranes. As for nature tourism, the northern area of this zone is one of the most popular trekking routes. A combination of nature tourism and other types of tourism, such as urban and community-based tourism, will provide a new tourism offer to international tourists.

Culture, nature experience destination: central zone

This zone, comprising Bumthang, Trongsa and Zhemgang, is commonly recognized as the religious heartland with the oldest Buddhist temples and monasteries in Bhutan. In addition to such kinds of cultural resources, this zone could provide nature-based tourism given its unique characteristics such as highland and nomadic culture. International tourists could enjoy the nomadic culture and life in the form of the Tshechu festival in Bumthang and farm stays. Moreover, there are the traditional villages such as Ura, which maintains a medieval atmosphere for international tourists. As for additional aspects of nature tourism, this zone has plenty of potential because of untouched landscapes on the way to Zhemgang and Thrumshingla National Parks, which have precious wild animals such as the golden langur and birds, such as the rufous-necked hornbill, the beautiful nuthatch, the Ward's trogon, the white-naped yuhina and the brown wood owl *Strix leptogrammica*. Furthermore, characteristic foods, such as processed cheese, local beer, brandy and honey, add to the cultural offer in this zone.

Nature and handicraft experience destination: eastern zone

This zone, consisting of Trashigang, Yangtse, Monggar and Lhuentse, could provide experiences of nature and handicrafts to tourists. In this zone, a rich cropping area with beautiful terraced paddy fields is the site to make a livelihood and could be the basis of nature tourism. This zone will create a model that is eco-friendly, culture oriented and economically viable for the host community to promote community-based tourism. Trashigang is the gateway to Merak and Sakteng, where a unique nomadic lifestyle and Sakteng Wildlife Sanctuary can be experienced. In addition, handicraft making experience tourism should be promoted with farm

stays, since this zone has different types of genuine handicrafts, such as lacquerware in Yangtse, kishu thara in Lhuentse and weaving in Trashigang. Not only shopping for handicrafts but also handicraft-making experiences will attract more international tourists who are looking to observe the real life of Bhutan.

Winter resort destination: south-eastern and south-western zone

Two places in the southern area could be specified as winter resorts, i.e., around Samtse and Pemagatshel. This zone could provide backwoods and a winter resort for domestic and international tourists, mainly from India and Bangladesh. There are places where backwoods and a winter resort could be developed in Samtse and Pemagatshel owing to the comfortable climate and beautiful scenery. Manas National Park is a one-day trip from Pemagatshel. However, it could be developed with the backwoods and summer resorts as well as nature tourism to encourage tourists to have an overnight trip than a one-day trip"

Health tourism destination: south central zone

This zone could offer wellness tourism combined with several tourism resources. Wellness tourism in this zone could integrate unique traditions, culture, landscape, nature, food, traditional medicine and religion into one programme. This zone will be improved as a destination of health tourism by effectively utilizing these resources. Particularly, hot springs in Gelephu, Bhutanese traditional medicine with MAPs, and hiking should be integrated into a programme for health tourism in this zone. This health tourism programme will become an attractive tourist package with new value additions. As an additional factor in health tourism, hot spring tourism should include several amenities other than having a bath in the hot spring town itself. Unified town planning for wellness tourism is required at the centre of the hot spring. The formulation of a hot spring town can lead to the creation of a primary attraction for international tourists.

4) Collaboration with CSI and tourism development

Relationship with CSI and tourism

The CSI sector should collaborate with the tourism sector for efficient development. In terms of concrete collaboration, the eco-tourism industrial cluster, comprising, for example, handicraft-making experience tours and agro-tourism, should be developed through collaboration between stakeholders such as dzongkhags, travel agencies, tour guide associations, hotels and restaurants, the local CSI sector and organized farmers. For instance, Khoma Village in Lhuentse offers traditional and highly prized weaving of kishu thara and has succeeded in promoting farm stay in the village to some extent. Some hotels in Punakha serve local organic foods due to close collaboration with local farmers. These examples could be model cases of collaboration between the CSI and tourism sectors.

Moreover, several organizations support CSI development including the Decentralized Hands-on Exhibition Programme (D-HOPE). In particular, the Agency for the Promotion of Indigenous Crafts (APIC) promotes and supports local indigenous crafts by encouraging craftspeople to produce well-designed, skilfully made products for the market. The table below sets out the current craft cluster in Bhutan. These genuine crafts should be reflected in the handicraft-making experience tours and farm stays in each area. As a result, the clusters are expected to create more job opportunities through collaboration with the tourism sector.

Table 15.4.4 APIC Craft Clusters

Cluster and Location	Craft
Chorten Kora, Trashiyangtse	Wood turning and lacquering
Bjokha Tsharzo Gongphel Cooperatives, Zhemgang.	Cane and bamboo products
Yurung Weaving Cluster, Pemagatshel	Weaving
Teotsho Weaving Cluster, Yangtse	Weaving
Jamkhar Weaving Cluster, Yangtse	Weaving
Changjiji ThagZo Tshogpa	Weaving
Drupkhang BarGonpa Zangru Tshogpa, Trashigang	Weaving
Thongsa Kamthangma Tshogpa, Pemagatshel	Cotton weaving

Source: Website of the Agency for the Promotion of Indigenous Crafts

There are the weaving industries in several places which are promising CSI sectors. Generally, the skill of traditional weaving and dyeing in Bhutan is unique in the world and differs by region. The weavers produce regionally unique textiles, such as yathra, bura, and mathra, with high skill, by using a very thin needle. Traditional cloth of gho and kira is made from different types of the textiles.

(Photo) Rice Terrace in Lobesa

(Photo) Traditional Weaving

Figure 15.4.5 Image of Candidate sector for the Collaboration with Tourism

CSI development with a single narrative and theme-based tourism

Based on the tourism resources and local agricultural products, value-added products under one narrative and theme should be developed and promoted to the international market. Activities such as clustered animal husbandry, the value addition of agro-products through collaboration among farmers, and hotel and restaurant services should be implemented. In addition, it is more effective to create a regional brand and develop new products by collaborating with outside experts, such as marketing professionals and designers.

It is recommended that the tourism and CSI sector becomes the sixth sector industry through the diversification of primary, secondary and tertiary industries. The sixth sector industry comprises making products (discovering resources), processing (creating resources in the area) and selling (expanding local consumption). It is essential to consider refining and selling resources that are 'buried' in the local community. Furthermore, refined local resources contribute to the creation of a regional brand.

Setting up a system for processing and providing local resources in the area will contribute to the creation of a regional brand. At the same time, a total design approach to local industry, which can tell a story about what is wholesome in the local area, should be created for the expansion of marketing channels for domestic and international markets.

There is a tendency among international tourists to seek out unique traditions, cultures and products from the natural environment. International tourists are keen to gain access to authentic products, not mass-produced products, even if they are expensive. The creation of a regional

brand should be focused on adding value to local industries. The photos above show a rice terrace and traditional weaving; these are considered examples of the valuable scenery and lifestyle in Bhutan, which should be maintained and displayed to international tourists.

In addition, international tourists are interested in both visible tourism resources and the invisible lifestyles of local people. It is important to international tourists if they can visit somewhere that is attractive as a place to live, and not just a tourism destination. Experience-based tourism such as farm and village stays can be promoted, since Bhutan still preserves its traditions and cultures. Each locality should maintain its distinctive lifestyle and original landscape, while making use of existing resources for tourism development with the support of government.

Each area in Bhutan has real culture and traditions, such as kishu thara in Khoma Village, Lhuenze, which can be shown to international tourists. Hidden traditions and culture should be found, developed and promoted. If local people cannot find the necessary resources, there is the option to ask outside experts to help in the search. The dzongkhag genuine products fair in Thimphu and Paro is part of the promotion work directed at international tourists, in order to increase their interest in visiting less explored areas, other than the western zone, in Bhutan

(3) Human Resource Development Necessary for Implementation

Human resource development is suggested as follows. The allocation of a planner who can understand the value of cultural heritage and landscape is required to formulate and implement the tourism development plan. Marketing is one of the most important factors in tourism development. Therefore, a marketer who knows about the latest marketing techniques, especially involving SNSs, such as influencer marketing, will be needed. International connections are an option to connect to the global tourism sector. As for souvenir development, the utilization of outside experts is recommended. Improving the tourism sector's service level will help to increase the satisfaction of international tourists.

Table 15.4.5 Essential Human Resources Necessary for Implementation

Factor	Detail
Cultural heritage and landscape	A planner who knows the significance of the cultural heritage and landscape
Marketing	A marketer who is familiar with the latest tourism marketing by SNSs
International connection	An officer who has connections with the international tourism sector such as World Heritage Sites and Geoparks
Souvenir development	An expert who can discover local resources and develop the souvenir and handicraft offer, e.g., a designer or marketer
Tourism sectors	Guides, hotel, restaurant, tourism agency, cooks

(4) Budget and Institutional Arrangements Necessary for Implementation

1) Budget

Below is the necessary budget allocation for tourism promotion and CSI development.

- An adequate budget for a detailed survey and marketing activities should be secured by the TCB. In the long run, such a budget will be allocated to the Destination Management Organization (DMO).
- The budget for SNS promotion including hiring SNS promotion experts should be secured by the TCB. In the long run, such a budget will be allocated to the DMO.
- The budget for the implementation of the tourism flagship programme, especially in the eastern area, in dzongkhags should be secured by the TCB.

- The budget for souvenir, handicraft and speciality development should be secured by the CSI section of the MoEA and the TCB.

2) Institutional arrangements

General arrangements

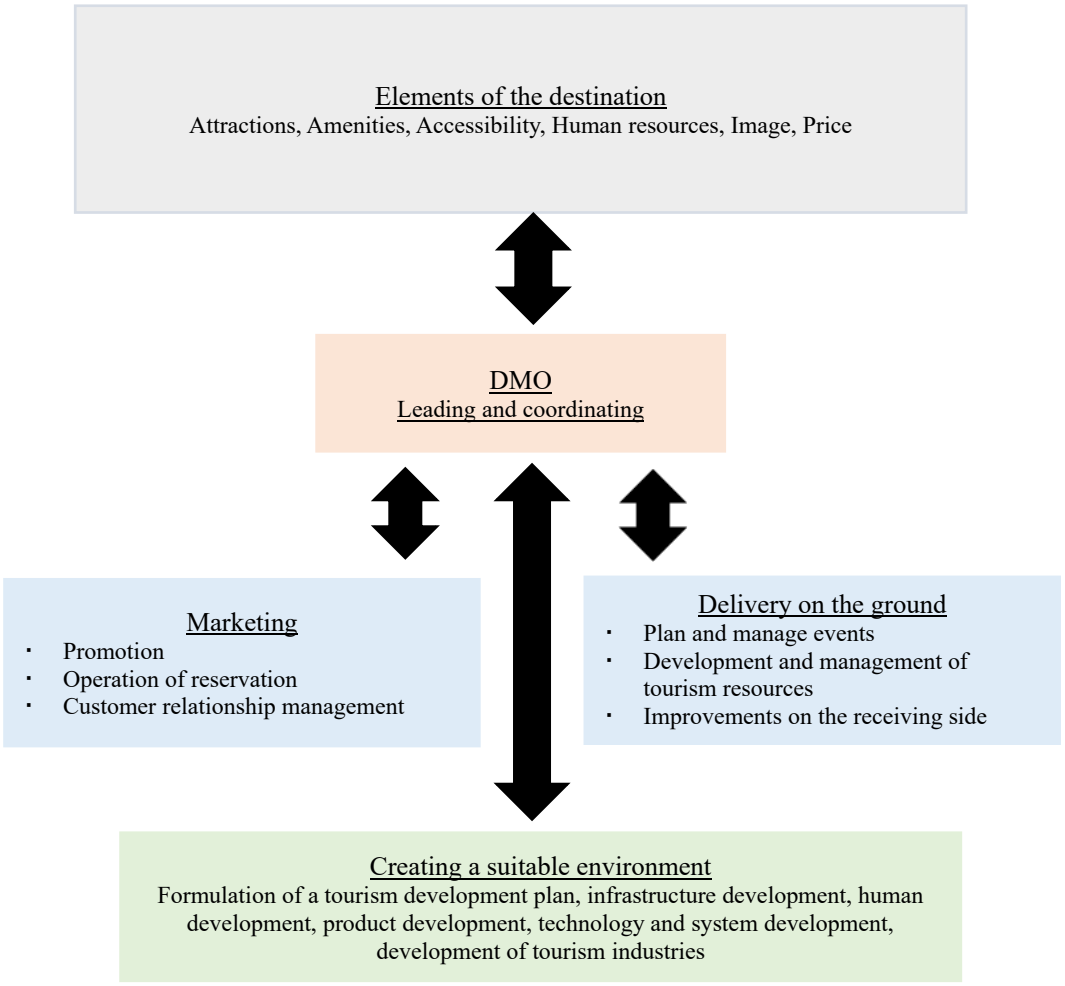
Further coordination is an essential prerequisite for future tourism development, since tourism requires integrated development, involving various sectors such as transportation, agriculture, communication, CSI, culture, traditions, food and foreign direct investment (FDI) attraction.

- The TCB will collaborate with the MoWHS, MoEA, MoAF and MoHCA. In particular, the collaboration with the MoHCA is important in terms of the preservation and utilization of Bhutanese culture and traditions. A committee will be established to coordinate the TCB and the ministries.
- Responsibility for planning and implementation should be given to each dzongkhag by the TCB regional office. It is recommended that each dzongkhag is voluntarily responsible for the creation of regional branding and promotion, as well as collaboration with neighbouring dzongkhag and related agencies.
- As for road and airport development, the TCB should coordinate with the MoWHS.
- The TCB should liaise with the MoEA about attracting tourism investment.

Destination Management Organization

The Destination Management Organization (DMO) is an organization or corporate entity which acts as the main body for supporting the creation of tourist destinations through cooperating and coordinating with various stakeholders, based on a clear concept. The DMO should be the leading organization that involves different regional stakeholders according to a scientific approach. The DMO will be established in each Dzongkhag. Their core members are civil servants responsible for economic sectors and infrastructure. The TCB will facilitate productive collaboration. The DMO implement regional tourism development in order to generate income by effectively and efficiently attracting international tourists and utilizing local resources. The DMO is composed of tourism stakeholders, such as commerce and industry, hotels, agriculture and forestry, transportation business operators, restaurant and local people.

The function of the DMO is to develop the various elements of the tourism destinations. In addition, the DMO should tackle issues such as tourism infrastructure development, marketing, delivery on the ground and creating a suitable environment.



Source: UNWTO

Figure 15.4.6 Functions and Roles of the Destination Management Organization

Conformity with Tourism Flagship Program

The RGoB prepared the final draft flagship program which will be the base for the 12th Five Year Plan for the tourism sector. It will change the focus to different key initiatives.

- Five focus dzongkhags have been identified for tourism development.
- At least one project will be developed in each 20 Dzongkhags. Some of the projects identified were adventure sports, water-based sports, development of festivals and development of infrastructure and promotion.
- The third focus will be on Policy and regulatory frameworks, institutional strengthening and skills development.

The holistic tourism network as one of the development approaches and the development guidance for the tourism promotion proposes the tourism route and institutional improvement. Those proposals complement the key initiatives suggested in the flagship program.

(5) Projects and Programmes

1) Project for Strengthening the Capacity for Tourism Promotion in the Eastern Region

This flagship tourism programme will be formulated by the TCB. According to the programme,

the implementation project, including the pilot projects, will be conducted in the Eastern Region. The project includes 1) establishing the regional branding and theme, 2) creating an inventory of tourism resources, 3) integrating all tourism resources with a narrative and theme, 4) developing souvenirs and handicrafts, 5) marketing, 6) carrying out promotion activities and 7) supporting the establishment of the DMO.

Title of project	Project for Strengthening the Capacity for Tourism Promotion in the Eastern Region
Project cost	USD 3 million
Possibility of environmental and social negative impact	As the pilot project has the potential to utilize natural resources, meaningful consultation should be considered, involving an EIA, if needed.
Location	Trashigang, Yangtse, Monggar, Bumthang, Lhuentse

2) Artist-in-residence Project

The artist-in-residence project will invite artists from around the world to a village in order create artistic work with support from the community. The impacts of the project are 1) installation of other types of art in the village, 2) improvements to the cultural image of the village, 3) promotion of the village to the world by the artists and 4) contributions to tourism development. As a side benefit, the artists will be welcome to move into the village after the programme has finished.

Title of project	Artist-in-residence Project
Project cost	USD 100,000
Possibility of environmental and social negative impact	Foreign artists will come to a local village. Local people may be confused by the presence of another culture. A polite explanation to local people will be required in advance.
Location	Yangtse

15.5 Information Technology and Mechanical Promotion

(1) Issues

1) Global trend

The world is facing the Fourth Industrial Revolution, which is characterized by the integration of technologies that blur the lines between the physical, digital and biological spheres. It is marked by epoch-making technological breakthroughs, including artificial intelligence (AI), automated driving, biotechnology, the Internet of Things (IOT), fifth-generation wireless technologies (5G) and 3D printing. With the Fourth Industrial Revolution, the industrial structure of the world is expected to change drastically. Bhutan will be also involved in this trend.

2) Issues

Concentration in Thimphu and depopulation in the rural area are the main issues. Furthermore, the shortage of workers, a weak economic infrastructure and a lack of comparative advantages for industrial development are highlighted. According to the development experiences of other countries, manufacturing sectors, such as textile production, has expanded by utilizing an abundant, cheap labour force and stable economic infrastructure such as transportation networks, ports and airports. Bhutan, however, does not have such advantages in its manufacturing sectors under the given conditions.

Social issues such as shortage of workers, a weak economic infrastructure and a lack of

comparative advantages in industrial development will be partly solved or complemented by ICT utilization as one option.

Bhutan has an ICT vision known as "An ICT-enabled Knowledge Society as a Foundation for Gross National Happiness". Moreover, the CNDP has positioned ICT utilization as one of the development approaches. The ICT sector will have more potential to act as a key enabler of sustainable economic development.

Bhutan's ICT sector has comparative advantages in some aspects. In concrete terms, cheaper management costs than other countries, such as the Philippines, the presence of English speakers and a comfortable natural environment are highlighted as advantages by the principal of Thimphu Tech Park. Furthermore, the low personnel turnover rate among Bhutanese IT engineers is a favourable characteristic for investors. Therefore, companies can develop a management plan based on the accumulation of IT engineers.

(2) Development Guidance

1) Development of ICT infrastructure

ICT is one of the important infrastructure components in Bhutan as it can facilitate access to information from around the world without any geographical restrictions. ICT gives new opportunities to Bhutanese people in terms of improving their living conditions and economic development. Thus, the foundation of solid ICT networks, such as fixed and mobile networks, cloud sharing platforms, data centres, cyber security and an open-access environment should be developed. The development of a stable ICT platform will increase the possibilities for ICT investment. In Bhutan, the transition from 4G to 5G will be considered, since some developed countries are already making this shift.

2) ICT for sectors

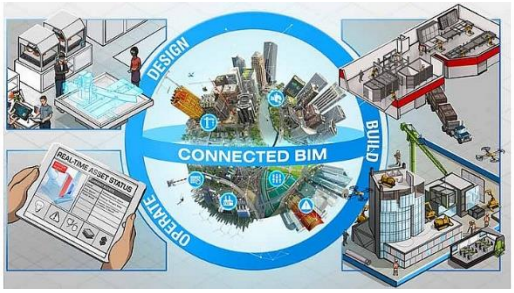
The rural area is facing several social issues, such as lack of regional revitalization and depopulation. Hence, efforts to pursue ICT-based solutions will be an option in addition to traditional approaches. The table below shows the possibilities for sectoral ICT application. ICT application for sectors will be established via new industries, in turn creating new job opportunities.

Table 15.5.1 Examples of ICT Application for Sectors

Sector	Overview	Possible Locations
Education	Distance learning, programming education, lifelong learning by e-learning	Remote area
Health/nursing	Online medical examination, health information network, electronic health records	Remote area
Work style	Teleworking	Everywhere in the country
Finance	Fintech and E-banking	Everywhere in the country
Disaster prevention	Disaster prevention mapping using GIS, sharing information on damage and recovery	Mainly in hazard area
Construction	BIM, GPS	Construction sites
Tourism	SNS marketing, tourism applications, digital boards	Main tourism places
Agriculture	Drones, Internet direct sales, traceability, POS data, agro-technology	Farmlands and agro-processing on industrial estates
Fab lab	Manufacturing using analogue and digital machine tools	Education facilities

ICT applications for the education and health sectors will benefit the rural area where there is

limited access to schools and hospitals. The implementation of teleworking will bring about improvements in efficiency and work-life balance. This may help to mitigate over-concentration in Thimphu. In the area of disaster prevention, the preparation of disaster maps and a regional disaster prevention system will be practical activities to be undertaken, although some activities have already been implemented by the Bhutanese government. Furthermore, an early warning system involving smartphones and the transportation of goods as part of rescue operations should be utilized. Meanwhile, building information modelling (BIM) is attracting the attention of the construction sector as a breakthrough system. All construction information is managed via one database. In addition, BIM creates 3D models, which can be used for cost control and construction control of buildings. The tourism sector on a global scale is already using ICT, such as SNS marketing, application development and digital boards. In particular, ICT applications for the tourism sector could create a new demand via SNS marketing. Such ICT applications will add value to the Bhutanese tourism sector. There is some potential to increase efficiency in the agriculture sector such as via drone use, direct sales over internet, traceability and an agro-technology park. Meanwhile, there is one fab lab in Thimphu which can facilitate manufacturing by analogue and digital machine tools, such as 3D printers and cutting machines. The fab lab can provide manufacturing venues to local people anywhere, provided basic infrastructure such as electricity and the Internet are available. If this is the case, a new CSI sector will even be possible in the rural area.



Source: Website of the BIM hub

Figure 15.5.1 Building Information Modelling Image

Source: Website of Anslow Bryant Construction Ltd.

Figure 15.5.2 3D Modelling Image

3) Development of an ICT model town, centred on Gyalpozhing Tech Park

The ICT industry should establish itself as a new industry in order to promote ICT-related services such as processing of information and software development based on solid ICT infrastructure. Hence, several efforts such as the development of the ICT and transportation infrastructure, a reduction in communication costs, and improvements in the living environment should be implemented to attract human resources and companies to the ICT sector in Bhutan.

As the second tech park in Bhutan, the development of Gyalpozhing Tech Park in Monggar has been proposed by the JICA Project Team. The proposal was inspired by the establishment of Gyalpozhing College of Information Technology, which was opened in 2017 and provides practical courses, for example, on computer applications, networking and IT management. In future, the college plans to provide courses on trending topics, such as AI, cloud computing and big data. In addition, the college understands the required IT engineering skills that the IT industry needs, based on information shared by the GNH Commission, the Ministry of Information and Communication, the Royal University of Bhutan and the Bhutan IT Association. The proposed tech park will utilize the accumulation of IT engineers from the college.

A further suggestion is to develop Monggar as an ICT model town based on the close collaboration between Gyalpozhing College of Information Technology and Gyalpozhing Tech Park. Based on ICT applications for various sectors, several social initiatives will be conducted in Gyalpozhing. One option will be to introduce ICT in the Bondeyma Industrial Estate.

Source: Gyalpozhing College of Information Technology

Figure 15.5.3 Master Plan of the College

Figure 15.5.4 Photo of the College

Access to Gyalpozhing is likely to be an issue for international investors, as it takes one day to travel there from Thimphu and five hours from India through Nganlam. Thus, it is suggested that the Thimphu Tech Park is mainly used for international companies and Gyalpozhing Tech Park is used for domestic companies and entrepreneurs.

4) Sharing economy

A sharing economy is defined as a mediation service of unused individual resources including intangible assets. The lender can benefit from unused resources while the borrower can utilize products and services. Social media via ICT is used in sharing economy services. The applicability of the sharing economy concept to the GNH concept could be considerable since the characteristic of the former is not owning but sharing. Bhutan, especially in the rural area, has a culture of mutual cooperation, although it may be disappearing in the urban area. ICT applications for a sharing economy could facilitate mutual cooperation. Moreover, the application of a sharing economy is recommended in terms of the effective use of the limited resources in Bhutan.

The table below sets out several types of sharing services, which have already been launched around the world. Services such as space sharing, vehicle sharing and shared parking are effective in addressing the urban problems. Space sharing helps to increase the amount of available land, which is critical given the limited available land in cities, especially in Thimphu. Car-sharing services can help to solve the traffic jam problem in Thimphu and other towns. The further development and expansion of sharing services should be promoted, although some have already been launched in Bhutan.

Table 15.5.2 Examples of Sharing Services

Type	Service	Outline
Skill	Time sharing	Sharing skills, knowledge and experience
	Home service	Outsourcing of cleaning, cooking and shopping services
	Food delivery	Food delivery services
Thing	Clothing rentals	Clothing rental services
Money	Crowdfunding	Money sharing for investments and business enterprises
Movement	Taxi	Arrangement of the taxi by application
	Car sharing	Car sharing service between individuals
	Bicycle and electric bicycle sharing	Sharing bicycle in the area
Space	Space sharing	Sharing spaces for meetings and training
	Shared parking	Shared parking services
	Holiday rentals	Holiday rentals for tourists

(3) Human Resource Development Necessary for Implementation

Human resource activities are aimed at ensuring appropriate ICT awareness and skills, from basic computer literacy to high-level technical skills, to boost the ICT industry. Activities outlined in this area aim to improve the quality and coverage of training institutions and, in turn, standards in the ICT sector. The following are proposed appointments for human resource development.

- A policymaker who can formulate a long-term ICT strategy based on global trends
- A dzongkhag officer who can utilize ICT to address social issues
- An officer who can understand ICT utilization in each sector
- A highly skilled ICT engineer who can develop online services and applications

An additional suggestion is that Bhutan should promote to send both policymakers and IT engineers to major ICT areas in the world such as Silicon Valley in the USA, a centre of innovation where ICT companies, entrepreneurial ventures, research institutes and universities are accumulated. The experience of a residency in the most advanced ICT area in the world should provide policymakers and IT engineers with new ideas for ICT development. In that sense, studying abroad in emerging fields such as computer science and AI should be encouraged as the main overseas education option for civil servants.

(4) Budget and Institutional Arrangement Necessary for Implementation

1) Budget

The MoIC should plan for the development of an ICT network with cyber security measures to ensure connectivity for the whole population. In addition, the MoIC should consider the incentives and support needed by private telecommunications companies to install new communications technology such as 5G. One option could be to attract such companies from abroad, since only a few companies dominate the market at present. Moreover, each line ministry should have a budgeting plan for ICT applications.

As for the development of Gyalpozhing Tech Park, the DHI will secure a budget not only from the ministry but also from other donors and FDI, as well as explore a public-private partnership development scheme.

2) Institutional arrangements

ICT has the two aspects: basic infrastructure and the basis of a new industry. Measures to enhance interdivisional communication and cooperation should be formulated, while a working

group chaired by the MoIC should be established. The working group members should come from the MoE, the MoH, the MoEA, the TCB, the MoLHR, the MoWHS, academia and the private sector to consider and implement the ICT application plans.

(5) Projects and Programmes

1) Development of Gyalpozhing Tech Park

The project is centred on the development of a second tech park in Monggar. There is land neighbouring Gyalpozhing College of Information Technology which could be used for the tech park. The park will become as the core of the domestic ICT industry and young entrepreneurship. Foreign teachers who are practitioners in the IT industry and the college will provide practical advice and support to entrepreneurs.

Title of project	Development of Gyalpozhing Tech Park
Project cost	USD 4 million
Possibility of environmental and social negative impact	The development of the park needs some levelling of the ground and utility expansion although the college already owns land for the tech park.
Location	Gyalpozhing, Monggar

2) The Formulation of a Plan for a Social Experiment Project

The application of ICT could have some impact, including a negative impact, on society. Thus, a social ICT experiment project will be implemented to validate the effectiveness of the application and determine problems in the specified area and timelines. The project aims to formulate a plan for this project in order to resolve associated social issues including in relation to some of the pilot projects. The objectives of the project are to create a social experiment plan with key performance indicators, implement the plan and outline the future vision of ICT applications in Bhutan. The target sectors are education, health, remote work, disaster prevention, construction, tourism, agriculture and the fab lab.

Title of project	The Formulation of a Plan for a Social Experiment Project
Project cost	USD 3 million
Possibility of environmental and social negative impact	The project includes those pilot projects seeking to conduct social experiments by drones and uninhabited airborne vehicles. Thus, regulations should be confirmed and an announcement made to local people in advance.
Location	Monggar

15.6 Mining and Manufacturing Promotion

(1) Issues

1) Global trend

The global demand for base metal has increased; in particular, demand from China has rapidly increased. Accordingly, securing competitiveness in the case of natural resources has been intensified. Partly due to the demand increase from emerging countries, there is a tendency that the price of base metal has fluctuated. As for rare metal, the global demand has seen an increase, although the demand trend differs for each rare metal. For instance, the demand for nickel and tungsten stems from China. However, the demand for platinum comes from Europe, due to its use as an automotive catalyst. The volatility of prices for rare metal is greater than for base metal since the market of rare metal is small. In addition, rare metal is unevenly reserved, while future demand may change because of the trend for new product development.

2) Issues

Need for the management of mining resources and a master plan

Mineral resources in Bhutan are important natural and non-renewable resources for sound socio-economic development. Only 40% of Bhutan has been geologically mapped to date, despite the endowment of abundant mineral resources. Long-term strategies cannot be formulated because of a lack of a strategic mining master plan, although the Mineral Development Policy was enacted in 2017.

Development of industrial estates

Some industrial estates, such as in Motanga, Jigmeling, Dhamadum and Bondeyma, will be developed. These industrial estates cover vast land areas; in particular, Jigmeling in Sarpang will become the largest estate in Bhutan with 755 acres. The types of industries are mainly assumed to be mineral-, agro- and forest-based. The main issue is how to attract both domestic and foreign investors.

As depicted in Chapter 4.11, Bhutan's business development is better than that of neighbouring countries although there are critical issues, such as its geographical location as well as a small-scale market for foreign investors, which is not included in the Doing Business Report from the World Bank. In this report, lower-level items such as dealing with construction permits (ranked 97th), obtaining credit (ranked 82nd), protecting minority investors (ranking 114th) and resolving insolvency (ranked 169th) should be improved. Improvements to the business environment are required to promote the Southern Economic Corridor.

(2) Development Guidance

1) Formulation of a strategic mining plan and management system

A mining strategic plan, which sets out the long-term prospects including international demand, should be formulated. The completion of the mapping of mineral resources and the formulation of data management should be essential preconditions to the formulation of the strategic master plan.

Around the world, especially in developed countries, mineral resources, especially rare metals, are used by several industries, such as steel, automobiles, airplanes, electronics and renewable energies. In addition, the demand for rare metals is expected to increase. Bhutan also has rare metals such as tungsten. One option to identify a strategic mineral resource for development from among the potential mineral resources. This will allow Bhutan to conduct a series of development activities from the formulation of a strategic plan to a survey, mining operations, and dressing and closing mines. Tungsten has the potential for export, for example, to Japan, which requires a source of tungsten, although this may be difficult to develop due to the reservation status of tungsten. However, if Bhutan seriously considers further mining development in the case of tungsten, it should be discussed and coordinated with agencies and local people.

As the Mineral Development Policy from 2017 encouraged, industrial mineral resources such as limestone, dolomite and gypsum should be identified as the final products appropriate for further value addition. Bhutan can enjoy the advantages offered by marketing, once the mining sector is able to produce the final products from mineral resources. The utilization of abundant industrial mineral resources, such as limestone, dolomite and gypsum, will be considered not only for export use. Currently, most of those minerals are exported to India and Bangladesh. This is because of a lack of local industries in Bhutan that can utilize mineral resources domestically. If local industries can be promoted with the support of the Bhutanese government,

the potential for these mineral resources will be huge. Thus, the Bhutanese government should study this potential and promote local industries in order to pursue development in this area within the country. This will lead to the creation of new job opportunities.

Concerning international trends, major resource companies should initiate the development of minerals. Attracting such resource companies should be considered in the long term.

2) Development of the business environment

As described, industrial estates have developed, some of which are quite vast. In order to adapt to the global trend, especially in the case of India and Bangladesh, industrial estates located in the southern area should enhance the sophistication of manufacturing, such as value addition to mineral materials by utilizing the accumulated technology and human resources. In particular, the accumulation of highly skilled management in the Bhutanese labour force, as the basis for industrial development, should be increased. The activation of a cross-industry association and government-industry-academia collaboration will provide the comprehensive information necessary for product development and marketing of the companies in the Southern Economic Corridor. According to the input output analysis in the previous chapter, all manufacturing sectors, including those involved in mineral products, have a high index value. In other words, these industries have the potential to boost other sectors. Thus, promotion of the manufacturing sector is recommended in order to develop the business environment.

In order to attract investment into Bhutan, an increase in location competitiveness should be improved through the development of the business environment. The table below sets out the general factors appropriate to attracting investors to the Special Economic Zones (SEZs). Bhutan has advantages in terms of infrastructural development, such as a stable power supply. However, Bhutan's labour force and location may be categorized as disadvantages, which are difficult to improve.

Table 15.6.1 Factors to Attract Investors to the Special Economic Zones

Item	Detail
Infrastructure	Power, water, sewerage, drainage, power, telecommunication, solid waste, ICT
Labour force	Labour cost, quantity, quality, labour regulation
Cost performance	Land acquisition and compensation procedures, infrastructure service, construction works
Legal and institutional arrangements	Appropriate legal system, incentives and taxes, institution for management procedures
Location	Physical condition, accessibility to sea/airport, materials and market, living environment for the employee

Thus, Bhutan's legal and institutional arrangements and living environment should be improved. Particularly, this should include regulatory reform concerning the specification of an SEZ, along with incentives, the formulation of an energy policy in order to deliver stable and cheap energy prices, and further improvements to the FDI receiving system. Improving urban functions and facilities in neighbouring industrial estates will be necessary in order to promote their location. Improved urban functions and services will increase the comparative advantage of the industrial estates leading to the location of several industries as well as reducing economic transaction costs. Moreover, it will be necessary to foster a good working environment, develop the road and ICT network and strengthen domestic flight arrangements at Gelephu Airport. In addition, social services, such as education, health, caregiving, commerce and entertainment, should be developed in the cities neighbouring the industrial estates.

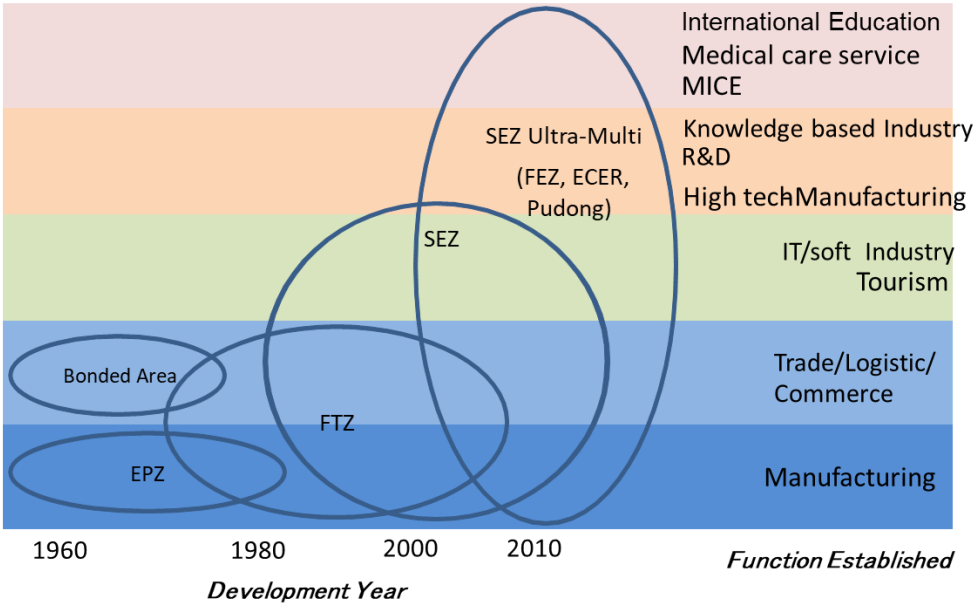
Bhutan should attract foreign companies, especially from India, by highlighting its comparative advantages such as a stable and cheaper power supply. Indeed, the southern area has a border

with Assam State in India, which is expected to grow. Each industrial estate (Pasakha, Motanga, Jigmeling and Dhandhum) should become a unique industrial location, which exploiting each advantage such as special incentives for specific sectors.

Development of the SEZ system

There is no clear difference between industrial estates and SEZs in Bhutan. Currently, Bhutan offers incentives based on the category of the sector, as opposed to industrial estates only. Industrial estates and SEZs should be defined. According to the definition to be decided, some incentives should be given to the SEZs, most probably the southern industrial estates. For instance, incentives should be given to companies with high-processing and eco-friendly technology for mineral resources.

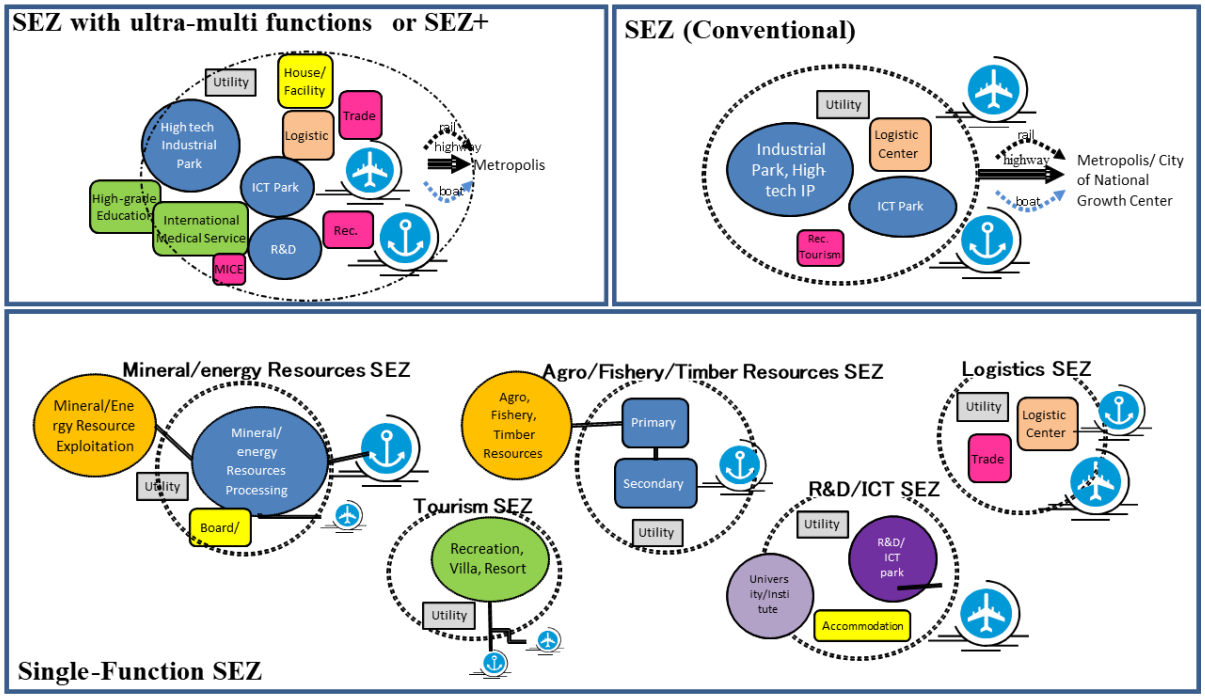
The figure below indicates the world SEZ trend. As the figure shows, SEZs have extended the range of functions gradually from a single function. Most industrial estates in Bhutan operate as single-function SEZs, such as the manufacturing sector, at present. There are possibilities to add to the list of functions, such as logistics, commerce, knowledge-based industries and international education.



Source: Based on JICA's Special Economic Zone Development Master Plan Survey in the Republic of Indonesia, February 2012

Figure 15.6.1 Direction of Special Economic Zone Development

Jigmeling, in particular, has the potential to increase the range of functions available, such as trade, logistics and commerce, due to favourable access to Gelephu Airport.



MICE: Meeting, Incentive Travel, Convention/Conference and Event/Exhibition

Source: Based on JICA's Special Economic Zone Development Master Plan Survey in the Republic of Indonesia, February 2012

Figure 15.6.2 Special Economic Zone Development

Developing a one-stop service window for each SEZ would be an effective measure to attract investors. Based on examples from other countries, the typical functions of a one-stop service window are company registrations, investment permits, location permits, construction permits, customs approval on imported goods, and supplying utilities including electricity and water.

3) Industries targeted for India and Assam State

Power-intensive industry

In India, the power demand is 159,816 MW and the supply is 158,393 MW as of 2017. As a result, the power deficit was -1,423 MW in 2017. In future, the power demand in 2021-22 will increase to 235,317 MW. Therefore, India must increase its power supply capacity and import power from Bhutan and Nepal at the same time to compensate for its power supply deficit.

Bhutan is bordered with Assam State, which is extremely important for Bhutan, as it is realistically the main trading state, including in the future. The growth rate of the population in Assam from 2005 to 2015 was 14.1% and is expected to increase in future. In addition, the state has 64 commercial estates and 50 industrial estates. The lack of a power supply will be the bottleneck for Assam State's industrial development. Thus, Bhutan can promote power-intensive industries such as aluminium smelting, steel manufacturing and value addition to mineral resources with Indian companies. As a matter of fact, the Indian company, Nippon Power, is going to start aluminium smelting at the Gelephu Industrial Estate with Druk Holdings and Investments (DHI). In this case, bauxite will be imported from Orissa State in India. Furthermore, steel manufacturing is considered as a possible industry. Raw materials will be imported from West Bengal State. Given the challenges for new areas, DHI is expected to invest in and start up businesses in the private sector. The Southern Economic Corridor should focus on THE planned mineral-, agro- and forest-based industries, as well as power-intensive

industries in collaboration with Indian companies. In addition, the data centre industry could have the potential to attract foreign investment due to the plentiful electricity supply and cold climate. Power-intensive industries can benefit from Bhutan's comparative advantage and resolve Assam State's bottleneck.

Medical plants industry

Bhutan has huge potential with regard to medical plants due to an extensive plant habitation with clean and positive conditions. Several organizations, such as the National Biodiversity Centre (NBC) under the Ministry of Agriculture and the Department of Department of Traditional Medicine under the Ministry of Health, are researching the potential of Bhutanese medical plants, including development of related products. In particular, the NBC is attempting to develop medical plant-based products with the private sector and local communities. To date, products such as soap, perfume, massage balm and tea have been successfully commercialized or moved onto the market testing stage.

According to the general manager of the Assam Industrial Development Corporation, using medical plants to treat humans has regressed. Moreover, the extraction and value addition of herbal MAPs are clearly defined as among the drivers in the state. Some medical plants have already disappeared from Assam State, while this has not been the case in Bhutan. Thus, there is considerable potential for the export of medical plants to India. The demand for medical plants from other countries is also high. At the present stage, a private company dominates the market with Germany, Singapore, Taiwan and Japan.

Currently, the scale of production is limited since the production of medical plants mainly relies on naturally growth plants. The main recommended action is to achieve the stable production of plants with enough product quality, as cultivated by local communities.

(3) Human Resource Development Necessary for Implementation

Human resource development is suggested for the mining sector and the promotion of the manufacturing sector in the industrial estate.

Mining

- A planner who can create a mining strategy based on the international market and trend
- A GIS specialist who can create a GIS database for comprehensive mineral resource mapping
- A planner who can understand relevant environmental and social factors, such as mine pollution prevention measures and environmental remediation after closing mines

Manufacturing promotion

- A planner who has experience of SEZ development in terms of regulation and setting up institutions
- A planner who can attract foreign investors with appropriate measures

(4) Budget and Institutional Arrangements for Implementation

1) Budget

The necessary budget allocation for mining and manufacturing promotion is given below.

- A budget for improving physical conditions, accessibility to the sea and airport, materials and markets, living environment, and social services for employees on the industrial estates in order to attract workers, including from foreign companies, should be prepared by the MoWHS and MoEA.

- A budget for a detailed survey on how to develop power-intensive industries, targeted at India and Bangladesh, should be secured by the MoEA.
- A budget for experiments and research on the cultivation of medical plants should be secured by the MoAF and MoH. Subsequently, a budget for promotion to international markets should be secured by the MoEA.

2) Institutional arrangements

Mining sector

As for mining sector, coordination with several organizations is a key issue and should be strengthened. In light of relevant regulations and rules, administrative functions have been shifted to several organizations in the mining sector in the development phase. Coordination with related organizations in implementing their specific tasks and functions is imperative. A lack of appropriate coordination will become a barrier to the development of the mineral sector. There are opportunities to improve the coordination system as follows.

- Coordination between the Department of Geology and Mine (DGM) and the DOI should be facilitated in order to exchange information on licensing businesses and attracting foreign investment.
- Further coordination should be necessary between the DGM and the Department of Revenue and Customs in the sharing of information about collecting taxes.
- Coordination between the DGM and the NEC should be strengthened regarding environmental issues.

Manufacturing promotion

Coordination between the DOI and related agencies should be necessary. The DOI is responsible for the development of industrial estates and attraction of foreign investment. In terms of targeting Indian companies, active collaboration with the DHI will be required. For the further promotion of medical plants, close collaboration between the MOH, the BDC, the CSI sector and private companies is recommended in terms of investigating, researching and developing new products as well as marketing. In order to develop new products, advice and technology from foreign companies may be required.

(5) Projects and Programmes

1) Project for the Formulation of a Mining Master Plan

Based on the trend concerning mineral resource demand and supply and markets, a mining master plan will be formulated. Subsequently, development activities will be considered. Suggested resources will be determined based on the presence of mineral resources. According to the master plan, some strategic resources are selected and a detailed study will be conducted.

Title of project	Formulation of a Mining Master Plan Project
Project cost	USD 3 million
Possibility of environmental and social negative impact	Tungsten is reserved in the wildlife sanctuary. If the development of tungsten is decided, approval should be obtained from the NEC, the GNH Commission and the related ministry in order to proceed with development via study and discussion.
Location	Thimphu, and Zhemgang and Sarpang (tungsten-reserved places)

2) Improving Investment Management Project

The project aims to improve the management of investment including FDI. The content of the project includes the development of an internal manual, the analysis of prospective investors

and marketing activities for attracting foreign investors.

Title of project	The Project for the Management Improvement Project for Investment
Project cost	USD 500,000
Possibility of environmental and social negative impact	No negative impact is expected.
Location	Thimphu

CHAPTER 16 GENERAL GUIDELINE FOR TRANSPORTATION DEVELOPMENT

16.1 Inland transport development

16.1.1 Issues

(1) Road Network

The proposed ladder-type arterial road network connects four regions, regional centres and almost all the district centres. However, the travel time for some sections of the road network is still poor compared with the target travel time, based on the standard travel speed. There are multiple issues that need to be resolved to improve the travel time; in particular, setting appropriate targets for improvements to the travel time and reliability are important. Actions needed to connect inter- and intraregional locations via a hierarchical transport network are as follows.

- To develop an efficient and reliable transport system for ensuring economic development
- To secure transportation throughout the year on an arterial road network in order to ensure travel safety

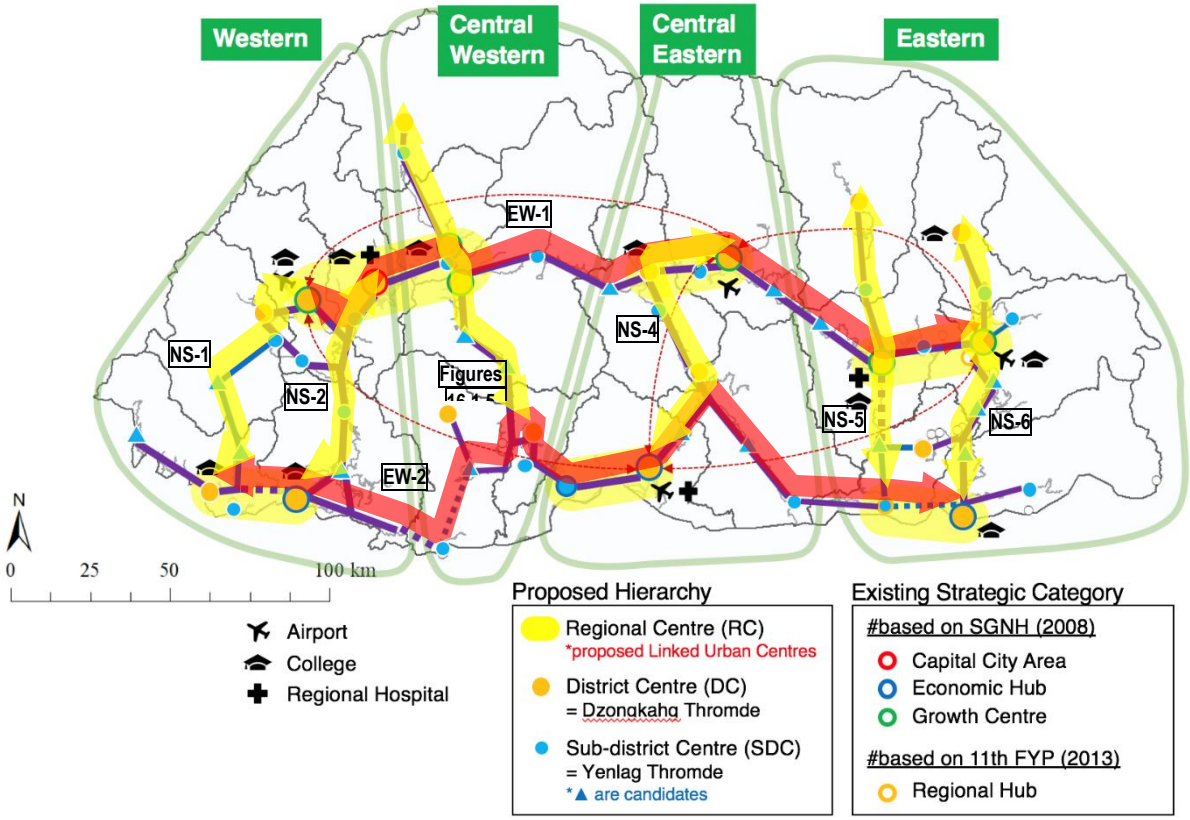


Figure 16.1.1 Proposed Transport System for the Hierarchical National Service Network

Within a region, the proposed holistic service delivery system needs to develop the hierarchical

nature and reliability of the road network between SDCs, GCs and service facilities as mentioned in Section 13.2 of this report. To maintain and improve the rural road network is critical for a service delivery system in order to provide socio-economic services.

(2) Public Transport

The proposed service delivery system needs a hierarchical inter- and intraregional public transport service network as shown in Figure 16.1.1. Bus services represent the main public transport system, with taxi services offering a supplemental transport service to buses in Bhutan. The following problems with the current public transport service have been identified:

- The size of the bus fleet is limited due to the mountainous road geometric structure
- Facilities in terminals, such as waiting rooms, transfer areas and parking, are poor
- Information services, regarding general information, transfers, operational status and operational schedules, are poor
- Bus services have been taken over by private operators, with a low-rate government tariff insufficient to make a profit, across the entire country

One issue here is to provide an efficient and flexible public transport service based on demand, both inter- and intraregionally.

16.1.2 Development Guidance for the Road Network

A ladder-type arterial road network with good travel times is required in order to develop an efficient and reliable transport system which supports economic development. The target travel times are set at eight hours or less for six north-south routes and 16 hours or less for two east-west routes as shown in Figure 16.1.1. Considering range of target travel speeds and the importance of each routes, a target speed is proposed for each route based on the road design standards in Bhutan, as shown in Figure 16.1.2.

Road Classification		Primary National Highway				Secondary National Highway				Dzongkhag Road				Farm Road			
Terrain classification		L	R	M	S	L	R	M	S	L	R	M	S	L	R	M	S
Design speed (km/h)		60	50	40	30	50	40	30	20	40	30	20	15	30	25	15	10
Traffic volume (vpd)		>200				100-200				30-100				<30			
Width (m)	Right of way	30				30				20				12			
	Carriageway	7.5				5.5				3.5				3.5			
	Shoulder	1m on valley side				1m on valley side				1m on valley side				0.5x2			
	Drain	1m on hill side				1m on hill side				1m on hill side				0.6			
	Debries Collection	1m on hill side				1m on hill side				1m on hill side				0			
Min. radii of horizontal curve (m)		115	80	50	30	75	75	25	15	75	25	15	15	15 Exceptional =10			
Pavement slope (%)		2-5				2-5				4				4			
Shoulder slope (%)		3-6				4				5				5			
Type of pavement		Double. bituminous treatment				Dense bituminous premix				Base Course				Single Layer Base Course			
Max. super-elevation (%)		10				10				10				10			
Max. vertical grade (%)		7				7				7				7			
Structure loading (minimum)		HS20-44				As per DoR standard				As per DoR standard				As per DoR standard			

Note:-

1. Thromde Roads – Design standards to be prepared by DES in consultation with DoR.
2. Access Road - Design standard to be set by DoR in consultation with the concerned agencies.
3. The Design standards for AH are at par with the design standards for PNH.

vpd = vehicles per day, L= Level terrain (0 to 10°), R= Rolling terrain (10 to 25°), M= Mountainous terrain (25 to 60°), S = Steep terrain (More than 60°)

Source: Road Classification System in Bhutan, Royal Government of Bhutan Ministry of Works & Human Settlement, Department of Roads, June 2017

Figure 16.1.2 Road Design Standards in Bhutan

Some sections of the proposed ladder-type arterial road network have not been developed, as mentioned in Table 16.1.1, while some sections of the routes have also not been double-laned, as shown in Figure 16.1.3. Moreover, there are some critical bottleneck sections, which is reducing the average travel speed, such as steep narrow sections and frequent slope failure sections on the proposed routes.

Table 16.1.1 Outline of Proposed Routes

Type	Routes		Route Length (Missing Section) (Km)	Average Travel Time (H)	Average Travel Speed (Km/h)	Desirable Travel Time	Target Travel Speed (Km/h)	Target Design Speed (Km/h)	Remarks
	ID	**Name**							
North-south route	NS-1	Paro-Samtse	201 (95)	-	-	Eight hours' travel (one day)	25.1	30	Haa-Samtse section is missing (under construction)
	NS-2	Thimphu-Phuentsholing	142.5	4.5	31.5		31.5	40	Via Damchu-Chukha Bypass
	NS-3	Gasa-Sarpang	213	10.3	20.9		26.6	30	
	NS-4	Bumthang-Gelephu	312	12	26		26.3	30	
	NS-5	Lhuentse-Nganglam	173 (98)	-	-		21.6	30	Monggar-Kurizampa (double lane) Kurizampa-Nganglam (Single lane)
	NS-6	Trashiyangtse-Samdrupjongkhar	234	8.5	27.5		29.2	30	
East-west route	EW-1	Paro-Trashigang:	605	20	30.2	16 hours' travel (two days)	37.8	40	
	EW-2	Samtse-Samdrupjongkhar (without environmental negative impact)	488 (231)	-	-		30.5	40	Lhamoizhingkha-Sarpang, Nganglam-Dewathang, and Gelephu-Panbang sections are missing (planning stage)

Note: Source of average travel time is based on interview results with commercial drivers.

Road network improvements, including new road construction, will incur significant construction costs and an impact on environment. An implementation plan should be prepared to evaluate the importance of each road section in the planned ladder road network. The evaluation is carried out based on the district-wise security risk analysis and the bottleneck analysis.

(1) District-wise security risk analysis by road section

The district-wise security risk analysis for disasters is examined based on the endemic functions of districts and the substitutability of those functions. The proposed arterial road network is expected to play important role on substitutability of above functions by networking. Prioritization of the routes is considered, as shown in Table 16.1.2, based on district-wise risk analysis findings.

Table 16.1.2 Prioritization Based on Security Risk Factors

Type	Routes		Earthquake	Landslide	Flood	GLOF
	ID	Name				
North -south route	**NS-1**	**Paro-Samtse**				
		a. Paro-Haa				
		b. Haa-Samtse				
	NS-2	**Thimphu-Phuentsholing**				
		a. Thimphu-Chuzom				
		b. Chuzom-Phuentsholing				
	NS-3	**Gasa-Sarpang**				
		a. Gasa-Punakha				
		b. Punakha-Mesina				
		c. Mesina-Wangdue				
		d. Wangdue-Tsirang				
		e. Tserang-Sarpang				
	NS-4	**Bumthang-Gelephu**				
		a. Bumthang-Trongsa				
		b. Trongsa-Zhemgang				
		c. Zhemgang-Gelephu				
	NS-5	**Lhuentse-Ngalam**				
		a. Lhuentse-Monggar				
		b. Monggar-Ngalam				
	NS-6	**Trashiyangtse-Samdrupjongkhar**				
		a. Trashiyangtse-Trashigang				
		b. Trashigang-Tshelingkhor				
		c. Tshelingkhor-Samdrupjongkhar				
East-west route	EW-1	Paro-Trashigang:				
		a. Paro-Chuzom				
		b. Chuzom-Thimphu				
		c. Thimphu-Mesina				
		d. Mesina-Wangdue				
		e. Wangdue-Trongsa				
		f. Trongsa-Bumthang				
		g. Bumthang-Monggar				
		h. Monggar- Trashigang				
	EW-2	**Samtse-Samdrupjongkhar** (without environmental negative impact)				
		a. Samtse-Phuntsholing				
		b. Phuntsholing-Monitor				
		c. Monitor-Raidak				
		d. Raidak-Lamoizingkha				
		e. Lamoizingkha-Sarpang				
		f. Sarpang-Gelephu				
		g. Gelephu-Panbang				
		h. Pangbang-Nganglam				
		i. Nganglam-Dewathang				

Note: high priority, middle priority.

(2) Section-wise Bottleneck Analysis

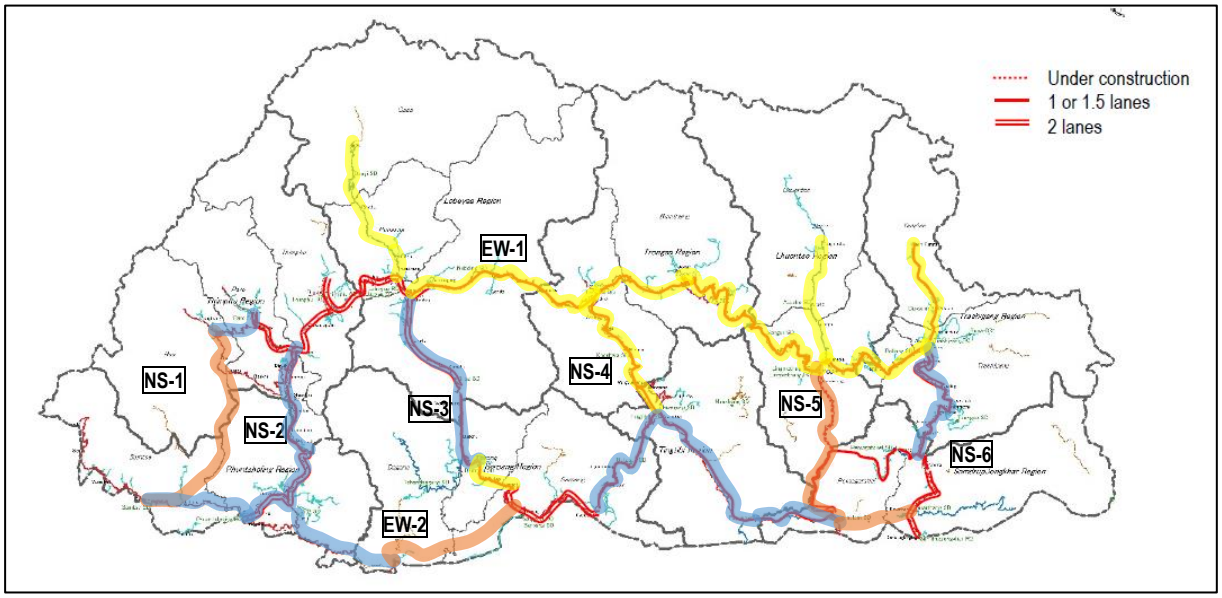
The section-wise bottleneck analysis, based on the target travel time, is examined in order to provide detailed sectional information to inform the implementation of improvement measures. Bottlenecks are classified into three levels, and the results are shown in Table 16.1.3.

Table 16.1.3 Classification of Bottleneck Sections on Routes (Travel Speed)

Type	Routes		Route Length (Km)	Average Travel Time (H)	Average Travel Speed (Km/h)	Remarks
	ID	Name				
North-south route	**NS-1**	**Paro-Samtse**	**201 (95)**	-	-	
		a. Paro-Haa	106	3	35.3	
		b. Haa-Samtse	(95)	-	-	Missing section (under construction)
	NS-2	**Thimphu-Phuentsholing**	**142.5**	**4.5**	**31.5**	
		a. Thimphu-Chuzom	30	0.5	60.0	
		b. Chuzom-Phuentsholing	112.5	4.0	28.3	
	NS-3	**Gasa-Sarpang**	**213**	**10.3**	**20.9**	
		a. Gasa-Punakha	27	2.3	11.6	
		b. Punakha-Mesina	12	0.5	24.0	
		c. Mesina-Wangdue	11	0.3	33.0	
		d. Wangdue- Tsirang	103	5	20.6	
		e. Tsirang-Sarpang	60	2.2	27.2	
	NS-4	**Bumthang-Gelephu**	**312**	**12**	**26**	
		a. Bumthang-Trongsa	68	2	34	
		b. Trongsa-Zhemgang	111	5	22.2	
		c. Zhemgang-Gelephu	133	5	26.6	
	NS-5	**Lhuentse-Ngalam**	**173 (98)**	-	-	
		a. Lhuentse-Monggar	75	3	25	
		b. Monggar-Ngalam	(98)	-	-	Missing section (under construction)
	NS-6	**Trashiyangtse-Samdrupyongkhar**	**234**	**8.5**	**27.5**	
		a. Trashiyangtse-Trashigang	54	2	27	
		b. Trashigang-Tshelingkhor	109	4	27.2	
		c. Tshelingkhor-Samdrupjongkhar	71	2.5	28.4	
East-west route	**EW-1**	**Paro-Trashigang:**	**605**	**20**	**30.2**	
		a. Paro-Chuzom	24	0.6	36	
		b. Chuzom-Thimphu	30	0.5	60	
		c. Thimphu-Mesina	59	2	29.5	
		d. Mesina-Wangdue	11	0.3	33	
		e. Wangdue-Trongsa	129	4.5	28.6	
		f. Trongsa-Bumthang	68	2	34	
		g. Bumthang-Monggar	193	7	27.5	
		h. Monggar-Trashigang	91	3	30	
	EW-2	**Samtse-Samdrupjongkhar (without environmental negative impact)**	**488 (231)**	-	-	
		a. Samtse-Phuntsholing	61	-	-	
		b. Phuntsholing-Monitor	48	-	-	
		c. Monitor-Raidak	35	-	-	
		d. Raidak-Lamoizingkha	18	-	-	
		e. Lamoizingkha-Sarpang	(87.5)	-	-	Missing section (planning stage)
		f. Sarpang-Gelephu	39	-	-	
		g. Gelephu-Panbang	(70)	-	-	Missing section (planning stage)
		h. Pangbang-Nganglam	55.6	-	-	
		i. Nganglam-Dewathang	(74)	-	-	Missing section (planning stage)

Note: significant bottleneck (missing section), moderate bottleneck (NS: 25 km/h >average travel speed, EW: 30 km/h > average travel speed), minor bottleneck (NS: 30 km/h > average travel speed > 25 km, EW: 40 km/h > average travel speed > 30 km); EW-2 a, b, c, d, f, h are classified as moderate bottlenecks since the road classification of those sections are equivalent to secondary national highways and the terrain is generally mountainous.

The section-wise bottleneck analysis, based on networking and double laning, is also examined to provide detailed sectional information for purpose of considering improvement measures to implement. Bottlenecks are classified into three levels, and the result is shown in Figure 16.1.3.



Note: significant bottleneck, moderate bottleneck, minor bottleneck.

Figure 16.1.3 Classification of Bottleneck Sections on Routes (Network and Double Laning)

(3) Prioritization of Route Improvements Based on Bottleneck Analysis

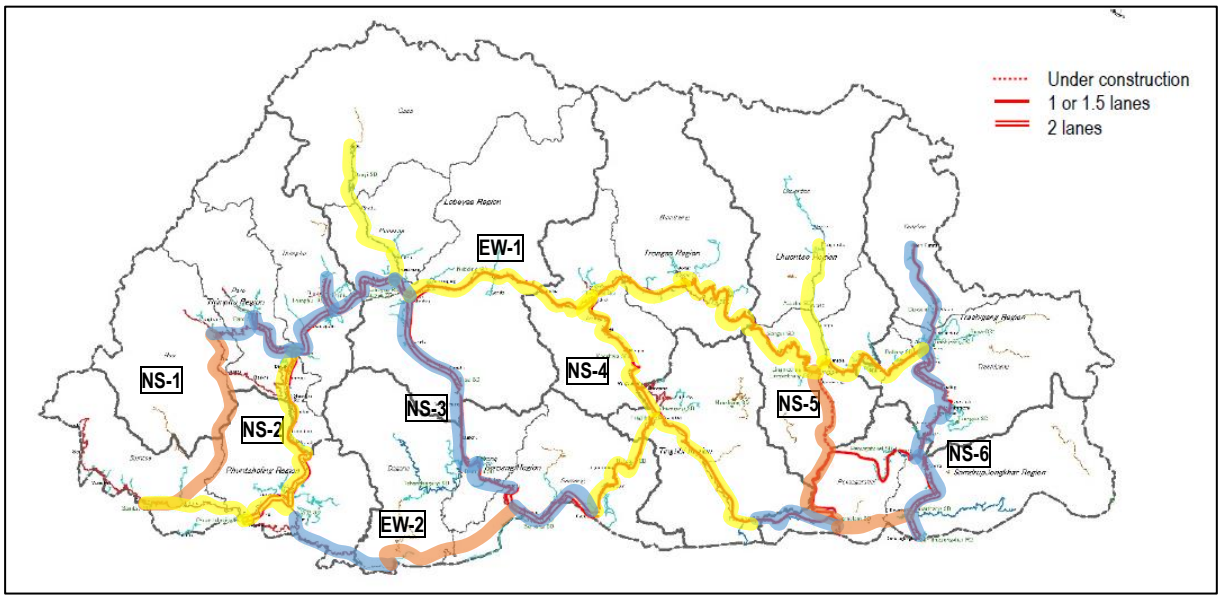
The findings on prioritization, based on the security risk factors and the classification of bottleneck sections on routes, are integrated and the section-wise prioritization of improvements is examined, as shown in Table 16.1.4 and Figure 16.1.4.

Table 16.1.4 Prioritization of Route Improvements Based on Bottleneck Analysis

Type	Routes		Disaster Risks				Travel Speed	Network and Double Laning	Total
	ID	Name	Earth quake	Land slide	Flood	GLOF			
North-south route	**NS-1**	**Paro-Samtse**							
		a. Paro-Haa	2		2			1	2
		b. Haa-Samtse			2		3	3	6.5
	NS-2	**Thimphu-Phuentsholing**							
		a. Thimphu-Chuzom			2				0.5
		b. Chuzom-Phuentsholing	3	3	3		1	1	4.2
	NS-3	**Gasa-Sarpang**							
		a. Gasa-Punakha			2	3	2	2	5.2
		b. Punakha-Mesina			2	3	2	2	5.2
		c. Mesina-Wangdue			2	3			1.2
		d. Wangdue-Tserang			2	3	2	1	4.2
		e. Tserang-Sarpang	2	2	3		1	2	4.7
	NS-4	**Bumthang-Gelephu**							
		a. Bumthang-Trongsa	2	3	3	3		2	4.7
		b. Trongsa-Zhemgang	2	3			2	2	5.2
		c. Zhemgang-Gelephu	2	2	3		1	1	3.7
	NS-5	**Lhuentse-Ngalam**							
		a.Lhuentse-Monggar	3	3	2		1	2	5
		b. Monggar-Ngalam	3	3	2		3	3	8
	NS-6	**Trashiyangtse-Samdrupjongkhar**							
		a. Trashiyangtse-Trashigang		3	2		1	2	4.2
		b. Trashigang-Tshelingkhor	3	3	2		1	1	4
		c. Tshelingkhor-Samdrupjongkhar	3	2	2		1		2.7
East-west route	**EW-1**	**Paro-Trashigang:**							
		a. Paro-Chuzom			2		1		1.5
		b. Chuzom-Thimphu			2				0.5
		c. Thimphu-Mesina			2		2		2.5
		d. Mesina-Wangdue			2		1		1.5
		e. Wangdue-Trongsa	2	3	2		2	2	5.7
		f. Trongsa-Bumthang	2	3	3	3	1	2	5.7
		g. Bumthang-Monggar		3		3	2	2	5.5
		h. Monggar-Trashigang	3	3	2		1	2	5
	EW-2	**Samtse-Samdrupjongkhar (without environmental negative impact)**							
		a. Samtse-Phuntsholing	3	3	3		2	1	5.2
		b. Phuntsholing-Monitor	3	3	3		2	1	5.2
		c. Monitor-Raidak					2	1	3
		d. Raidak-Lamoizingkha					2	1	3

Type	Routes		Disaster Risks				Travel Speed	Network and Double Laning	Total
	ID	Name	Earth quake	Land slide	Flood	GLOF			
		e. Lamoizingkha-Sarpang		2	3		3	3	7.2
		f. Sarpang-Gelephu	2	2	3		2		3.7
		g. Gelephu-Panbang		2	3		3	1	5.2
		h. Pangbang-Nganglam					2	1	3
		i. Nganglam-Dewathang	3	2	2		3	3	7.7

Note: significant bottleneck (total score > 6), moderate bottleneck (6 > total score > 5), minor bottleneck (5 > total score). Scoring for prioritization is as follows: disaster risks (high priority-3, middle priority-2, and total score of disaster risk is divided by 4); travel speed (significant bottleneck-3, moderate bottleneck-2, minor bottleneck-1); network and double laning (significant bottleneck-3, moderate bottleneck-2, minor bottleneck-1).



Note: high priority, middle priority, low priority.

Figure 16.1.4 Prioritization of Route Improvements Based on Bottleneck Analysis

The arterial road network consists of primary and secondary national highways. These road classes should apply to appropriate geometric standards, as shown in Figure 16.1.2.

(4) Environmental consideration on the South East-West Highway

The South East-West highway is an essential corridor in order to formulate the ladder-type arterial road network for ensuring effective transport system development. The current status of improvements to the South East-West Highway is summarized in Table 16.1.5.

Table 16.1.5 Current Status of the South East-West Highway

Section No.	Section	Length (Km)	Width (10.5 M, Pavement 7.5 M) (Km)	Width (8.5 M, Pavement 5.5 M) (Km)	Remarks
1	Samtse-Phuntsholing	61	-	58	SASEC (3 km) Under procurement of contractor
2	Phuntsholing-Monitor	48	-	48	
3	Monitor-Raidak	35	-	35	
4	Raidak-Lamoizingkha	18	-	18	
5	Lamoizingkha-Sarpang	87.5	-	-	ADB F/S
6	Sarpang-Gelephu	39	-	39	
7	Gelephu-Panbang	70	-	-	ADB F/S Royal Manas National Park (RMNP)
8	Pangbang-Nganglam	55.6	-	55.6 (7.5 m, pavement 3.5m)	
9	Nganglam-Dewathang	74	-	-	ADB F/S
Total		488.1	0.0 (0.0%)	253.6 (51.9%)	

Source: DoR

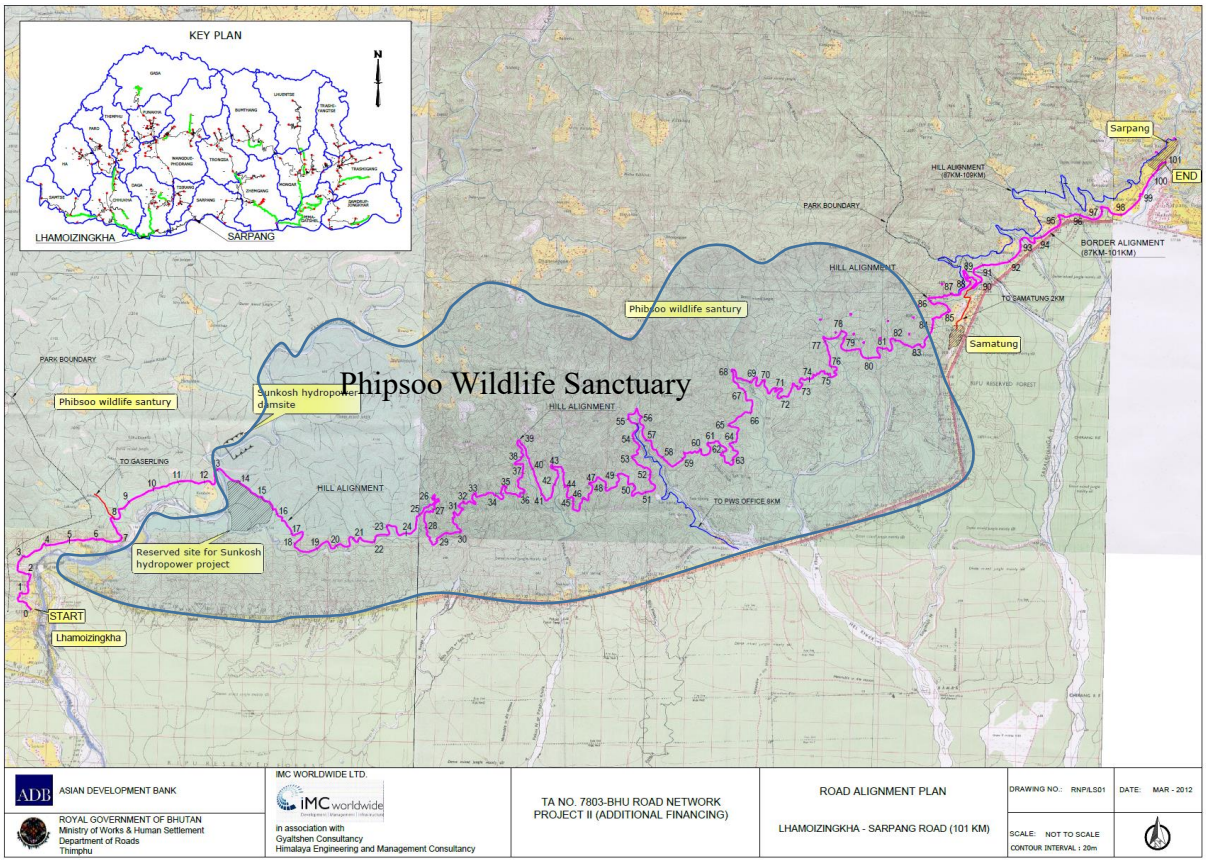
An alternative alignment of the missing sections (No. 5 and No. 9) in Table 16.1.6 was studied in the course of ADB TA 7803-BHU Road Network Project II (Additional Financing) (hereinafter referred to as "ADB F/S"). A bypass was also studied for Section No. 7. Sections e, g and i of EW-2 in Table 16.1.5 are the same as Sections No. 5, No. 7 and No. 9, respectively. A summary of the above studies is given in Table 16.1.6. The principle of the proposed alignment policy for the three sections in the ADB Study is appropriate.

Figures 16.1.5 to 16.1.7 show the proposed alignment of each section.

Table 16.1.6 Summary of the ADB F/S Alignment Study

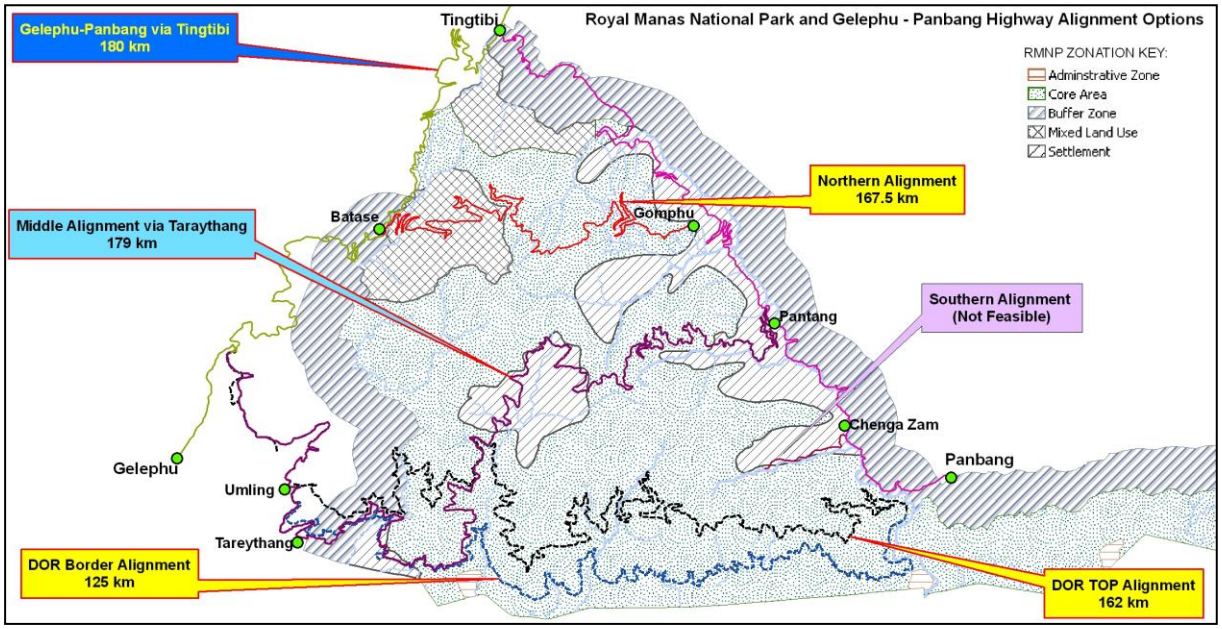
Section No.	Section	Summary of Alignment Study
5	Lamoizingkha-Sarpang	The Lhamoizinghka-Sarpang road is divided into three sections. The Lhamoizingkha-Kerabari section will provide access to the Sunkosh Hydropower Project near Kerabari. Improvements to this road section will also be made, including a bridge across the Sunkosh River, as part of that project; therefore, this section is omitted from the RNP IIAF cost estimates and economic analysis. The Kerabari-Sematung section crosses the Phipsoo Wildlife Sanctuary and a higher hill alignment is recommended in order to avoid unstable areas and significant wildlife activity which occurs near the border (particularly elephant migration). The Sematung-Sarpang section closely follows an existing track through the centre of Senge Gewog and several villages located along the border. The road will end in the new Sarpang Township.
7	Gelephu-Panbang	The TA examined several alignments across the RMNP in the southern, central and northern sections of the park. There is no possibility of avoiding the core area of the park and, in particular, the areas with an identified tiger population. Furthermore, all of the alignments are very circuitous due to the mountainous terrain and will not reduce the driving distance between Gelephu and Panbang via Tingtibi. The Tingtibi-Gomphu road is being widened and the Pantang-Panbang road is under construction. The TA recommends that the DoR should abandon the idea of crossing the RMNP and adopt the Gelephu-Tingtibi-Gomphu-Panbang route as part of the South East-West Corridor. The TA recommends that the Geleg Zam-Taraythang road should be improved to provide an all-weather road to the settlements in the Gelephu Dhunkhag Sub-district east of the Mau River.
9	Nganglam-Dewathang	The Nganglam-Deothang alignment will make use of an existing farm road from Nganglam to Choekhorling Gewog and an existing road between Deothang and the coal mine at Rishore. But there is a 53-km section in the middle, which will be an entirely new alignment through mountainous and steep terrain.

Source: ADB TA 7803-BHU Road Network Project II (Additional Financing) Draft Final Report, April 2012



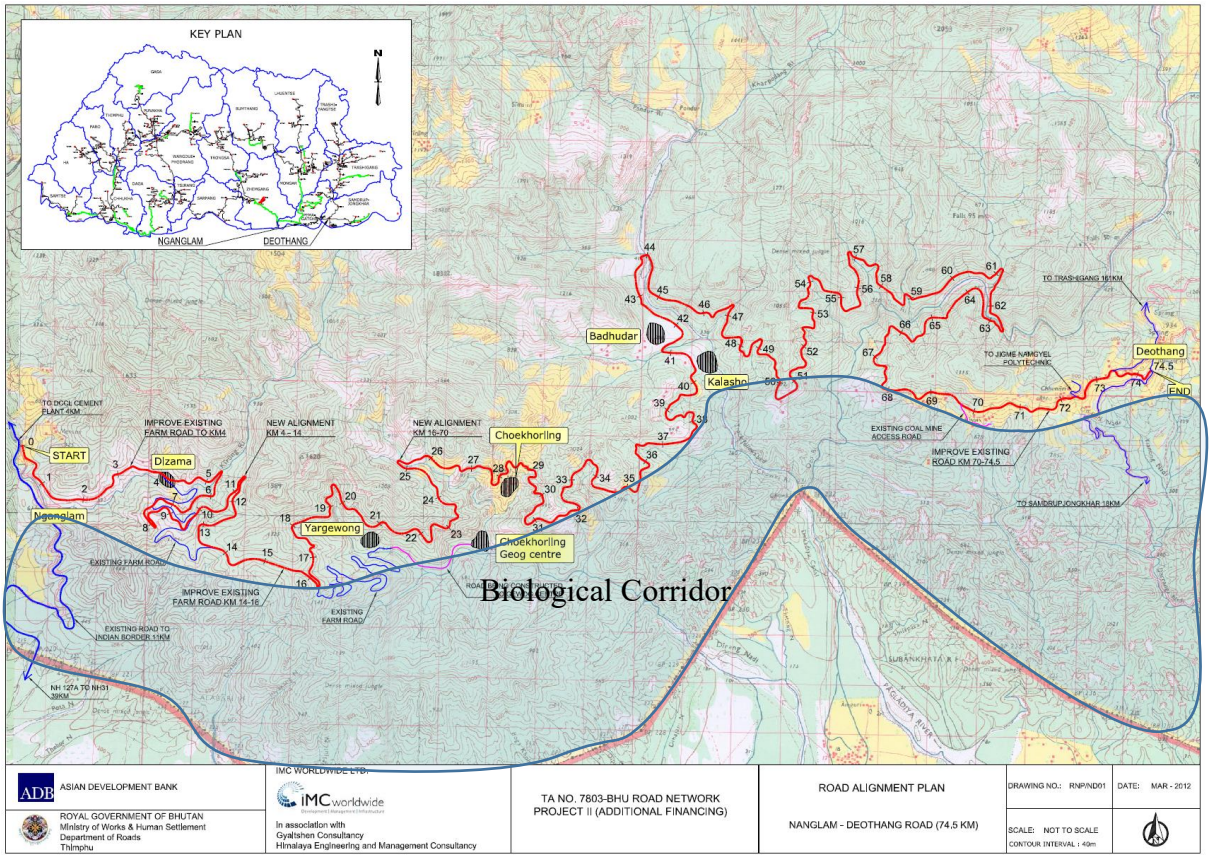
Source: ADB TA 7803-BHU Road Network Project II (Additional Financing) Draft Final Report, April 2012

Figure 16.1.5 Proposed Alignment of the South East-West Highway (Lamoizingkha-Sarpang Section) by ADB Study



Source: ADB TA 7803-BHU Road Network Project II (Additional Financing) Draft Final Report, April 2012

Figure 16.1.6 Alternative ADB Study of the South East-West Highway (Gelephu-Panbang Section)



Source: ADB TA 7803-BHU Road Network Project II (Additional Financing) Draft Final Report, April 2012

Figure 16.1.7 Proposed Alignment of the South East-West Highway (Nganglam-Dewathang) in the ADB Study

(5) Proposed projects

Projects for the formulation of the ladder-type arterial road network with good travel times are selected based on following principles:

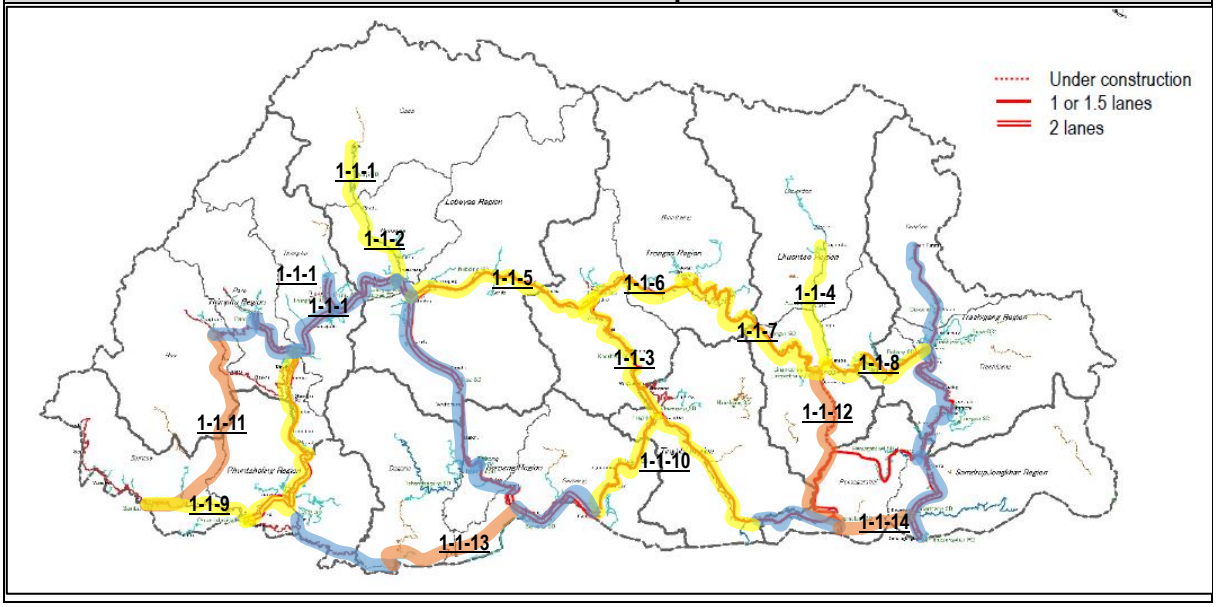
- High-priority sections mainly refer to missing sections and sections under construction, while the implementation of section development needs a large budget, an implementation period and environmental considerations, compared with widening improvements. Considering the above and the limited budget allocation in the 12th FYP, a middle-term implementation schedule is appropriate for project implementation.
- Double laning for middle-priority sections, other than double-laned sections, should be promptly started, taking the prioritization in Table 16.1.3 into accounts.
- Low-priority sections are mainly double-laned sections and low-traffic-demand sections; therefore, improvement works for low-priority sections can be considered beyond the long term.

Proposed projects are listed in Table 16.1.7.

Table 16.1.7 Proposed Projects for the Formulation of a Ladder-type Arterial Road Network with Good Travel Times

ID	Title of Project	Project Cost (Million BTN)	Implementation Schedule	Responsible Organization	Possibility of Environmental and Social Negative Impact	Remarks
1-1-1	NS-3-a: Gasa-Punakha	918	Long	MoWHS	Minor impact on roadside residents is anticipated due to widening improvement	27 km, double laning
1-1-2	NS-3-b: Punakha-Mesina	408	Long	MoWHS	Same as above	12 km, double laning
1-1-3	NS-4-b: Trongsa-Zhemgang	3,774	Middle	MoWHS	Same as above	111 km, double laning
1-1-4	NS-5-a: Lhuentse-Monggar	2,550	Long	MoWHS	Same as above	75 km, double laning
1-1-5	EW-1-e: Wangdue-Trongsa	4,386	Short	MoWHS	Same as above	129 km, double laning
1-1-6	EW-1-f: Trongsa-Bumthang	2,312	Short	MoWHS	Same as above	68 km, double laning
1-1-7	EW-1-g: Bumthang-Monggar	6,562	Short	MoWHS	Same as above	193 km, double laning
1-1-8	EW-1-h: Mongar-Trashigang	3,094	Short	MoWHS	Same as above	91 km, double laning
1-1-9	EW-2-a: Samtse-Phuntsholing	2,074	Short	MoWHS	Same as above	61 km, double laning
1-1-10	EW-2-g: Gelephu-Panbang	5,610	Short	MoWHS	Same as above	165 km, double laning
1-1-11	NS-1-b: Haa-Samtse	3,230	Middle	MoWHS	Same as above	95 km, double laning (under construction)
1-1-12	NS-5-b: Monggar-Nganglam	3,332	Middle	MoWHS	Same as above	98 km, double laning A potential alternative route is to conncect between Kuri-Gongri-and Sherichu.
1-1-13	EW-2-e: Lamoizingkha-Sarpang	3,718	Middle	MoWHS	Impact on Phipsoo Wildlife Sanctuary is anticipated	87.5 km, new
1-1-14	EW-2-i: Nganglam-Dewathang	3,145	Middle	MoWHS	Impact on Biological Corridor is anticipated.	74 km, new

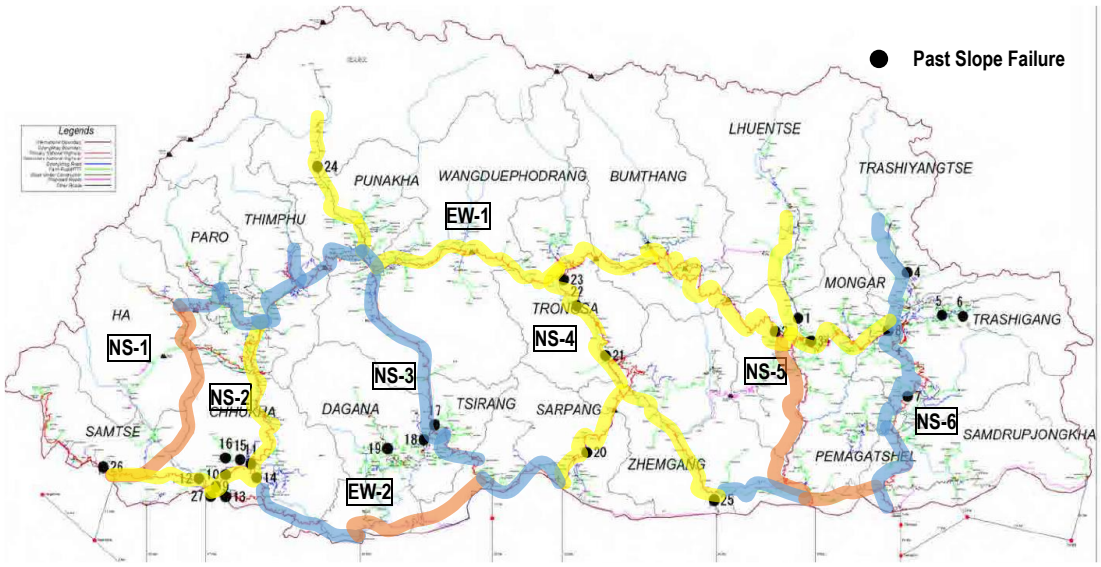
Location Map



Note: Short term 2018-2022, middle term 2023-2027, long term 2028-2030;
high priority, middle priority, low priority;
project cost BTN 42.5 m/km (new), BTN 34 m/km (double laning).

16.1.3 Development Guidance for Landslide Prevention

Roads in Bhutan are geologically fragile due to the very steep mountainous terrain, and there are innumerable slopes and landslides along the roadside. Past major slope failures were recorded by the DoR, most of which primarily overlapped with the proposed network, as shown in Figure 16.1.8. The elimination of road closures due to landslides and slope failure is required to achieve a stable road network.



Source: DoR

Figure 16.1.8 Location of Major Slope Failures

Countermeasures for landslides include stabilization using physical measures and bypasses with structures such as tunnels and bridges. Massive structures for stabilization and bypasses generally require advanced technology and large amount of costs. Tunnels especially require more advanced technologies and larger costs compared with other countermeasures. Considering that current practices regarding landslide stabilization and bypass structures in Bhutan are in their infancy, stepwise implementation planning, which starts with further technology transfer, is essential.

(1) General Practice for the Selection of Landslide Prevention Measures

Figure 16.1.9 presents a flow chart for the selection of landslide prevention measures. As mentioned in the figure, the design of road alignment with widening was carried out by taking into consideration the location of the critical slopes, so as to avoid adverse impacts on landslide movements. Thus, if there is no or a positive impact on an inactive landslide, any prevention measure is unnecessary. However, if a landslide is active or there is concern that it could be destabilized by road widening, landslide countermeasures should be implemented. Landslide prevention measures are mainly divided into three types, namely: groundwater drainage work, earthwork such as earth removal and counterweight filling, and restraint work including anchors, rock bolts and pile work. In general, groundwater drainage work is the cheapest, followed by earthwork. But they are often constrained by topographical, geotechnical and hydrological conditions. On the other hand, restraint work, which prevents landslide movement by force, is typically expensive, but it can be adapted to most landslides because implementation can be carried out in a limited space. Therefore, groundwater drainage and earthwork will be introduced or combined with other methods as much as possible in order to reduce the cost of

the countermeasures.

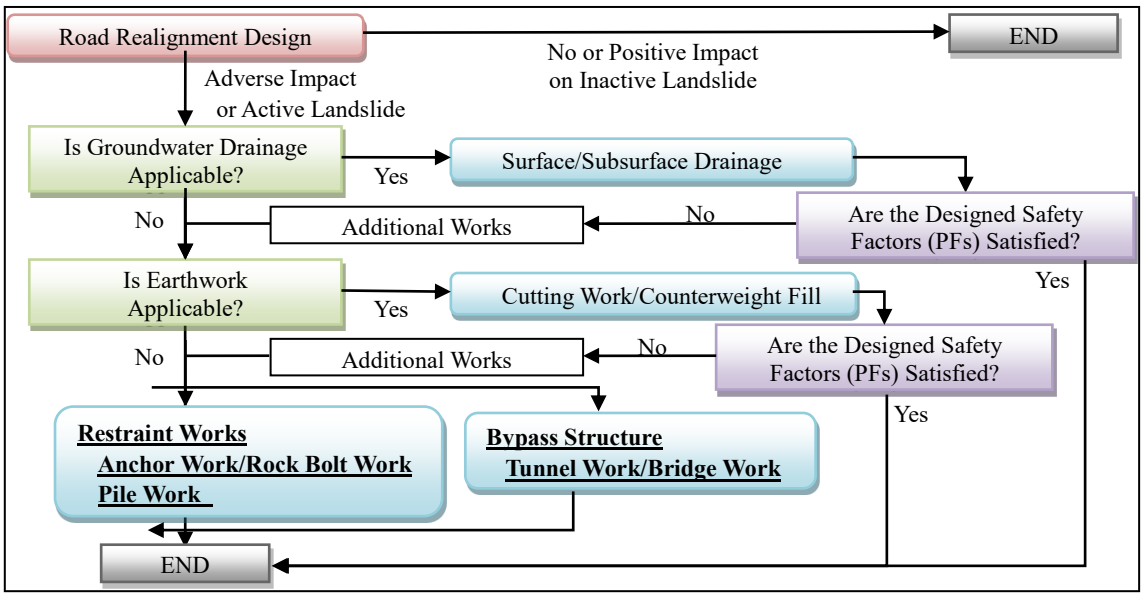


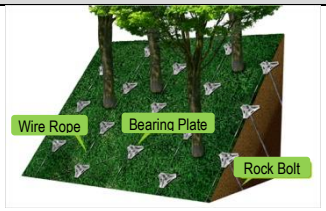
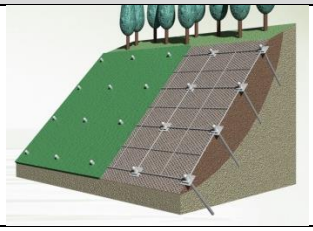
Figure 16.1.9 Flow Chart for Landslide Prevention Measures

(2) Introduction of Slope Failure Prevention Measures on Natural Slopes

For slope failure on natural slopes above retaining walls at the toe of the slope or cut slopes with stable grading, prevention measures will be planned in the same manner as the landslide prevention measures mentioned above. Since construction will take place on natural slopes, both economic factors and the landscape must be taken into consideration when selecting the countermeasure.

Table 16.1.8 presents a comparison of the three countermeasures for slope failure on natural slopes. Two countermeasures, namely, non-frame methods and GF rock bolt measures, which are manufactured by Japanese companies, are compared with traditional methods, i.e., cribwork with rock bolts. These two countermeasures are advantageous in that forestation can take place after construction to improve the landscape. But they need to install rock bolts in the whole construction area, meaning that the economic burden is worse than for cribwork in many cases. The non-frame method can be constructed without deforestation as well as preserve existing trees in the construction area. It is also more economical than GF rock bolt method. Therefore, the non-frame method shall be adopted to deal with slope failure on natural slopes. Meanwhile, cribwork with rock bolt can be adopted for cut slopes where slope failure is concerned.

Table 16.1.8 Comparison of Three Slope Failure Prevention Measures on Natural Slopes

Construction Method	Non-frame	GF Rock Bolt and Rope Net	Cribwork with Rock Bolts
Photo/schematic image			
Manufacturer	Nippon Steel and Sumikin Metal Products Co., Ltd.	Tokyo Rope MFG Co., Ltd.	-
Environment	Unnecessary to deforest and environmentally friendly <good>	Necessary to deforest due to installation of metal mesh; planting and seeding are available after construction <fair>	Planting and seeding are available inside the frame; landscape is no better than other methods <poor>
Economics	More expensive than cribwork with rock bolts in many cases due to installing the rock bolt in the whole construction area <fair>	Needs more materials than the non-frame method and more expensive <poor>	Unnecessary to install the rock bolt in the whole area and more economical than other methods in many cases <good>

(3) Tunnel Introduction

A tunnel is one of the bypass measures to avoid landslides and slope failure. The development of 10 tunnels is proposed by the DoR, which will overlap with the proposed arterial road network as shown in Figure 16.1.1. A tunnel requires a large amount of cost compared with other landslide countermeasures. Therefore, a comparison of alternative measures should be examined to verify economic and financial viability, together with an implementation scheme.

Technology transfer in the case of tunnel engineering will include geological investigation and analysis, structure design and construction, and O&M. A comprehensive technology transfer plan and programmes are required for surveying, planning, designing, constructing, maintaining and operating mountainous tunnels, as outlined in Figure 16.1.10 below.

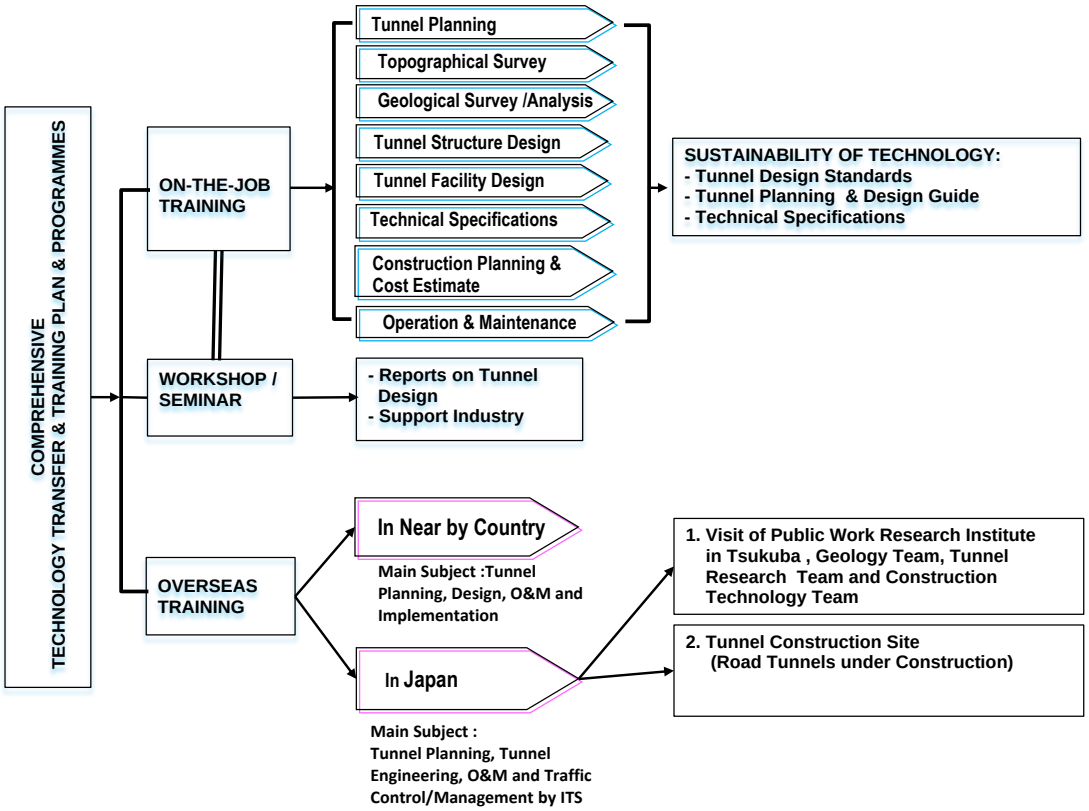


Figure 16.1.10 Comprehensive Tunnel Technology Transfer Plan/Programmes

(4) Economic and Financial Evaluation

The development of landslide treatment measures and bypass structures, such as tunnels and bridges, play a very important role in strengthening accessibility and economic growth. However, these measures need significant financing, and introducing these measures should be carefully analysed, along with an economic and financial evaluation. The measures must be economically viable, satisfying government-prescribed criteria known as hurdle rates. An economic evaluation will be carried for "with project" and "without project" cases. The difference in economic costs and benefits in both cases will be attributed to the project and subjected to economic feasibility measures. The economic feasibility of the project will be indicated by the economic internal rate of return (EIRR), the cost-benefit ratio (CBR) and the net present value (NPV) at an assumed discount rate of 12%, which is acceptable for the economic appraisal of public investment projects according to development banks, such as World Bank. These economic values are estimated by the following equations.

- NPV $$\sum_{t=1}^{n} \frac{B_{t-C_t}}{(1+i)^{t-1}} \quad i = 12.0\%$$
- CBR $$\sum_{t-1}^{n} \frac{B_{t/(1+i)}t-1}{C_t/(1+i)^{t-1}} \quad i = 12.0\%$$
- EIRR i_o : *social discount rate that satisfies the following equation*
$$\sum_{t=1}^{n} \frac{B_{t-C_t}}{(1+i)^{t-1}} = 0$$

The hurdle rates for economic feasibility are as follows: EIRR > 12%, CBR > 1.0 and NPV > 0. Sensitivities about the project arising from adverse changes in costs and benefits are examined in order to establish the capacity of the project to exhibit economic feasibility.

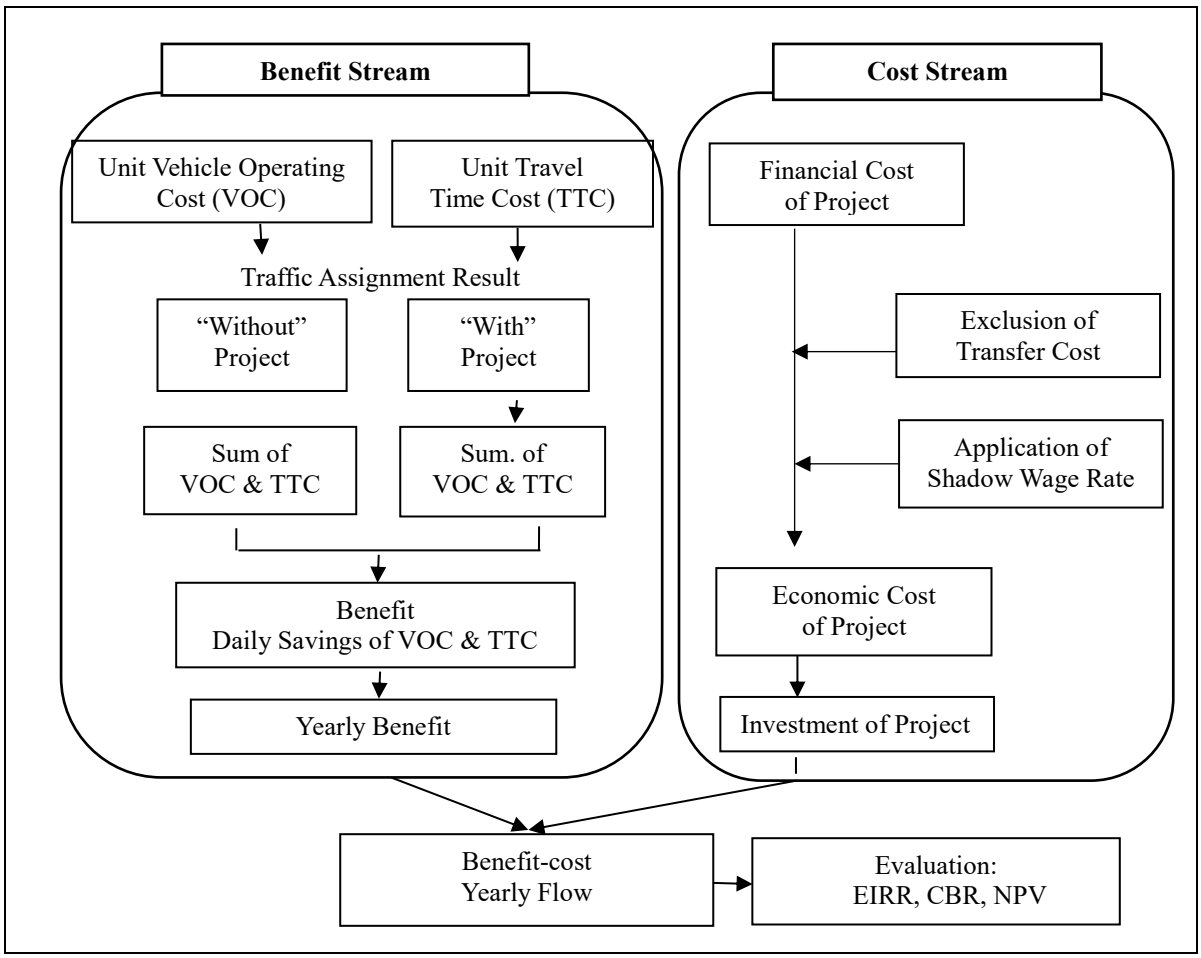


Figure 16.1.11 Work Flow for the Economic Evaluation and Economic Evaluation Indicators

Table 16.1.9 Calculation of Economic Internal Rate of Return and Financial Internal Rate of Return

Item	Economic Internal Rate of Return	Financial Internal Rate of Return
Objective	・ To examine the investment efficiency of the project from the viewpoint of the national economy by applying a cost-benefit analysis on the basis of a comparison between with-project case and without-project cases	・ To examine the investment efficiency of the project from the viewpoint of the executing agency by applying a cost-benefit analysis on the basis of a comparison between with-project case and without-project cases
Internal rate of return (IRR)*	・ This is deemed to be a return from the investment in the project; an indicator of investment efficiency	・ Same as on the left
With-project and without-project cases	・ With-project cases, e.g., tunnel development ・ Without-project cases, e.g., do nothing	・ Same as on the left
Conversion to economic prices	・ Market prices are converted to economic ones by multiplying (e.g., 0.97) to adjust for inefficiency in the market ・ Land prices can be discounted depending on the "solatium" to the landowners by law, which is a transfer item	・ Market prices are used, not converted
Transfer item	・ Tax, subsidy, solatium etc.: although the money is paid out, this does not directly consume resources, as it is just transferred from one actor to another; it is offset from the viewpoint of the national economy	・ Not considered in calculations
Discount rate	・ 12% = opportunity cost of fund, which is used as a criterion for the evaluation	・ Same as on the left
Project benefit	・ Reduction in vehicle operation cost (VOC) and travel time cost (TTC)	・ Toll charge; tariff rates need to be set by the RGoB
VOC	・ This is composed of a) fuel cost, b) tyre cost, c) engine oil cost, d) other oil cost, e) greasing cost, f) spare parts cost, g) maintenance cost and h) fixed cost	・ Not applicable
TTC	・ Opportunity cost in time for drivers and passengers; if you save driving time, you can earn more income	・ Not applicable
Project cost	・ This is composed of a) construction cost, b) physical contingency, c) consulting services, d) land acquisition cost, e) administration cost, f) O&M cost and g) replacement cost of electrical equipment	・ It is composed of a) construction cost, b) price escalation, c) physical contingency, d) consulting services, e) land acquisition cost, f) administration cost, g) VAT, h) O&M cost and g) replacement cost of electrical equipment
Evaluation period	・ The whole project life starting with preparing for construction (e.g., 25 years after the start of highway operations)	・ Same as on the left
Other preconditions	・ Interest payments and depreciation are not included ・ Price escalation is not included	・ Interest payments and depreciation are not included ・ Price escalation is not included ・ Vehicles exempted from toll charge are not included ・ Funding is assumed to be wholly financed by government equity ・ Corporate tax is not included

Note (*): Mathematically, IRR is the interest rate that makes the total present value of net benefit equal to zero.

(5) Proposed Projects

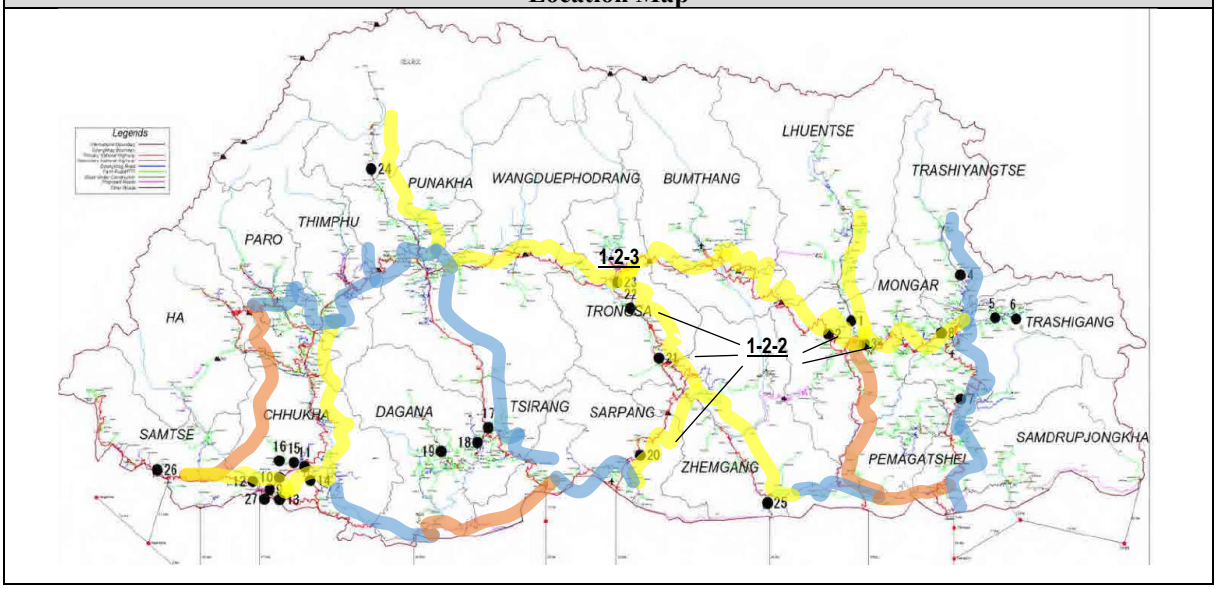
Projects for the elimination of road closures due to landslides and slope failure are selected based on following principle:

Construction of landslide treatment and bypass structures such as tunnels and bridges need a large amount of funding and a long implementation period. Moreover, current practice in the area of landslide treatment and tunnel technology in Bhutan is not well-developed. Therefore, stepwise implementation which starts with technology transfer is essential.

Proposed projects are listed in Table 16.1.10.

Table 16.1.10 Proposed Projects for the Elimination of Road Closures Due to Landslides and Slope Failure

ID	Title of Project	Project Cost (Million BTN)	Implementation Schedule	Responsible Organization	Possibility of Environmental and Social Negative Impact	Remarks
1-2-1	Technology Transfer Programme for Slope Protection and Tunnel (Planning, Design, Pilot Project, OJT)	0	Short	MoWHS	Nil	Donor assistance
1-2-2	Landslide Treatment	1,800	Middle	MoWHS	Minor impact on project site is anticipated	5 locations on middle-priority sections
1-2-3	Tomang Cliff Tunnel Project	2,100	Middle	MoWHS	Minor impact on approach road and portals is anticipated	840 m (tunnel: 745 m)
Location Map						



Note: Short term 2018-2022, middle term 2023-2027, long term 2028-2030; Landslide Treatment Project cost = BT 300 million/site.

16.1.4 Development Guidance for Rural Road Network

The formulation of the proposed service delivery network among GCs and service facilities using roads is essential. However, the budget for road improvements is limited to the existing, albeit plentiful, number of feeder roads, such as GC roads and farm roads. Therefore, the prioritization of roads for improvement is important with consideration of the following issues:

- Prioritization of road sections to be improved on GC roads and farm roads

- Review and update of standards and methods concerning design and construction to ensure the sustainability of improved structures

The service delivery network for each region, as shown in Figure 13.2.3 to Figure 13.2.6, shall be prioritized in the case of GC roads and farm roads. Practical pavement design standards, under various conditions, should be developed based on a review of improved GC roads.

Projects for securing road surface properties are selected based on the following principle:

- The budget for GC roads is limited and a simple standardized pavement and drainage design for GC roads is not economical. Therefore, practical pavement design standards, under various conditions, should be developed based on review of constructed GC roads

Proposed projects are listed in Table 16.1.11.

Table 16.1.11 Proposed Projects for Securing Road Surface Properties

ID	Title of Project	Project Cost (Million BTN)	Implementation Schedule	Responsible Organization	Possibility of Environmental and Social Negative Impact	Remarks
1-3-1	Technology Transfer Programme for Development of Road Structure Design Standard (Planning, Design, Pilot Project, OJT)	0	Short	MoWHS	Nil	Donor assistance

Note: Short term 2018-2022, middle term 2023-2027, long term 2028-2030.

16.1.5 Development Guidance for the Inter- and Intraregional Public Transport System and Infrastructures

(1) Existing Conditions of the Public Transport System

Regional centres are mostly connected by frequent long-distance interregional bus services. However, the service level of these bus services is still low because of the existence of an old and uncomfortable bus fleet, dysfunctional bus terminals, unreliable bus operations etc. To improve long-distance interregional bus services, improvements in the above conditions are essential. District centres and SDCs are mostly connected by inter- and intraregional bus services. However, the service level of these services is lower than that of long-distance interregional bus services. Moreover, the frequency of bus operations is limited on some routes in remote areas, due to low demand and operational profitability.

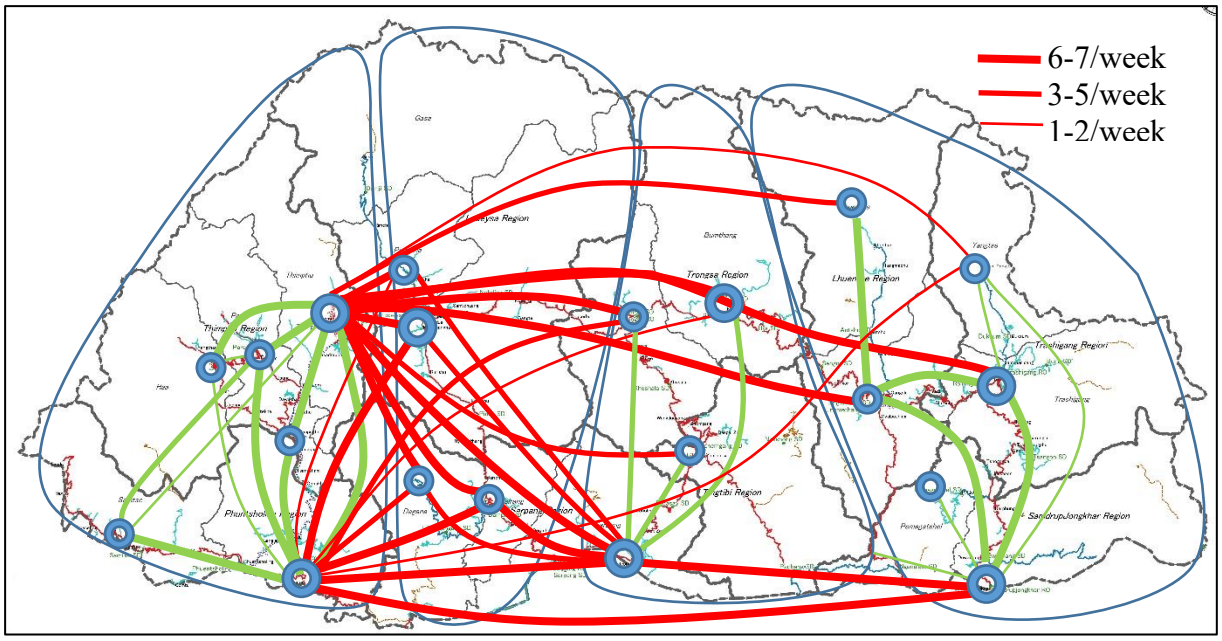


Figure 16.1.12 Existing Inter- and Intraregional Bus Network

Public and private bus operators need to use the bus fleet for a long time to ensure profitability of their business. This is more apparent in remote areas due to low operational profitability. Therefore, improvements to the bus fleet, in terms of passenger comfort and capacity, and subsidies for bus operations in remote area, are important issues.

Bus terminals for interregional and intercity services are not functional in terms of ticket sales, waiting areas, information about bus operations and transfers etc. Therefore, appropriate terminal facilities for major hubs in the interregional and intercity bus networks should be provided. Introducing an advanced IT system to enhance convenience for users and environmentally friendly systems are also needed.

	
Panoramic View (bus parking at the back, taxi at the front)	Ticket centre (Private bus operators sell tickets for their own line independently)
	
Insufficient comfortable facilities in a terminal building (bench, operational information etc.)	Typical intercity bus and bus bay

Figure 16.1.13 Intercity Bus Terminal in Thimphu

	
Panoramic view (bus parking right side, taxi parking left side)	
	
Ticket booth, insufficient comfortable facilities in the terminal (shelter, bench, operational information etc.)	Items offered at a ticket booth

Figure 16.1.14 City Bus Terminal in Thimphu

(2) Improvement Approach

The following measures are proposed to achieve development policy objectives:

- Development of a subsidy system for bus procurement and bus operations, based on performance-based evaluation criteria for unprofitable routes, in order to improve the bus fleet in terms of passenger comfort capacity and subsidies for bus operations in remote areas.
- Development of criteria for bus terminal and bus stop development by considering the introduction of facilities for electric vehicles (EVs), i.e., workshops, quick chargers etc., for the provision of appropriate terminal facilities for major hubs in the interregional and intercity bus networks.
- Introduction of a bus information system (centre, bus location system, bus schedule), a smart card for city buses, EV buses for cities, an advanced IT system to enhance convenience for users and environmentally friendly systems.
- Location of transit facilities including interregional bus terminals, community bus terminals and taxi stands close to public facilities in district centres and SDCs to ensure convenience for users.

(3) Proposed Projects

Projects to improve bus-related facilities (terminal, bay, fuel station etc.), in order to provide an efficient and comfortable service to passengers, are selected based on the following principle:

Demand from passengers for interregional and intraregional public transport differs. Interregional public transport requires safety, reliability and comfort, especially in the case of long-distance travel. Intraregional bus public transport needs to be convenient for the purposes of commuting. An eco-friendly system is also required.

Proposed projects are listed in Table 16.1.12.

Table 16.1.12 Proposed Project to Improve Bus-related Facilities (Terminal, Bay, Fuel Station etc.) to Provide an Efficient and Comfortable Service to Passengers

ID	Title of Project	Project Cost (Million BTN)	Implementation Schedule	Responsible Organization	Possibility of Environmental and Social Negative Impact	Remarks
2-1	Development of Intercity Bus Terminal	500	Short	Dzongkhag/ Thromde	Minor impact on project site is anticipated such as resettlement.	
2-2	Development of Intercity Bus Stop (Shelter Type)	3/location	Middle	Dzongkhag/ Thromde	Minor impact on road side residents is anticipated	Major cities on intercity bus route
2-3	Introduction of Bus Information System (Centre, Location, Schedule)	300	Middle	MoIC	Nil	
2-4	Incentive System for Unprofitable Intercity Line Operator	0	Middle	MoIC	Nil	
2-5	Development of City Bus Terminal	500	Short	Dzongkhag/ Thromde	Minor impact on project site is anticipated such as resettlement.	
2-6	Introduction of EV Bus and Quick Charging Facility for City Bus	200	Middle	Dzongkhag/ Thromde	Nil	
2-7	Introduction of Bus Information System (Centre, Location, Schedule)	300	Middle	Dzongkhag/ Thromde	Nil	
2-8	Introduction of Smart Card System	100	Middle	Dzongkhag/ Thromde	Nil	

Note: Short term 2018-2022, middle term 2023-2027, long term 2028-2030.

16.2 Air transport Development

16.2.1 Issues

Paro International Airport has contributed to the economic and industrial promotion of the nation as the sole international airport and a hub for domestic airports. However, the airport is predicted to be saturated by 2023, if the number of aircraft movements per hour is not improved. It is also predicted that saturation can be delayed till 2027, if aircraft movements per hour increase from four to five. Developing a second international airport as backup to Paro International Airport is essential in order to ensure both a hierarchical national network and national economic development.

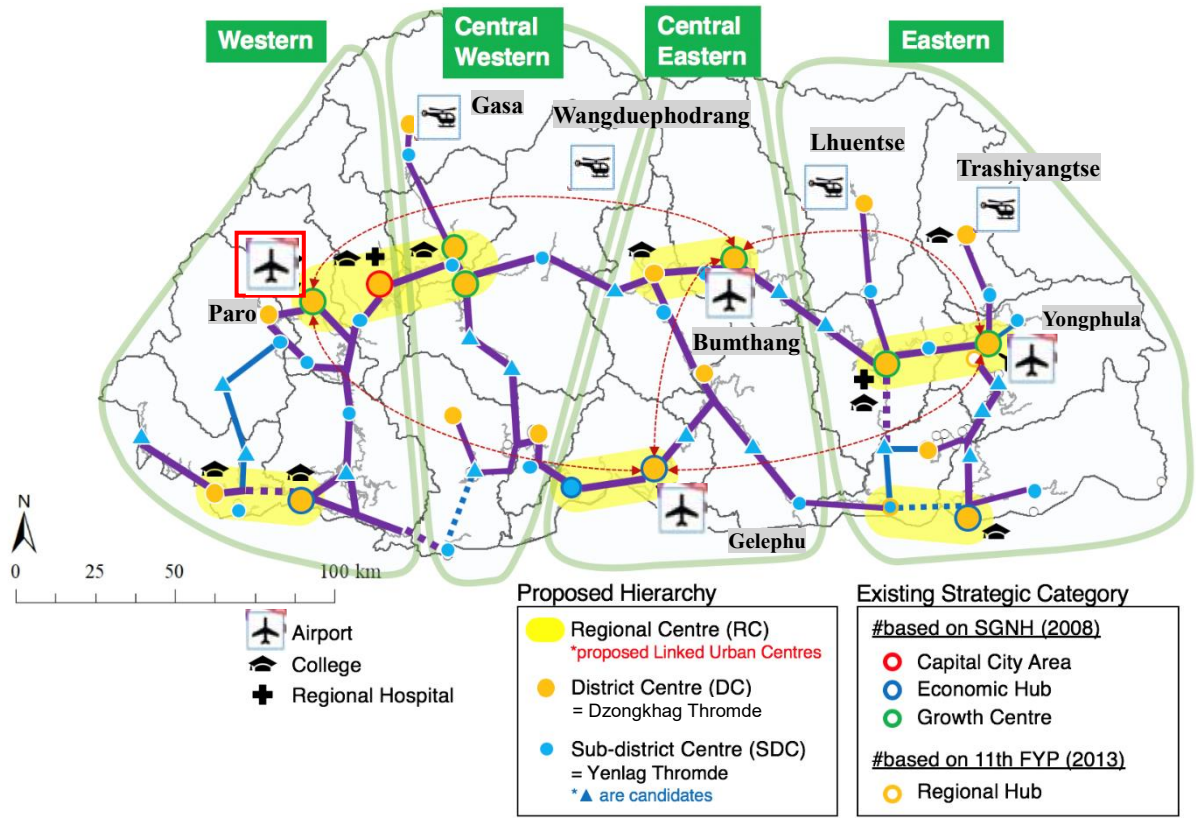


Figure 16.2.1 Proposed Air Transport System for a Hierarchical National Service Network

Improvements to the services and affordability of air transport should focus on the Eastern Region, which has poor accessibility to the industrial integrated area of Bhutan and international portals. A supplemental transport network for the northern district centres, which is not provided by the arterial road network, involving air transport should also be considered.

16.2.2 Strategic Development of a Second International Airport Based on the Comprehensive Development Plan

(1) Improvement Approach

The annual passenger growth rate in Bhutan exceeds 6%, due to a recent major policy aimed at increasing tourist numbers, while the demand for air transport is expanding rapidly. On the other hand, Paro International Airport is constructed on riverbeds between steep mountains. Therefore, the entry method to the airport is limited, and it is difficult to extend the runway and expand the airport site. In addition, passenger flights are limited to small jet aircraft, so the maximum number of handled passengers per year is about 600,000 (peak hours). Furthermore, the capacity of the runway at the airport is estimated to exceed capacity around 2023, and there is an urgent need to develop a second international airport to compensate for excess demand.

Domestic airports have only been developed in Bhutan recently; these are currently Bumthang Airport, Yongphula Airport and Gelephu Airport. However, because there are dedicated airports for propeller aircraft, there are limits on the number of people who can board aircraft. In addition, navigation aid facilities are insufficiently developed, and flight cancellations are frequent, so domestic mobility is in a vulnerable state. Therefore, most of the time, due to the nature of the land in Bhutan, transportation takes a long time to the eastern and southern parts, which in turn hinders the movement of travellers.

There are several discussions regarding the location of a second international airport with existing domestic airports among the candidates, as shown in Table 16.2.1.

From the aspect of industrial development in Bhutan, the development of the tourism industry in the eastern area is key to a balanced national development, while international direct access to the Eastern Region is desirable in light of the above. However, a comprehensive assessment is required to decide on the location of a second international airport based on a feasibility evaluation.

The above-mentioned problems, such as saturation at Paro International Airport and insufficient maintenance of domestic airports, adversely affect economic development in Bhutan. To properly harmonize the airport development scenario with the proposed industrial development, careful assessment and research from a comprehensive point of view are essential. These should include at least air traffic demand forecasts, airport infrastructure development, regional industrial development, economic and financial evaluations, and an implementation plan.

(2) Proposed Projects

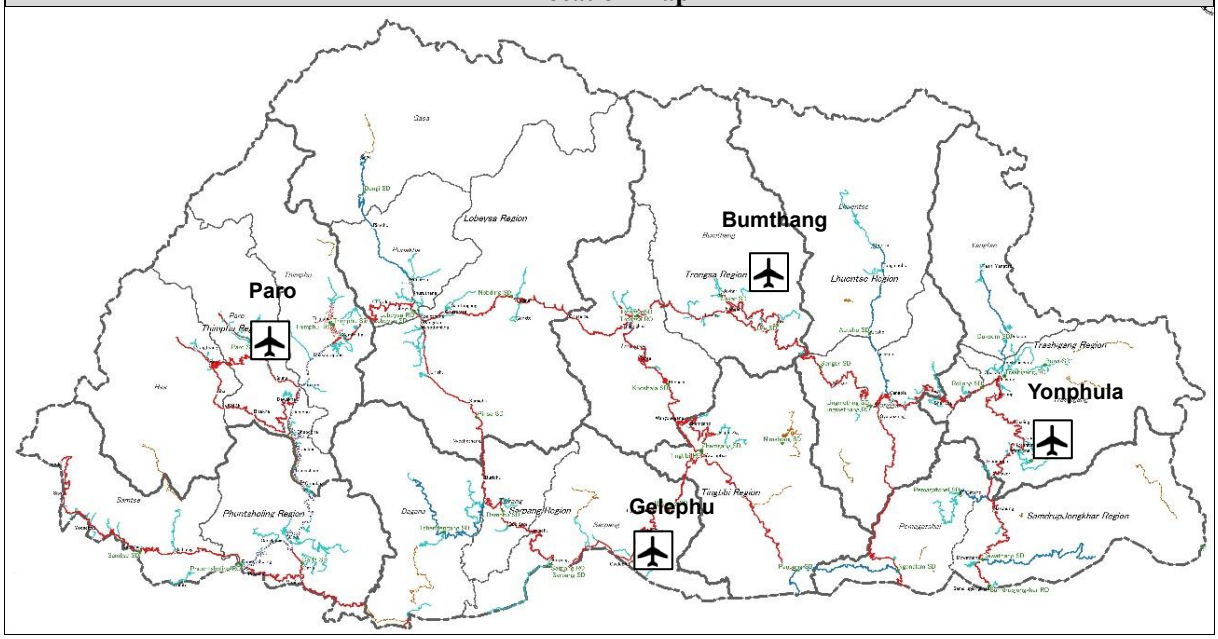
Projects supporting the strategic development of a second international airport based on the comprehensive development plan are selected according to the following principle:

- Airport capacity of Paro International Airport is predicted to be saturated until 2023. Therefore, the construction of a second international airport should begin by taking the above time frame into account. On the other hand, poor facilities at domestic airports will be apparent. The above situation, as well as harmonization with the comprehensive master plan, should be incorporated into airport development.

Proposed projects are listed in Table 16.2.1.

Table 16.2.1 Proposed Project for the Strategic Development of a Second International Airport Based on the Comprehensive Development Plan

ID	Title of Project	Project Cost (Million BTN)	Implementation Schedule	Responsible Organization	Project Cost (Million BTN)	Possibility of Environmental and Social Negative Impact	Remarks
1-1	Comprehensive Master Plan for a Second International Airport Development and Improvements to Domestic Airports	0	Short	MoIC	0	Nil	
1-2	Improvements to Domestic Airports	2,000	Middle	MoIC	2,000	No impact is anticipated in the absence of airport expansion	2 domestic airports, safety facilities etc.
1-3	Development of a Second International Airport	5,000	Middle/long	MoIC	5,000	Minor impact is anticipated due to airport expansion	
Location Map							



Note: Short term 2018-2022, middle term 2023-2027, long term 2028-2030.

16.2.3 Supplemental Transport Service for Arterial Road Network and Promotion of Domestic Air Transport Service

(1) Improvement Approach

The proposed arterial road network covers the entire country; however, networking for the major northern area, including Gasa, Lhuentse and Trashiyangtse, is difficult due to the steep mountainous terrain, as shown in Figure 16.1.8. It is important to secure redundancy of transport systems in terms of national and regional security, especially in the case of natural disasters.

The number of domestic air transport passengers is small, especially on the Paro to Yongphula route, because local people are not aware of domestic air transportation or because of much higher ticket prices compared with bus transport. Private airlines finds it difficult to participate in a domestic air transport service because of low profitability.

Redundancy of transport systems, in terms of national and regional security, especially in the case of natural disasters, is important. In this regard, the introduction of intermodal networking with road networks and heliports, in order to secure a backup function for the feeder section in

road networks shown in Table 16.2.2, is essential.

The provision of government subsidies to promote the domestic air transport service, as well as encouraging the participation of private airlines, is important.

The following measures are proposed to achieve development policy objectives:

- Development of airstrips or helipads at the end of feeder sections in the road network, such as Gasa, Lhuentse and Trashiyangtse, for a helicopter service is important.
- Development of a subsidy system for domestic air transport operations, based on performance-based evaluation criteria for unprofitable routes, in order to promote domestic air transport as well as the participation of private airlines.

(2) Proposed projects

Projects for a supplemental transport service to the arterial road network and the promotion of the domestic air transport service are selected based on following principle:

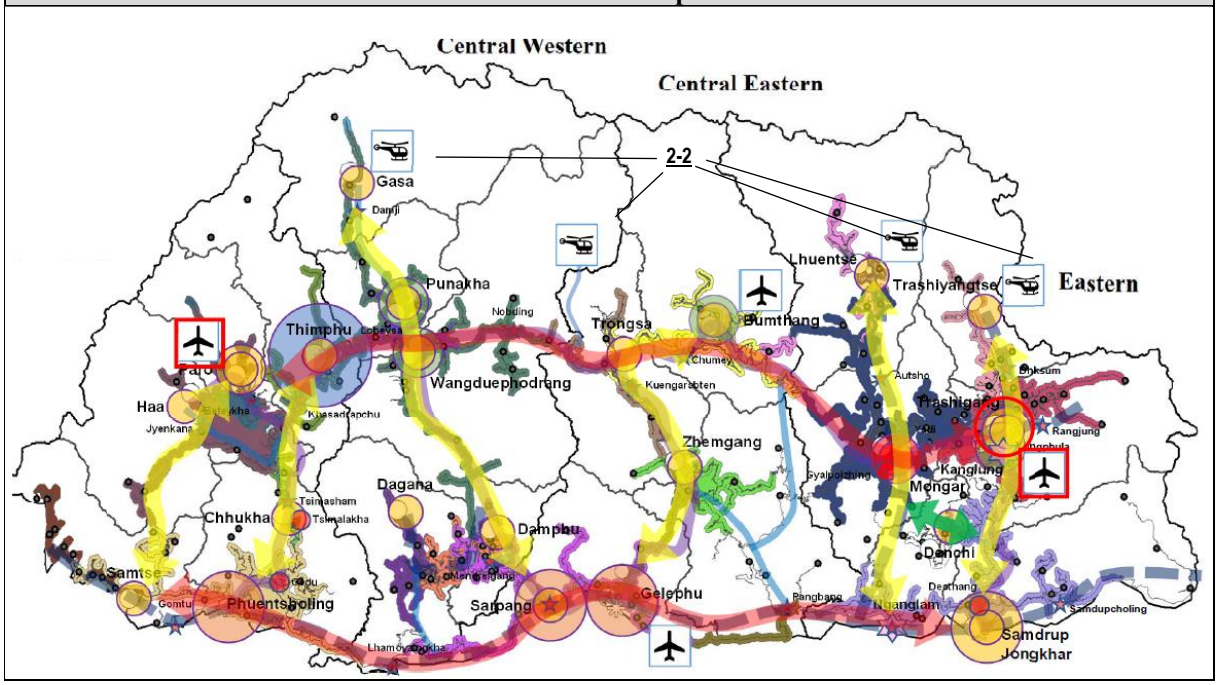
- The air transport service is mainly limited to tourism or governmental business purposes. To promote the air transport service in Bhutan, encouraging local passengers to shift from land transport options is important. Improving cost competitiveness is also key issue.

Proposed projects are listed in Table 16.2.2.

Table 16.2.2 Proposed Project for a Supplemental Transport Service to the Arterial Road Network and the Promotion of a Domestic Air Transport Service

ID	Title of Project	Project Cost (Million BTN)	Implementation Schedule	Responsible Organization	Project Cost (Million BTN)	Possibility of Environmental and Social Negative Impact	Remarks
2-1	Development of a Subsidy Scheme to Promote Domestic Air Transport Use by Local People	0	Short	MoIC	0	Nil	
2-2	Improvement in Helipads	2,000	Middle	MoIC	2,000	Minor impact is anticipated due to helipad development	4 helipads

Location Map



Note: Short term 2018-2022, middle term 2023-2027, long term 2028-2030.

16.2.4 Transport Using Advanced Technology (Unmanned Aerial Vehicles And Electric Vehicles)

(1) Issues

The transport sector discharges a significant share of CO_2 compared to other sectors in Bhutan. That said, EVs have been introduced in Bhutan, which has contributed to a reduction in CO_2 emissions. Hydroelectric power generation dominates the electric generation system in Bhutan, while the promotion of EVs has led to the transition to an all-electric society. Thus, environmentally symbiotic habitation free from oil should be effective in supporting sustainable development in Bhutan.

In the context of the above, the promotion of electric cars and quick charging stations, the electrification of public transportation, and the introduction of a drone-based freight transport system for remote areas are among the proposed solutions.

(2) Development Approach for EVs for Private and Public Transportation

The number of registered vehicles in Bhutan has rapidly increased, as shown in Figure 9.1.10. However, level of EV vehicle ownership has fallen, as shown in Table 16.3.1.

Table 16.3.1 Vehicle Ownership in Bhutan by Vehicle Type (2016/2017)

As of June 2016

Type	Ownership		Total
	Government	Private	
Heavy	1183	7858	9041
Medium	240	1296	1536
Light	2547	48911	51458
Two Wheeler	1398	7944	9342
Power Tiller	388	1495	1883
Tractor	115	288	403
Equipment	269	2142	2411
Taxi	0	4126	4126
BHT (LV)	0	52	52
CD (LV)	0	39	39
CD (TW)	0	1	1
Electric Vehicles	28	69	97
Total	6168	74221	80389

As of June 2017

Type	Ownership		Total
	Government	Private	
Heavy	1250	8582	9832
Medium	266	1391	1657
Light	2795	54215	57010
Two Wheeler	1415	8451	9866
Power Tiller	451	1681	2132
Tractor	125	321	446
Equipment	320	2514	2834
Taxi	0	4283	4283
BHT (LV)	0	46	46
CD (LV)	0	28	28
CD (TW)	0	0	0
Electric Vehicles	27	66	93
Total	6649	81578	88227

Source: Annual Report for 2015-16 & 2016-17, Road Safety and Transport Authority

The share of EVs as of 2017 is 0.105%. On the other hand, initiated by government policy, the target EV share in other countries is high, as shown in Table 16.3.2.

Table 16.3.2 Target of Electric Vehicle Share by Country

Country	Target Year	Electric Vehicle Share	Remarks
India	2030	30%	National E-mobility Programme, Ministry of Power
China	2020	12%	New energy vehicle
France, Ireland, Netherlands, Slovenia, Sweden, UK, Norway	2030-2040	End sales of internal combustion engine vehicles	-

Source: Global EV Outlook 2018, International Energy Agency

The introduction of EVs in Bhutan began with EV promotion by car companies. About 70 EVs were registered around 2015 including for government use, private use and taxi use. However, the number of EVs has not increased (93 EVs were registered in 2017), as shown in Table 16.3.1. There are several reasons behind the poor promotion results, at both the institutional and the infrastructural level, as shown below:

- Not affordable due to high initial costs of EVs
- Insufficient performance of EVs in terms of driving distance
- Limited performance and number of quick chargers
- Poor customer service system due to absence of proper EV mechanic

The following measures for private EVs are proposed to overcome the current constraints:

- Promotion of initial demand (preferential taxation, subsidies, service promotion etc): Subsidies and tax cuts play a major role in the rapid spread of EVs in the world. The level of subsidies for purchasing EVs varies by country, and the EV penetration rate tends to be high in countries with high subsidies. Introduction of EV for private in initial period requires promotion of customer service in terms of physical service (inspection, adjustment, repair) and instruction to drive the EV. of use service. Therefore, human resource development for those services is essential.
- Installation of quick charging stations: Most EV users normally charge their vehicles at home or at work, following by public charging; in rare cases, they use quick charging stations during long-distance driving. It is necessary to install these quick charging stations to meet the needs of EV owners.

- Establishment of an autonomous market: In addition to measures to promote initial demand and the installation of quick charging stations, a robust government initiative regarding an EV share target is essential.

A road map for the promotion of electric cars and quick charging stations, as well as the electrification of public transportation, is summarized in Table 16.3.3.

Table 16.3.3 Issues and Road Map for the Promotion of Electric Vehicles for Private and Public Transportation

Issues		Short Term	Middle Term	Long Term
Private use				
1	Promotion of initial demand (preferential taxation, subsidy, service promotion etc.)		→	
2	Installation of quick charging stations		→	→
3	Establishment of an autonomous market			→
Public use (urban)				
4	Promotion of initial demand (preferential taxation, subsidy etc.)	→	→	
5	Installation of quick charging stations	→	→	
Public use (rural)				

Note: Short term 2018-2022, middle term 2023-2027, long term 2028-2030.

(3) Development Approach for a Drone-based Freight Transport System for Remote Areas

Delivering cargo to remote areas has been a major burden for cargo distributers because it involves inefficient fuel consumption. Therefore, alternative means for cargo deliveries to remote areas have been being investigated, with the use of unmanned aerial vehicle (UAVs) among the alternative. However, the practical use of UAVs is still in its infancy, and technical and environmental issues need to be addressed in order to achieve commercialization.

In order to assure the safety level of each piece of aircraft, a pilot and flight control system for UAVs, with detailed regulations, is required. It is necessary to consider how to regulate UAV operations depending on the degree of risk, verify the safety of operations in relation to existing aeronautical laws, and develop a mechanism to ensure safety, both effectively and efficiently. In this regard, the following measures for UAVs are proposed in order to achieve development policy objectives:

1) Technical issues

- Realization of out-of-sight flights: The development of technology for efficient long-distance flights, with a reliability equivalent to manned aircraft, and an automatic operation management method is necessary.
- Prevention of unauthorized use: The development of technology for an automatic operation management method, an automatic authentication system and the utilization of image and communication data is necessary.

- Utilization technology: The development of technology for an automatic operation management method, an automatic authentication system, the utilization of accident failure data and the utilization of image and communication data is necessary. Exploring fields of use is also necessary.

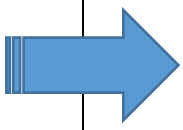
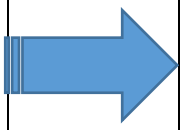
2) Environmental issues

In terms of non-technical measures, environmental arrangements for the following are necessary:

- Piloting licence
- Type certification
- Airworthiness certificate
- Flight application/permission
- Safety management system
- Accident reporting and related improvements
- Insurance
- Maps and navigation

A road map for the introduction of UAVs into the freight transport system in remote areas is summarized in Table 16.3.4:

Table 16.3.4 Road Map for the Introduction of a Drone-based Freight Transport System for Remote Areas

Issues			Short Term	Middle Term	Long Term
Technical issues					
1	Realization of out-of-sight flights	Aircraft technology			
		Operating technology			
2	Prevention of unauthorized use	Management technology			
3	Utilization technology	Data processing technology			
		Development of fields of use			
Environmental issues					
4	Piloting licence				
5	Type certification				
6	Airworthiness certificate				
7	Flight application/permission				
8	Safety management system				
9	Accident reporting and related improvements				
10	Insurance				
11	Maps and navigation				

Note: Short term 2018-2022, middle term 2023-2027, long term 2028-2030.

(4) Proposed Projects

Projects for improving the promotion of electric cars and quick charging stations, the electrification of public transportation and the introduction of a drone-based freight transport system for remote areas are selected based on following principles:

- Considering the current low level of EV ownership, a stepwise approach, involving environmental arrangements, is necessary to practically address driving range and charging time issues, affordability and the promotion of EV, especially in the case of private use. Therefore, public use should be promoted in advance with a government subsidy scheme.
- UAVs have not been commercialized even in developed countries; thus, environmental arrangements for commercialization are important.

Proposed projects are listed in Table 16.3.5.

Table 16.3.5 Proposed Projects for the Promotion of Electric Cars and Quick Charging Stations, the Electrification of Public Transportation and the Introduction of a Drone-based Freight Transport System for Remote Areas

ID	Title of Project	Project Cost (Million BTN)	Implementation Schedule	Responsible Organization	Possibility of Environmental and Social Negative Impact	Remarks
1-1	EV-Private: Promotion of Initial Demand (Preferential Taxation, Subsidy, Service promotion etc.)	0	Middle	Thromde	Nil	
1-2	EV-Private: Installation of Quick Charging Stations	4/location	Middle/Long	Thromde	Nil	Thromde
1-3	EV-Public: Promotion of Initial Demand (Preferential Taxation, Subsidy etc.)	0	Short/Middle	Thromde	Nil	
1-4	EV-Public: Installation of Quick Charging Stations	4/location	Short/Middle	Thromde	Nil	Thromde
1-5	UAV: Development of Technical Arrangements	0	Short/Middle	MoIC	Nil	
1-6	UAV: Development of Environmental Arrangements	0	Middle	MoIC	Nil	

Note: Short term 2018-2022, middle term 2023-2027, long term 2028-2030.

CHAPTER 17 PRIORITY PROJECTS TO IMPLEMENT THE COMPREHENSIVE NATIONAL DEVELOPMENT PLAN

17.1 Assessment of Priority Projects

17.1.1 Establishment of Assessment Criteria

A set of projects is proposed in the development guidance for urban development, rural development, the RNR sector, industries and transport of the Comprehensive National Development Plan (CNDP). They are expected to commence in the short (2018~2023), middle (2024~2028) and long terms (2029~).

A set of assessment standards is established to verify whether the proposed projects are in line with the development concept of the CNDP. The assessment standards include a national spatial structure and three aspects, namely, economic, social and environmental enhancements. Under the assessment standards, assessment criteria are constructed to meet the objectives of the vision and development issues, as shown in Table 17.1.1. The aim of the projects is to vitalize the rural area and create jobs for young people. The assessment criteria address those topics (1.3 and 2.3) and the promotion of the Eastern Region (1.4).

Table 17.1.1 Assessment Standards for Priority Projects

Assessment Standard		Assessment Criteria
1 Realization of a national spatial structure	1.1	Promotion of the Capital Region
	1.2	Promotion of linked urban centres
	1.3	Vitalization in the rural area
	1.4	Vitalization in the Eastern Region
	1.5	Promotion of an integrated communication network
2 Economic enhancement	2.1	Enhancement of food and energy self-sufficiency
	2.2	Promotion of an innovative economic model
	2.2	Creation of job opportunities
	2.3	Creation of job opportunities for young people
3 Social enhancement	3.1	Promotion of diversified value of life
	3.2	Promotion of tradition and cultural life
	3.3	Human resource development
4 Environmental enhancement	4.1	Improvement of environmental management
	4.2	Promotion of eco-friendly green technology

17.1.2 Assessment of Pwriority Projects

A set of 73 projects is proposed the CNDP. Fifty projects are proposed for the short-term projects. They are expected to commence in the short term and will be preferably completed by 2023, but the timing of their completion could be extended beyond 2030. The short-term projects are classified into 11 categories, according to the classification of the sector and assessed in respect of the assessment criteria. The priority project must contribute to at least one of the assessment criteria in the realization of a national spatial structure and at least one of the assessment criteria for the other standards. Excluding two short-term projects, 49 projects are selected as the priority projects in Table 17.1.2. The high priority projects are selected from

the priority projects with the highest evaluation points in each category. The high priority projects are framed in by the red line in the table. The number of high priority projects is 22 as shown in Table 17.1.3. Each project is also assessed if a project could cause any positive and negative impacts to nine domains of GNH.

The implementation cost for all proposed projects is estimated at BTN 74,082 million. The short-term projects require the implantation cost of BTN 36,605 million.

Table 17.1.2 Evaluation of Proposed Projects in Priority Sectors

ID	Sector and Project	Relevance of 12th FYP				Schedule[3]	Project Cost (million BTN)				Organization[4]	Realization of National Spatial Structure					Economic Enhancement				Social Enhancement			Environmental Enhancement		Total Score	Effect on GNH Nine Domains4)								
		Category[1]	Sl. No	Title	Additional[2]		Total	Short	Middle	Long		1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2									
												Promotion of Capital Region	Promotion of Linked Urban Centre	Vitalization in Rural Area	Vitalization in Eastern Region	Promotion of Integrated Communication Network	Enhancement of Food and Energy Self-sufficiency	Promotion of Innovative Economic Model	Creation of Job Opportunities	Creation of Job Opportunities for Young Generation	Promotion of Diversified Value of Life	Promotion of Tradition and Cultural Life	Human Resource Development	Improvement of Environmental Management	Promotion of Eco-friendly Green Technology		Psychological Well-being	Health	Time Use	Education	Cultural Diversity	Good Governance	Community Vitality	Ecological Diversity and Resilience	Living Standard
a	**Urban development**																																
a-1	Capital Region Development Programme Including Inland Transport Improvement	MoWHS	1.2	Preparation of human settlement plans	Y	S	21	21			**MoWHS**, NLCS	X				X		X			X	X	X	X	X	8			P		P			P	P
a-2	Eastern Region Development Programme	FL (MolHR, MoEA)	7	Startup & CSI Development	Y	S	56	56			**Dzongkhag**		X	X	X	X		X			X	X	X	X	X	10	P		P	P	P		P		P
a-3	Formulation of a Structure Plan for Urbanization Management Areas	MoWHS	1.2	Preparation of human settlement plans	Y	S	151	151			**MoWHS**, NLCS		X									X		X		3					P			P	P
a-4	Formulation of Regional Plan for Sarpang-Gelephu Linked Urban Centre	MoWHS	1.2	Preparation of human settlement plans	Y	S	15	15			**DHS**, Sarpang Dzongkhag		X	X	X	X		X	X	X	X	X	X			10	P	P	P	P	P				P
a-5	Development of Linked Urban Centres	MoWHS	1.2	Preparation of human settlement plans	Y	S	53	53			**Dzongkhag**		X	X	X	X		X	X	X	X	X				9	P	P	P	P	P				P
a-6	Project for Institutionalising Land Use Control Measures in Urbanisation Management Areas of Thimphu, Phuentsholing, and Gelephu	MoWHS	1.2	Preparation of human settlement plans	Y	S	25	25			**MoWHS**		X	X	X	X		X	X	X	X	X	X			10	P	P	P	P	P				P
b	**Rural development**																																
b-1	**Approach 1: Development of a Comfortable Rural Living Environment**	FL (NEC, MoH)	2, 9	24*7 Safe Drinking Water Health		S, M, L					**MoWHS**, MoH, LGs			X					X	X	X	X				5		P	P				P	P	P
(1)	Establishment of a Rural Living Environment Comparable to That of the Urban Area	FL (NEC, MoH)	2, 9	24*7 Safe Drinking Water Health		S, M, L	2,550	1,200	850	500	MoWHS, MoH, LGs			X					X	X	X	X				5		P	P				P	P	P
(2)	Development of a Better Educational Environment	MoE	1.1 1.2 1.3 1.4 1.5 1.6	Improve Quality and Inclusive Education Improve Health and Wellbeing of Children and Youth Enhance Equitable and Quality Tertiary Education Enhance Teacher Development and Support Strengthen and Expand Vocational Education in Schools Enhance Adult Literacy and Lifelong Learning		S	2,400	2,400			MoE, LGs			X									X				2			P	P				P		
b-2	**Approach 2: Creation of Job Opportunities in the Rural Area**	FL (QPO, MoLHR, MoEA, LGs)	4, 7, 8	OGOP Startup & CSI Development Rural Economy Development	Y	S					**MoAF**, LGs, Private sector			X			X		X	X						4								P		P
(1)	Promotion of agro-processing which leads to an expansion of local farm produce marketing	FL (QPO, MoLHR, MoEA,	4, 7, 8	OGOP Startup & CSI Development	Y	S	225	225			MoAF, LGs, Private sector			X			X		X	X						4								P		P

ID	Sector and Project	Relevance of 12th FYP				Schedule[3]	Project Cost (million BTN)				Organization[4]	Realization of National Spatial Structure					Economic Enhancement				Social Enhancement			Environmental Enhancement		Total Score	Effect on GNH Nine Domains4)								
		Category[1]	**Sl. No**	**Title**	**Additional[2]**		**Total**	**Short**	**Middle**	**Long**		1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2									
												Promotion of Capital Region	Promotion of Linked Urban Centre	Vitalization in Rural Area	Vitalization in Eastern Region	Promotion of Integrated Communication Network	Enhancement of Food and Energy Self-sufficiency	Promotion of Innovative Economic Model	Creation of Job Opportunities	Creation of Job Opportunities for Young Generation	Promotion of Diversified Value of Life	Promotion of Tradition and Cultural Life	Human Resource Development	Improvement of Environmental Management	Promotion of Eco-friendly Green Technology		Psychological Well-being	Health	Time Use	Education	Cultural Diversity	Good Governance	Community Vitality	Ecological Diversity and Resilience	Living Standard
		LGs)		Rural Economy Development																													
(2)	Research and development of equipment for human-wildlife conflicts	FL (MoLHR, MoEA, LGs)	7, 8	Startup & CSI Development Rural Economy Development	Y	S, M	90	30	60		MoAF, LGs, Research Institutes			X			X	X	X	X					X	6	P					P	P	P
(3)	Promotion of green tourism taking advantage of abundant natural resources	FL (TCB, MoLHR, MoEA, LGs)	6, 7, 8	Tourism Development Startup & CSI Development Rural Economy Development	Y	M	225		225		TCB, LGs			X					X	X	X	X		X		6	P				P		P	P	P
(4)	Development of care facilities for older people to cope with the ageing society in the Rural Area	NA				L	150			150	MoH, LGs			X				X	X	X	X	X				6	P	P					P		P
(5)	Promotion of construction and maintenance jobs to young people	NA				L	600			600	MoWHS, LGs			X					X	X	X					4							P		P
	Approach 3: Transformation of Jobs in Primary Industries into Attractive Offers for Young People																																	
b-3	**(Agriculture-related jobs)**	MoAF	1.4	Enhance agriculture infrastructure & farm mechanization	Y	S					**MoAF**, LGs			X			X		X	X						4			P				P		P
(1)	Policies to promote the consolidation of fallow and abandoned farmlands	MoAF	1.4	Enhance agriculture infrastructure & farm mechanization	Y	S	34	34			MoAF, LGs			X			X									2			P				P		P
(2)	Development of cool storage warehouses	MoAF	1.1	Enhance cereal production	Y	S	95	95			MoAF, LGs			X			X		X	X						4			P				P		P
(3)	Expansion of finance support for agriculture	FL (MoLHR, MoEA)	7	Startup & CSI Development	Y	S	250	250			MoAF, LGs			X			X		X	X						4	P						P		P
((4)	Expansion of crop insurance system	NA				S	52	52			MoAF, RICBL, LGs			X			X		X	X						4	P						P		P
b-4	**(Forestry-related jobs)**	FL (MoLHR, MoEA, LGs)	7, 8	Startup & CSI Development Rural Economy Development	Y	S, M, L					**MoAF**, NRDCL, LGs			X					X	X						3						N	P	N	P
(1)	Development of forest roads	NA				S,	750	250	250	250	MoAF,			X					X	X						3						N	P	N	P

ID	Sector and Project	Relevance of 12th FYP				Schedule[3]	Project Cost (million BTN)				Organization[4]	Realization of National Spatial Structure					Economic Enhancement				Social Enhancement			Environmental Enhancement		Total Score	Effect on GNH Nine Domains4)								
												1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2									
		Category[1]	**Sl. No**	**Title**	**Additional**[2]		**Total**	**Short**	**Middle**	**Long**		Promotion of Capital Region	Promotion of Linked Urban Centre	Vitalization in Rural Area	Vitalization in Eastern Region	Promotion of Integrated Communication Network	Enhancement of Food and Energy Self-sufficiency	Promotion of Innovative Economic Model	Creation of Job Opportunities	Creation of Job Opportunities for Young Generation	Promotion of Diversified Value of Life	Promotion of Tradition and Cultural Life	Human Resource Development	Improvement of Environmental Management	Promotion of Eco-friendly Green Technology		Psychological Well-being	Health	Time Use	Education	Cultural Diversity	Good Governance	Community Vitality	Ecological Diversity and Resilience	Living Standard
	and cable cranes in order to ship timbers					M, L					NRDCL, LGs																						
(2)	Support of modern sawmills, wood products and handicraft enterprises	FL (MoLHR, MoEA, LGs)	7, 8	Startup & CSI Development Rural Economy Development	Y	M, L	60		30	30	MoAF, LGs			X					X	X						3						P		P
(3)	Research and development of non-wood forest products and marketing promotion	FL (MoLHR, MoEA, LGs)	7, 8	Startup & CSI Development Rural Economy Development	Y	S	27	27			MoAF, LGs			X			X		X					X		4				P	P		P		P
b-5	**(Livestock-related jobs)**	FL (MoLHR, MoEA, LGs)	7, 8	Startup & CSI Development Rural Economy Development	Y	S, M, L					**MoAF**, LGs			X			X		X	X						4						P		P
(1)	Development of cool storage warehouses for dairy products	FL (MoLHR, MoEA, LGs)	7, 8	Startup & CSI Development Rural Economy Development	Y	S, M	300	150	150		MoAF, LGs			X			X		X	X						4						P		P
(2)	Development of slaughterhouses	FL (MoLHR, MoEA, LGs)	7, 8	Startup & CSI Development Rural Economy Development	Y	L	75			75	MoAF, LGs			X			X		X	X						4	N					P		P
	(Economic generation)																																
b-6	Project for Dzongkhag Vitalization in Eastern Region	FL (MoLHR, MoEA)	7	Startup & CSI Development	Y	S	35	35			**MoEA**			X	X				X	X			X			5			P	P	P	P	P	P
c	**Agriculture promotion**																																
(1)	**Improvement in the Self-sufficiency Rate for Rice**																																
	Approach 1: Area expansion																																
c-1	Rice variety improvement and area expansion for second cropping	MoAF	1,1	Enhance cereal productivity	Y	M	456	319	137		**DoA** (ARDC, NSC), FMCL			X			X		X	X			X			5	P			P			P		P
c-2	Improvement in cultivation techniques for labour saving	MoAF	1.4	Enhance agricultural infrastructure & farm mechanization	Y	S	182	182			**DoA** (ARDC)			X	X		X	X	X	X			X	X	X	9	P		P	P			P		P
c-3	Promotion of mechanization	MoAF	1.4	Enhance agricultural infrastructure & farm mechanization		S	138	138			**DoA** (AMC), FMCL			X	X		X	X	X	X			X			7	P		P	P			P		P
	Approach 2: Yield increase																																
c-4	Establishment of community-wildlife coexistence	MoAF	4.4	Enhance research knowledge and information management		S	226	226			**DoA** (NPPC)			X	X		X	X	X	X			X	X	X	9	P		P	P			P	P	P
c-5	Realization of the National Irrigation Master Plan	MoAF	1.1	Enhance cereal productivity		M	620	310	310		**DoA**			X	X		X		X	X			X			6	P			P			P		P
c-6	Development of soil nutrition management	MoAF	4.3	Enhance adoption of RNR technologies		S	140	140			**DoA** (NSSC)			X	X		X						X	X	X	6	P			P			P		P
c-7	Development of weed control methodology	MoAF	1,1	Enhance cereal productivity	Y	S	137	137			**DoA** (AMC, NPPC)			X	X		X						X	X	X	6	P		P	P			P		P
	Approach 4. Post-harvesting																																
c-8	Improvement in rice milling	MoAF	1,1	Enhance cereal	Y	S	132	132			**DoA** (AMC,			X	X		X		X	X			X			6	P		P						P

ID	Sector and Project	Relevance of 12th FYP				Schedule[3]	Project Cost (million BTN)				Organization[4]	Realization of National Spatial Structure					Economic Enhancement				Social Enhancement			Environmental Enhancement		Total Score	Effect on GNH Nine Domains4)								
												1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	3.1	3.2	3.3	4.1	4.2									
		Category[1]	**Sl. No**	**Title**	**Additional**[2]		**Total**	**Short**	**Middle**	**Long**		Promotion of Capital Region	Promotion of Linked Urban Centre	Vitalization in Rural Area	Vitalization in Eastern Region	Promotion of Integrated Communication Network	Enhancement of Food and Energy Self-sufficiency	Promotion of Innovative Economic Model	Creation of Job Opportunities	Creation of Job Opportunities for Young Generation	Promotion of Diversified Value of Life	Promotion of Tradition and Cultural Life	Human Resource Development	Improvement of Environmental Management	Promotion of Eco-friendly Green Technology		Psychological Well-being	Health	Time Use	Education	Cultural Diversity	Good Governance	Community Vitality	Ecological Diversity and Resilience	Living Standard
	ratio			productivity							NPHC), BSB																						
(2)	**Promotion of Market-oriented Agriculture**																																
	Approach 1: Strengthening of the Bhutan brand																																
c-9	Expansion of the certification system	MoAF	FL	Organic Bhutan	Y	S	181	181			**DoA**, DAMC, BAFRA			X	X								X			3	P			P		P	P		P
c-10	Development of market-oriented post-harvesting skills	MoAF	2,1	Establish commodity value chain for RNR produce	Y	S	140	140			**DoA** (AMC, NPHC)			X	X				X	X			X			5	P			P			P		P
	Approach 2: Horticulture/medicinal and aromatic plant production																																
c-11	Promotion of environmentally balanced slope cultivation	MoAF	4,3	Enhance adoption of RNR technologies		S	131	131			**DoA** (NSSC)			X	X								X	X		4	P			P	P		P	P	P
c-12	Strengthening of capacity for horticulture production	MoAF	2,1	Establish commodity value chain for RNR produce	Y	S	174	174			**DoA** (ARDC), DAMC			X					X	X			X			4	P			P			P		P
	Approach 3: Infrastructure improvement																																
c-13	Improvement in farm accessibility, transportation and storage facilities	MoAF	2,1	Establish commodity value chain for RNR produce	Y	M	620	412	208		**DoA**, DAMC			X	X	X			X	X			X			6	P			P			P		P
(3)	**Nutritional Improvement**																																
	Approach 1: Awareness raising for nutrition																																
c-14	Preparation of general guidance on nutrition	MoH	2.8	Nutritional status of the general population improved	Y	S	131	131			**MoH**, DoA										X		X			2	P	P		P			P		P
c-15	Expansion of dietary education	MoE	2.9	School agriculture programme	Y	S	161	161			**MoE**, DoA										X		X			2	P	P		P			P		P
c-16	Establishment of community centres	NA			S	S	67	67			**DoA**, LG			X									X			2	P	P		P			P		P
	Approach 2: Diversification of food diet																																
c-17	Promotion of high-nutrition food and fortified food	NA				S	131	131			**DoA**, MoH			X					X	X			X			4	P	P		P			P		P
d	**Livestock promotion**																									0									
d-1	**Approach 1: Productivity improvement of livestock**	MoAF	1.6, 1.7, 1.8 1.9, 1.10	Enhance meat production Enhance egg production Enhance dairy production Enhance livestock input supply Enhance animal health and nutrition services	Y	S					**MoAF**, LGs																2						P		P
(1)	Breeding improvements in cooperation with various breeding centres/farms under the Do	MoAF	1.6, 1.7, 1.8	Enhance meat production Enhance egg production Enhance dairy production	Y	S	86	86			MoAF, LGs			X			X									2						P		P
(2)	Better feeding through fodder and pasture improvements	MoAF	1.9, 1.10	Enhance livestock input supply Enhance animal health and	Y	S	65	65			MoAF, LGs			X			X									2						P		P

ID	Sector and Project	Relevance of 12th FYP				Schedule[3]	Project Cost (million BTN)				Organization[4]	Realization of National Spatial Structure					Economic Enhancement				Social Enhancement			Environmental Enhancement		Total Score	Effect on GNH Nine Domains4)								
		Category[1]	Sl. No	Title	Additional[2]		Total	Short	Middle	Long		1.1 Promotion of Capital Region	1.2 Promotion of Linked Urban Centre	1.3 Vitalization in Rural Area	1.4 Vitalization in Eastern Region	1.5 Promotion of Integrated Communication Network	2.1 Enhancement of Food and Energy Self-sufficiency	2.2 Promotion of Innovative Economic Model	2.3 Creation of Job Opportunities	2.4 Creation of Job Opportunities for Young Generation	3.1 Promotion of Diversified Value of Life	3.2 Promotion of Tradition and Cultural Life	3.3 Human Resource Development	4.1 Improvement of Environmental Management	4.2 Promotion of Eco-friendly Green Technology		Psychological Well-being	Health	Time Use	Education	Cultural Diversity	Good Governance	Community Vitality	Ecological Diversity and Resilience	Living Standard
				nutrition services																														
d-2	**Approach 2: Population increase**	MoAF	1.6, 1.7, 1.8	Enhance meat production Enhance egg production Enhance dairy production	Y	M					**MoAF**, LGs			X			X		X	X			X			5						P		P
(1)	Provision of animal shed construction materials	MoAF	1.6, 1.7, 1.8	Enhance meat production Enhance egg production Enhance dairy production	Y	M	43		43		MoAF, LGs			X			X									2						P		P
(2)	Expansion of facilities to provide effective artificial insemination at a reasonable price	MoAF	1.6, 1.8	Enhance meat production Enhance dairy production	Y	M	35		35		MoAF, LGs			X			X		X	X			X			5						P		P
e	**Forestry promotion**																									0								
e-1	**Approach 1: Acceleration of LFMP formulation**	MoAF	3.1 3.3	Sustainable management and utilization of timber Enhance community based forest management and conservation	Y	S					**MoAF**, LGs			X											X	X	3					P	P	P	
(1)	Prioritization of Gewogs where the LFMP is significantly important	MoAF	3.1 3.3	Sustainable management and utilization of timber Enhance community based forest management and conservation	Y	S	2	2			MoAF, LGs			X											X	X	3					P	P	P	
(2)	Close cooperation from the gewog administration to formulate the LFMP	MoAF	3.1 3.3	Sustainable management and utilization of timber Enhance community based forest management and conservation	Y	S	19	19			MoAF, LGs			X											X	X	3					P	P	P	
e-2	**Approach 2: Further research and marketing of NWFPs and MAPs**	FL(QPO, MoLHR, MoEA, LGs)	4, 7, 8	OGOP Startup & CSI Development Rural Economy Development	Y	S, M, L					**MoAF**, MoH, LGs, Research Institutes			X			X	X	X	X		X	X	X	X	9					P		P		P
(1)	Enabling rural residents to utilize NWFPs and MAPs	FL(QPO, MoLHR, MoEA, LGs)	4, 7, 8	OGOP Startup & CSI Development Rural Economy Development	Y	S, M	90	45	45		MoAF, MoH, LGs, Research Institutes			X			X	X	X	X		X	X	X	X	9					P		P		P
(2)	Promoting NWFPs and MAPs domestic and international market	FL(QPO, MoLHR, MoEA, LGs)	4, 7, 8	OGOP Startup & CSI Development Rural Economy Development	Y	M, L	90		45	45	MoAF, MoH, LGs			X			X	X	X	X		X	X	X	X	9						P		P
e-3	**Approach 3: Improvements in accessibility to available forest resources**																																	
(1)	Better accessibility to available forest resources by improve forest road and cable crane networks.	NA		(included in b-12. Development of forest roads and cable cranes in order to ship timbers)		S, M, L	(750)	(250)	(250)	(250)	MoAF, NRDCL, LGs			X					X	X						3					N		P	N	P
f	**Tourism promotion including CSI**																																	
f-1	Project for Strengthening the	FL	6	Tourism Development	Y	S	215	215			Dzongkhag,			X	X			X	X	X	X	X	X			8	P			P	P	P	P		P

ID	Sector and Project	Relevance of 12th FYP				Schedule[3]	Project Cost (million BTN)				Organization[4]	Realization of National Spatial Structure					Economic Enhancement				Social Enhancement			Environmental Enhancement		Total Score	Effect on GNH Nine Domains4)								
		Category[1]	Sl. No	Title	Additional[2]		Total	Short	Middle	Long		1.1 Promotion of Capital Region	1.2 Promotion of Linked Urban Centre	1.3 Vitalization in Rural Area	1.4 Vitalization in Eastern Region	1.5 Promotion of Integrated Communication Network	2.1 Enhancement of Food and Energy Self-sufficiency	2.2 Promotion of Innovative Economic Model	2.3 Creation of Job Opportunities	2.4 Creation of Job Opportunities for Young Generation	3.1 Promotion of Diversified Value of Life	3.2 Promotion of Tradition and Cultural Life	3.3 Human Resource Development	4.1 Improvement of Environmental Management	4.2 Promotion of Eco-friendly Green Technology		Psychological Well-being	Health	Time Use	Education	Cultural Diversity	Good Governance	Community Vitality	Ecological Diversity and Resilience	Living Standard
	Capacity for Tourism Promotion in the Eastern Region										**TCB**																						
f-2	Artist-in-residence Programme	FL	6	Tourism Development	Y	S	7	7			Dzongkhag, **TCB**		X	X	X			X	X	X	X	X	X		X	10	P			P	P	P	P		P
g	**Information technology and mechanical promotion**																																
g-1	Development of Gyalpozhing Tech Park	FL	3	Digital Drukyul	Y	S	287	287			**MoEA**, DHI, GCIT		X		X	X		X	X	X	X		X		X	9				P	P			P	P
g-2	Formulation of a Plan for Social Experiment Projects	FL	3	Digital Drukyul	Y	S	215	215			**MoEA,** DHI, GCIT			X	X	X		X	X	X	X		X		X	9	P	P	P	P		P	P	P	P
h	**Mining and manufacturing promotion**																																
h-1	Formulation of a Mining Master Plan	MoEA	1.5	Others (Exploration of minerals)		S	215	215			**MoEA**		X						X				X	X		4				P		P			P
h-2	Project for a Management Improvement Project for Investment	MoEA	1.5	Others (Investment promotion)		S	36	36			**MoEA**		X						X				X			3				P		P			P
i	**Inland transport development**																																
(1)	**Formulation of a Ladder-type Arterial Road Network**																																
i-1	NS-3-a: Gasa-Punakha	NA				L	918			918	**MoWHS**		X			X			X							3			P			P	P	P	P
i-2	NS-3-b: Punakha-Mesina	NA				L	408			408	**MoWHS**		X			X			X							3			P			P	P	P	P
i-3	NS-4-b: Trongsa-Zhemgang	NA				M	3,774		3,774		**MoWHS**		X			X			X							3			P			P	P	P	P
i-4	NS-5-a: Lhuentse-Mongar	NA				L	2,550			2,550	**MoWHS**		X			X			X							3			P			P	P	P	P
i-5	EW-1-e: Wangdue-Trongsa	MoWHS	2	Wangdue-Chuserbu, Chuserbu-Trongsa		S	4,386	4,386			**MoWHS**		X		X	X			X							4			P			P	P	P	P
i-6	EW-1-f: Trongsa-Bumthang	MoWHS	2	Trongsa-Nangar		S	2,312	2,312			**MoWHS**		X		X	X			X							4			P			P	P	P	P
i-7	EW-1-g: Bumthang-Mongar					S	6,562	6,562			**MoWHS**		X		X	X			X							4			P			P	P	P	P
i-8	EW-1-h: Mongar-Trashigan	MoWHS	2	Yadi-Lingmethang, Yadi-Trashigang		S	3,094	3,094			**MoWHS**		X		X	X			X							4			P			P	P	P	P
i-9	EW-2-a: Samtse-Phuntsholing	NA				S	2,074	2,074			**MoWHS**		X			X			X							3			P			P	P	P	P
i-10	EW-2-g: Gelephu-Panbang	NA				S	5,610	5,610			**MoWHS**		X			X			X							3			P			P	P	P	P
i-11	NS-1-b: Haa-Samtse	MoWHS	10	Construction of Haa-Samtse Highway		M	3,230		3,230		**MoWHS**		X			X			X							3			P			P	P	P	P
i-12	NS-5-b: Mongar- Nganglam	NA				M	3,332		3,332		**MoWHS**		X			X			X							3			P			P	P	P	P
i-13	EW-2-e: Lamoizingkha-Sarpang	NA				M	3,718		3,718		**MoWHS**		X			X			X							3			P			P	P	P	P
i-14	EW-2-i: Nganglam-Dewathang	NA				M	3,145		3,145		**MoWHS**		X			X			X							3			P			P	P	P	P
(2)	**Elimination of Road Closures Due to Landslides and Slope Failure**																																
i-15	Technology Transfer Programme for Slope Protection and Tunnel (Planning, Design, Pilot Project, OJT)	MoWHS	13	Tunneling		S	22	22			**MoWHS**					X				X			X	X		4			P				P		

ID	Sector and Project	Relevance of 12th FYP				Schedule[3]	Project Cost (million BTN)				Organization[4]	Realization of National Spatial Structure					Economic Enhancement				Social Enhancement			Environmental Enhancement		Total Score	Effect on GNH Nine Domains4)								
		Category[1]	Sl. No	Title	Additional[2]		Total	Short	Middle	Long		1.1 Promotion of Capital Region	1.2 Promotion of Linked Urban Centre	1.3 Vitalization in Rural Area	1.4 Vitalization in Eastern Region	1.5 Promotion of Integrated Communication Network	2.1 Enhancement of Food and Energy Self-sufficiency	2.2 Promotion of Innovative Economic Model	2.3 Creation of Job Opportunities	2.4 Creation of Job Opportunities for Young Generation	3.1 Promotion of Diversified Value of Life	3.2 Promotion of Tradition and Cultural Life	3.3 Human Resource Development	4.1 Improvement of Environmental Management	4.2 Promotion of Eco-friendly Green Technology		Psychological Well-being	Health	Time Use	Education	Cultural Diversity	Good Governance	Community Vitality	Ecological Diversity and Resilience	Living Standard
i-16	Landslide Treatment	MoWHS	15	Slope stabilization along National Highway		M	1,800		1,800		**MoWHS**		X			X			X							3			P					P	
i-17	Tomang Cliff Tunnel Project	NA				M	2,100		2,100		**MoWHS**		X			X			X							3			P					P	
(3)	**Securing Road Surface Properties**																																		
i-18	Technology Transfer Programme for Development of Road Structure Design Standard (Planning, Design, Pilot Project, OJT)	NA				S	22	22			**MoWHS**			X		X				X			X			4			P				P		
(4)	**Improve Bus-related Facilities to Provide an Efficient and Comfortable Service to Passengers**																																		
i-19	Development of Intercity Bus Terminal	NA				S	500	500			**Dzongkhag/ Thromde**		X			X										2			P						
i-20	Development of Intercity Bus Stop (Shelter Type)	NA				M	287		287		**Dzongkhag/ Thromde**		X			X										2			P						
i-21	Introduction of Bus Information System (Centre, Location, Schedule)	NA				M	300		300		**MoIC**					X										1			P						
i-22	Incentive System for Unprofitable Intercity Line Operator	NA				M	72		72		**MoIC**								X							1			P						
i-23	Development of City Bus Terminal	NA				S	500	500			**Dzongkhag/ Thromde**	X	X			X										3			P						
i-24	Introduction of EV Bus and Quick Charging Facility for City Bus	NA				M	200		200		**Dzongkhag/ Thromde**	X	X													2			P						
i-25	Introduction of Bus Information System (Centre, Location, Schedule)	NA				M	300		300		**Dzongkhag/ Thromde**					X										1			P						
i-26	Introduction of Smart Card System	NA				M	100		100		**Dzongkhag/ Thromde**					X										1			P						
j	**Air transport development**																																		
(1)	**Strategic Development of a Second International Airport**																										0									
j-1	Comprehensive Master Plan for a Second International Airport Development and Improvements to Domestic Airports	NA				S	9	9			**MoIC**			X	X				X	X						4			P						
j-2	Improvements to Domestic Airports	MoIC	1, 2	Development and improvement of Aerodrome, Expansion of Gelephu airport		M	2,000	2,000			**MoIC**			X	X				X	X						4			P						
j-3	Development of a Second International Airport	NA				M/L	5,000		3,000	2,000	**MoIC**								X	X						2			P						
(2)	**Supplemental Transport Service to the Arterial Road**																																		

ID	Sector and Project	Relevance of 12th FYP				Schedule[3]	Project Cost (million BTN)				Organization[4]	Realization of National Spatial Structure					Economic Enhancement				Social Enhancement			Environmental Enhancement		Total Score	Effect on GNH Nine Domains4)								
		Category[1]	Sl. No	Title	Additional[2]		Total	Short	Middle	Long		1.1 Promotion of Capital Region	1.2 Promotion of Linked Urban Centre	1.3 Vitalization in Rural Area	1.4 Vitalization in Eastern Region	1.5 Promotion of Integrated Communication Network	2.1 Enhancement of Food and Energy Self-sufficiency	2.2 Promotion of Innovative Economic Model	2.3 Creation of Job Opportunities	2.4 Creation of Job Opportunities for Young Generation	3.1 Promotion of Diversified Value of Life	3.2 Promotion of Tradition and Cultural Life	3.3 Human Resource Development	4.1 Improvement of Environmental Management	4.2 Promotion of Eco-friendly Green Technology		Psychological Well-being	Health	Time Use	Education	Cultural Diversity	Good Governance	Community Vitality	Ecological Diversity and Resilience	Living Standard
	Network and the Promotion of a Domestic Air Transport Service																																	
j-4	Development of a Subsidy Scheme to Promote Domestic Air Transport Use by Local People	NA				S	72	72			**MoIC**		X		X	X			X								4			P					
j-5	Improvement in Helipads	NA				M	2,000		2,000		**MoIC**										X						1		P	P			P		P	
k	**Transport using advanced technology**																																	
k-1	Promotion of Electric Vehicles for Private and Public Transportation	NA				S/ML					**Thromde**					X		X		X			X	X	X	6			P					P	
(1)	EV-Private: Promotion of Initial Demand (Preferential Taxation, Subsidy etc.)	MoIC	5	Bhutan Sustainable Low Emission Transport System		M	72		72		**Thromde**					X		X		X			X	X	X	6			P					P	
(2)	EV-Private: Installation of Quick Charging Stations	NA				M/L	29		15	15	**Thromde**					X		X		X			X	X	X	6			P					P	
(3)	EV-Public: Promotion of Initial Demand (Preferential Taxation, Subsidy etc.)	NA				S/M	72	36	36		**Thromde**					X		X		X			X	X	X	6			P					P	
(4)	EV-Public: Installation of Quick Charging Stations	NA				S/M	29	15	15		**Thromde**					X		X		X			X	X	X	6			P					P	
k-2	Drone-based Freight Transport System for Remote Areas	NA									**MoIC**			X		X		X		X			X	X	X	7		P	P			P		P	
(1)	UAV: Development of Technical Arrangements	NA				S/M	36	18	18		**MoIC**			X		X		X		X			X	X	X	7		P	P			P		P	
(2)	UAV: Development of Environmental Arrangements	NA				M	36		36		**MoIC**			X		X		X		X			X	X	X	7		P	P			P		P	
	Total						**74,082**	**36,605**	**29,937**	**7,541**																										

Note: 1) NA: A related projet1is not available in the 12th FYP. 2) Yes: A proposed project is not specified in 12th FYP. 3) Short term: ~2023, Midde term: ~2028, Long term: 2029~. 4) P: Positive effect, N: Negative effect, 5) A project in a red box is a high priority project. 4) Organization in bold letter is responsible for proposal and implementation of a proposed project.

17.1.3 Number of Proposed Projects, Priority Projects and High Priority Projects

	Category	All Projects	Short-term Projects	Priority Projects	High Priority Projects
a	Urban development	6	6	6	3
b	Rural development	6	6	6	2
c	Agriculture promotion	17	16	14	2
d	Livestock promotion	2	1	1	1
e	Forestry promotion	3	2	2	1
f	Tourism promotion including CSI	2	2	2	1
g	Information technology and mechanical promotion	2	2	2	2
h	Mining and manufacturing promotion	2	2	2	1
i	Inland transport development	26	10	10	6
j	Air transport development	5	2	2	2
k	Transport using advanced technology	2	2	2	1
	Total	73	51	49	22

Source: JICA Project Team

17.2 Profiles of Priority Project

A set of project profiles is prepared for 43 priority projects. Each project profile specifies the objectives, expected effects, location, implementation body, investment cost, existing conditions, project description, and social and environmental issues of the respective project. Tables 17.2.1 to 17.2.43 set out the project profiles.

17.2.1 Profiles of Priority Projects For Urban And Rural Development

Table 17.2.1 Capital Region Development Programme Including Inland Transport Improvement (a-1)

Location	Thimphu Thromde, Paro Town, Punakha Town, Wangudue Town and their vicinities
Implementing body	MoWHS, NLCS, Thimphu Thromde and Paro, Punakha, Thimphu and Wangduepunakhahodrang Dzongkhags
Objectives	(1) To formulate a development plan for the Capital Region (2) To formulate a transport plan for the Capital Region (3) To formulate a local area plan for urban renewal and new human settlements (4) To formulate an implementation plan for the development of the Capital Region
Expected effects	(1) The urban environment is improved in Thimphu (2) Urban functions are strengthened in Paro, Punakha and Wangudue, reducing urban pressure on Thimphu (3) Resiliency of the national capital against natural disasters is enhanced (4) Effective land use to conserve the natural environment and promotion of economic activities is ensured
Investment cost	BTN 21 million

Description

(1) Existing conditions

The Capital Region covers Thimphu Thromde, Paro Town, Punakha Town and Wangudi Town. The existing population amounts to 141,215 people (2017 figures). The proportion of those towns in relation to the total population is 19.4%. According to the estimated population in the CNDP, the Capital Region will see an incremental population increase of approximately 70,000 people over the next 13 years until 2030. The pace of this increase will be fast, as the annual growth rate is 3.3%. The proportion of the population in relation to the total population will be 25.9% in 2030.

To prepare for the rapid population increase, the effective use of land and an efficient transport system are required in the Capital Region. The rustic scenery downriver from Thimphu Thromde has been transformed into human settlements in order to provide residential areas. Further development will require the conversion of agriculture lands. A land use plan is required to identify the most suitable land use without causing a serious negative impact on the landscape and natural environment.

Developing Paro, Punakha and Wangdue is a means of mitigating the rapid rate of urbanization in Thimphu. The three towns should establish an urban environment in well-ordered manner to prepare for the development.

A development plan for the Capital Region will specify a spatial plan to define the function of each town and land use. It will be a regional spatial plan specified in Spatial Planning Act. The proposed land use plan will cover the area along the road network between Thimphu and other towns. The effective use of land is an important approach to pursue a comfortable living environment including better mobility and a better townscape in Thimphu Thromde. An integrated communication network is required to encourage interlinkage between the target towns.

(2) Project description

This project will include the activities mentioned below:

a) To identify urban functions for Thimphu, Paro and Wangdue/Punakha
b) To prepare a spatial plan for the Capital Region including a land use plan in and around the target towns
c) To prepare an inland transport plan for efficient linkage within the Capital Region. The inland transport includes use of EV that contributes the image-building.
d) To prepare a traffic management plan including public transport in the Capital Region
e) To prepare a local area plan for urban renewal to promote a better townscape and mobility in Thimphu
f) To implement a pilot project using eco-friendly green technology for transport (EV public transport, UAV etc.)

The target towns include Thimphu Thromde, Paro Town, Punaka Town, Wangudi Town and towns in the vicinity such as Khasadrapchu Town (Thimphu Thromde) and Lobesa Town (Punakha).

(3) Social and environmental issues

To supply a residential area to meet the estimated land demand in 2030, the conversion of agriculture lands into

residential use may be required. This conversion of land use will cause negative impacts, both socially and environmentally. A strategic environmental assessment (SEA) is required to identify the potentially negative social and environmental impacts and recommend means to avoid them.

Table 17.2.2 Eastern Region Development Programme (a-2)

Location	Nganglam, Monggar, Pemagatshel, Zhemgang, Lhuentse and Trashiyangtse
Implementing body	Samdrupjongkhar, Monggar, Pemagatshel, Zhemgang, Lhuentse and Yangtse Dzongkhags
Objectives	(1) To formulate a structure plan for the main towns in the Eastern Region (2) To formulate a development plan for human resources to support regional development is developed (3) To implement A pilot project including for human resource development
Expected effects	(1) A spatial plan for the main towns in the Eastern Region. (2) A centre to encourage human resource development to support regional development (3) A brand for the Eastern Region is established
Investment cost	BTN 56 million

Description

(1) Existing conditions

The Eastern Region includes Lhuente, Monggar, Pemagatzel, Samdrupjongkhar, Trashigang and Trashiyangtse. The existing regional population was 173,116 in 2017. It will decrease to 159,620 in 2030 according to the estimated population stated in the CNDP, although policy intervention is to carried out to promote the region. This population decrease is due to rural-urban migration. Although the linked urban centres of Monggar, Nganglam, Samdrupjongkhar and Trashigang will experience an incremental population increase of 15,501 people between 2017 and 2030, the total population of the Eastern Region will decline.

To mitigate the population decrease in the Eastern Region, vitalization of the towns is key to the success of economic, cultural and social activities in the region. These enhanced activities will result in encouraging rural development. The towns will be best placed to provide the human resources, equipment and facilities necessary for regional development.

This project aims to formulate the development plan for the main towns in the Eastern Region. As human resources are key to success in the long term, the project formulates a human resource development plan to enable local people to take on a leading role in regional promotion, with the aim of establishing branding for the region.

(2) Project description

This project will include the activities mentioned below:

a) To formulate a structure plan for the linked urban centres and towns with specialized objectives to differentiate the characters of each town: for example, environmental management in Nganglam, science and engineering in Trashigang, ICT in Monggar, agriculture in Pemagatzel, ecology in Zhemgang, handicrafts in Lhuentse and tourism in Yangtse.
b) To promote a programme for human resource development to support rural development. Civil servants in the dzongkhags and gewogs, as well as local people, are candidates to be local leaders. The proposed programme includes a curriculum and necessary equipment and facilities for ICT and STEM (science, technology, engineering and mathematics), such as a fab lab.
c) To carry out a pilot project for human resource development as the initial step to establish a system for promoting the brand of the Eastern Region. The pilot project includes the activities listed below.
   - Creation of specialty products: Bamboo products in Zhemgang, new handicraft product following woven fabric in Lhuetse.
   - Creation of small station and roadside station: An old farm house which is currently empty is used for small station and roadside station where the visitors and residents interact each other.
   - Community bonding: Holding an event such as athletic festival in a school and a village.
   - Reform of old form house which is an empty house to be a local hotel and visitor centre.
   - Human resource development for entrepreneur: Training program in collaboration with technical training institute and FabLab

(3) Social and environmental issues

To supply a residential area to meet the estimated land demand in 2030, the conversion of agriculture lands into residential use may be required. This conversion of land use will cause negative impacts, both socially and environmentally. An SEA is required to identify the potentially negative social and environmental impacts and recommend means to avoid them.

Table 17.2.3 Formulation of a Structure Plan for Urbanization Management Areas (a-3)

Location	Thromdes and towns which require designation as urbanization management areas (UMAs) around the urban area
Implementing body	MoWHS, NLCS, dzongkhags and thromdes responsible for thromdes and towns to designate the UMAs
Objectives	(1) To formulate a structure plan including a land use plan comprising UMAs (2) To formulate a landscape plan in the urban area and UMAs (3) To formulate a guideline and regulation to manage UMAs
Expected effects	(1) To establish mixed land use for human settlements, agriculture lands and forests in line with the satoyama and rurban concepts for close human interaction with nature (2) To raise public awareness of the cultural value of a landscape
Investment cost	BTN 151 million

Description

(1) Existing conditions

The proportion of the urban population to the total population is increasing (from 30.9% in 2005 to 37.8% in 2030). The proportion will further increase to 50.6% in 2030 according to the population projection estimated in the CNDP. This increase reflects an incremental population growth of 137,980 in the urban area in the same period. The new residential land of approximately 17 km^2 is required to meet land demand.

Due to the mountainous topography, there is very limited flatlands in Bhutan. Agriculture lands in and around towns need to be converted to supply residential areas. However, agriculture lands such as the terraced paddy fields are among the precious assets which represent the cultural landscape of towns in Bhutan. These lands supply rice and other foodstuff. Agriculture lands are an important resource in achieving food self-sufficiency as highlighted in the 12th FYP. The conversion of agricultural lands is a significant factor in supplying a residential area, food self-sufficiency and cultural conservation.

With the aim of conserving agriculture lands and forest, a proposed national land use plan, as part of the CNDP, specifies UMAs for the thromdes and towns whose population will experience a high growth rate. The UMAs seek to regulate urban development in large towns with a population of more than 10,000 and promote urban development in small and medium-sized towns.

This project aims to designate UMAs based on local conditions such as landscape and the distribution of agriculture lands. The outputs of the project include regulations and guidelines for UMAs. These documents will demonstrate that the mixed use of agriculture lands, forests and the urban area is in line with the satoyama and rurban concepts.

(2) Project description

This project will include the activities mentioned below:

a) Study of existing land use including agriculture lands and forests of thromdes and towns
b) Study of cultural assets including landscape
c) Study to examine land availability in order to meet the land demand for residential areas
d) Study to examine the possibility of converting agriculture lands including wetlands and drylands
e) Preparation of a structure plan including UMAs and a landscape plan
f) Preparation of guidelines and regulations for UMAs
g) Coordination of the land use plan and UMAs with land-use zoning by the National Land Commission Secretariat
h) Preparation of programmes to utilize the UMAs including the satoyama and rurban areas for mixed use

Four thromdes and 14 towns experiencing a population growth of more than approximately 30% during the period 2005-2017 were selected as candidate thromdes/towns for establishing UMAs in the CNDP. The selected thromdes and towns are listed below.

Dzongkhag	Thromde/Town	Dzongkhag	Thromde/Town
Thimphu	Thimphu Thromde	Samdrupjongkhar	Samdrupjongkhar Thromde
	Khasadrapchu Town		Samdrupchoelin Town
Paro	Paro Town	Pemagatshel	Nganglam Town
Punakha	Punakha Town	Bumthang	Bumthang Town
	Lobesa Town	Monggar	Monggar Town
Wangdue Phodrang	Wangdue Phodrang Town	Trashigang	Trashigang Town
Chhukha	Phuntsholing Thromde		Rangiung Town
Sarpang	Gelephu Thromde		Kanglung Town
	Sarpang Town		

(3) Social and environmental issues

a) The project basically aims to formulate a land use plan and a landscape plan to conserve the natural environment and cultural assets in towns which will experience rapid population growth. No significant social and environmental impacts are expected.

b) To meet land demand, the conversion of agriculture lands into residential use may be required. This conversion of land use will cause negative impacts, both socially and environmentally. A SEA is required to identify the potentially negative social and environmental impacts and recommend a method to avoid them.

Table 17.2.4 Formulation of Regional Plan for Sarpang-Gelephu Linked Urban Centre (a-4)

Location	Sarpang Dzongkhag
Implementing body	Sarpang Dzongkhag, Sarpang Thromde, Gelephu Thromde, DHS
Objectives	(1) To prepare a regional plan and a land use plan for the Linked Urban Centre (LUC) (2) To prepare a service delivery plan including a roadside station and a small base in the LUC and Sarpang Dzongkhag (3) To prepare an infrastructure development plan and a feasibility study for a priority project for the LUC (4) To carry out capacity development
Expected effects	(1) To create a model of a Linked Urban Centre (2) To create a model of a service delivery system associated with a roadside station and a small base in the LUC and Dzongkhag (3) To identify a priority project for infrastructure development and public services
Investment cost	BTN 15 million
Description	

(1) Existing conditions

LUCs, a concept to develop Regional Centres comprising two towns, are proposed for five locations in the CNDP. The LUCs are among the policy interventions to pursue regional development in order to support balanced development in the country.

The development concept of the Sarpang-Gelephu LUC is a 'logistics hub for import/export products'. Gelephu has feasible economic and locational conditions compared to Sarpang. Hence, this will help to realize the development concept. The proposed future image for Gelephu is that of an 'airport city', and this means that the utilization of Gelephu Airport is crucial to realize the development concept. Promotion of the tourism industry is also proposed to utilize the airport.

As for Sarpang, the proposed future image is that of an 'agri-business town'. To do that, the development of agriculture-related wholesale trade functions and the establishment of a new college which offers agricultural studies are proposed. The establishment of a vocational institution and the development of tourism gateway functions are also proposed to increase the vitality of Sarpang as an Urban Centre.

Gelephu faces constraining factors which could inhibit efforts at developing the LUC. An unstable water supply and flood risks are the primary constraints. The land demand has created land competition between the agriculture and non-agricultural sectors. The Sarpang-Gelephu LUC is expected to be a Regional Centre which will provide public services in Sarpang Dzongkhag and the neighbouring areas. For promoting the sustainable growth of Sarpang-Gelephu LUC, it is necessary to formulate a regional plan for the LUC and its surrounding areas. The regional plan will also include a land use plan, a public services plan and an infrastructure improvement plan. A new industrial estate will become operational in Jigmeling between Gelephu and Sarpang. The regional plan will include a spatial plan for the Urban Link Corridor between two Thromdes.

(2) Project description

This project will include the activities mentioned below:

a) To formulate a regional plan for Sarpang Dzongkhag
b) To formulate a land use plan and development control measures in the Urban Area, the Urban Management Area and the Urban Link Corridor between Sarpang Thromde and Gelephu Thromde
c) To formulate a service delivery plan for the area which covers the LUC and the selected roadside station and small base (service delivery includes education and medical services)
d) To prepare an infrastructure development plan including for road and public transport, water and drainage, and solar energy use
e) To prepare a feasibility study for a priority infrastructure project
f) To carry out capacity building for officers in local and central governments

(3) Social and environmental issues

A development plan could include the development of construction and public facilities. The conversion of agricultural lands for residential use may be required. This conversion will cause negative impacts, both socially and environmentally. An SEA is required to identify potentially negative social and environmental impacts and recommend means to avoid them.

Table 17.2.5 Development of Linked Urban Centres (a-5)

Location	Towns specified for linked urban centres
Implementing body	Dzongkhags containing towns specified for linked urban centres
Objectives	(1) To identify the expected functions of the linked urban centres (2) To formulate a development plan for the linked urban centres (3) To formulate a holistic service system for the linked urban centres and their vicinities (4) To formulate an implementation plan for the linked urban centres
Expected effects	(1) To establish a regional centre for each longitudinal region (2) To provide effective social services and markets to sustain the living standards and livelihoods in towns and villages in the vicinities of the linked urban centres (3) To promote regional development outside the Capital Region
Investment cost	BTN 53 million

Description

(1) Existing conditions

The Capital Region contains four towns: Thimphu, Paro, Punakha and Wangdue Phodrang. The population of the four dzongkhags containing the four towns was 255,978 people in 2017. This is equivalent to 35.2% of the total population. According to the estimate stated in the CNDP, the proportion of the four dzongkhags will increase to 39.8% in 2030, although a policy intervention will be adopted to encourage regional development in areas other than the Capital Region.

Linked urban centres, a concept to develop regional centres comprising two towns, are proposed at five locations in the CNDP. The linked urban centres are among the policy interventions to pursue regional development to support balanced development in the country. The small and medium population sizes of existing towns are characteristics of Bhutan. Those towns are not competent to be a regional centre with sufficient economic activities and markets needed for the towns and villages in their vicinities. The development of public facilities in each town requires a large amount of investment for the construction and maintenance of those facilities. This investment will be a burden on the financial resources of the country.

The development of the linked urban centres aims to provide social services and markets by interlinking two adjacent towns in each longitudinal region.

(2) Project description

This project will include the activities mentioned below:

a) To study the existing economic activities and public facilities in towns and villages
b) To study the development potential of candidate towns for linked urban centres
c) To formulate development alternatives for each town in order to clarify the most effective coordination of functions in the candidate towns
d) To formulate a development plan including a land use plan, a transport plan and a public facility plan (the land use plan and transport plan cover the area between candidate towns)
e) To formulate a holistic public service system in the linked urban centres to cover towns and villages in the vicinities
f) To formulate an implementation plan for the linked urban centres

The candidate towns for the linked urban centres include the following:

- Samtse ~ Phuentsholing
- Sarpang ~ Gelephu
- Trongsa ~ Bumthang
- Nganglam ~ Samdrupjongkhar
- Monggar ~ Trashigang

(3) Social and environmental issues

A development plan may include the development of construction and public facilities. The conversion of agriculture lands into residential use may be required. This conversion will cause negative impacts, both socially and environmentally. An SEA is required to identify the potentially negative social and environmental impacts and recommend means to avoid them.

Table 17.2.6 Project for Institutionalising Land Use Control Measures in Urbanisation Management Areas of Thimphu, Phuentsholing, and Gelephu (a-6)

Location	Thromdes of Thimphu, Phuentsholing, and Gelephu; Dzongkhags of Thimphu, Chukka, and Sarpang
Implementing body	MoWHS; NLCS; Thromdes of Thimphu, Phuentsholing, and Gelephu; Dzongkhags of Thimphu, Chukka, and Sarpang
Objectives (Outputs)	(1) To delineate Urbanisation Management Areas (UMAs) of Thimphu, Phuentsholing and Geleph Tbromdes (2) To set policies on the improvement, development and preservation of the three Thromdes' UMAs (3) To propose land development control mechanisms applicable in the three UMAs (4) To develop the capacity of implementation bodies to apply the proposed land development control mechanisms
Expected effects	(1) Both delineation and policy setting of the three UMAs will be done by referring to and adjusting each other the CNDP's land use planning categories and National Land Use Zoning's zoning categories. (2) Wide-ranged control mechanisms will be discussed to propose practical solutions including permissible categories and size of land development, infrastructure construction standards, levies/taxation on development, use of planned development method (e.g., land pooling), and so on. (3) Proposals will be made on the revision of the three Thromdes' structure plans so as the plans include UMAs possibly outside the boundaries of the Thromdes. (4) Capacity in land development control will be improved through training programs (e.g., seminars) in Bhutan and Japan, and joint work (or OJT) with Japanese experts.
Investment cost	BTN 25 million

Description

(1) Existing conditions

[Thimphu]

Concentration of population to the capital city of Thimphu has been continuing, and accordingly, developable land to accommodate increasing/incoming population capital city has become scarce. Since it is estimated that population concentration to Thimphu cannot be stopped fully, new measures to tackle the issue is indispensable from the perspective of land use planning and control. Such new measures would include, as proposed in CNDP, the expansion of Khasadrapchu, Yenlag Thromde, urban renewal (or high-densification) in Thimph's urban core precincts, and utilization of underused urban/agricultural land.

Thus, one major point of the proposed study in Thimphu is how to promote ordered land development in UMAs of the Thromde.

[Phuentsholing]

Phuentsholing, the second largest city in Bhutan, is also estimated to increase its population for the future. As the primal core city of Samtse – Phuentsholing Linked Urban Centre (LUC), Phuentsholing is expected to be further developed as nationally important Trade and Industrial City in CNDP.

Since the city's existing built-up area is almost fully developed, for the further development of the city, those should be considered include: a) expansion of the buit-up area to westward along Samtse-Phuentsholing High Way; b) improvement of functional linkage with Pashaka industrial hub including adequate urban corridor development; and c) provision of clever solution to .avoid further traffic congestion of the city centre through land use planning cum traffic planning.

Thus, one major point of the proposed study in Phuentsholing UMA is how to propose clever land use planning solutions to expand the city toward east and west, with probable shape of ribbon development.

[Gelephu]

Gelephu, the laegest city in the eastern half of the nation, is estimated to increase its population for the future, as well. As the primal core city of Sarpan – Gelephu LUC, Gelephu is expected to be further developed as Airport City with the second international airport in CNDP. Although the city is expected to be economically developed by the accumulation of the second and tertiary industries which are related to Gelephu Airport or related to the city's location as a gate to Manas National Park and heritage sites, the area surrounding the city, characterised by huge plain land, is an important food production base of the country.

Thus, one major point of proposed study in Gelephu UMA is how to allocate developable land for the second and tertiary industries in the way of avoiding conflict with agricultural land use.

(2) Project description

This project will include the activities mentioned below:

(1)-1 To estimate the needed quantity of land use change in each of the three UMAs.
(1)-2 To identify the areas suitable for land use change in the periphery of existing built-up area of each Thromde.
(1)-3 To check the consistency of the identified areas with zones of national land use zoning, and to make a necessary adjustment
(1)-4 To delineate the UMAs of the three areas
(2)-1 To grasp land use issues of each UMA
(2)-2 To establish land use policy of each UMA
(2)-3 To determine how to handle land development projects in each UMA
(3)-1 To grasp the existing land use control measures nationally and locally
(3)-2 To identify missing/weak control measures to adequately control land use in UMAs
(3)-3 To propose new land use/development control measures including both nationally and locally applicable ones
(3)-4 To propose revision of structure plans of the three thromdes so as to: expand the area coverage of the plans to include UMAs; and describe the policy on the management (or improvement, development and conservation) of UMAs
(4)-1 To hold seminars and workshops in Bhutan
(4)-2 To give short-term training opportunities in foreign countries

The target areas (UMAs) include: Thimphu Thromde and a part of Thimphu Dzongkhag surrounding Thimphu Thromde. Phuentsholing Thromude and a part of Chukka Paro Dzongkhag surrounding Phuentsholing Thromde; and Gelephu Thromde and a part of Sarpang Dzongkhag surrounding Gelephu.

(3) Social and environmental issues

To supply residential and industrial areas to meet the estimated land demand in 2030, the conversion of agriculture land into urban land use, to some extent, will be required in the three Thromdes' UMAs. The conversion should accompany social and environmental impacts. Accordingly, strategic environmental assessment (SEA) will be required to identify potential negative impacts and recommend means to avoid/mitigate them.

Table 17.2.7 Development of a Comfortable Rural Living Environment (b-1)

Location	Parts of the rural area where the living environment is inferior to that of the urban area
Implementing body	MoWHS, Ministry of Health, Dzongkhag, Gewog
Objectives	(1) To assess the latest situation concerning the living environment and facilities in the rural area together with rural residents as well as local government staff (2) To decide and establish appropriate standard levels for the rural area by facilities and population size, if necessary (3) To clarify proper procedures for the implementation of development interventions, not only for rural people but also for local governments
Expected effects	(1) Current situation concerning the living environment and facilities in the area are properly assessed and the information is shared among stakeholders. (2) Based on the information collected, the agencies concerned should discuss and decide appropriate standard levels for the rural area by facility (e.g., rural water supply, sewage system); if other factors, such as population size, land inclination and available water resources, matter, incorporate them into the standards (3) Facility development is implemented in accordance with the standards formulated by the agencies concerned (4) The living environment is improved through facility development works, which in turn will improve the GNH Index in the rural area
Investment cost	BTN 4,950 million

Description

(1) Existing conditions

In the rural area, facility development is still far behind that of the urban area. This has partly resulted in a lower GNH Index, due to the lower-level rating for the living standard domain of the GNH Index in the rural area. Physical infrastructure development is not regarded as the sole cause of the lower GNH Index in rural area, but comfortable living conditions seem to be important factors for rural residents to have happier life there. In fact, when the rural and the urban areas are compared with the latest statistics (2017 PHCB), the development levels of many facilities in the rural area are lower than those in the urban area. To reduce rural-urban gaps as well as mitigate rural-urban migration, various living facilities should be improved in the rural area. For the implementation of facility development in the rural area, various preparation procedures should be carried out.

(2) Project description

Public services, such as water supply, sewage systems, electricity, health services and road accessibility, are normally considered to be provided by either central or local government. Therefore, the country's entire population are supposed to be provided with the same service as long as service charges are properly paid. However, there are some gaps in service levels between the urban and the rural areas, with rural residents tending to be provided with less convenient services compared to urban dwellers. This project intends to: 1) establish appropriate standard development levels for the rural area by facility in consideration of various factors such as population size, land inclination, and available water resources, 2) formulate appropriate facility development plans based on the established standards after assessing the current situation concerning the living environment and facilities in the target area, and 3) implement facility development in the target area according to the formulated facility development plans in order to upgrade living conditions there, which in turn will improves its GNH Index. Project activities are as follows:

Photo: Obtained from the UNICEF website (https://www.unicef.org/wash/bhutan_92691.html)

a) Based on the latest statistical data and other related data sources, candidate gewogs are selected based on discussions with various stakeholders.
b) Current situations concerning the living environment and facilities in the target gewog are fully investigated and technical and financial barriers to implementation are identified.
c) Establish appropriate development standards for the rural area by facility in consideration of various factors such as population size, land inclination and available water resources. If there are special and/or specific locations, such as cultural heritage sites and highlander communities, in the target gewog, consider incorporating exceptional conditions into the development standards to cope with these special

circumstances.

d) The facility development plans for the target gewog are formulated based on the field investigation results and the established standards, taking into consideration other specific factors, if any. Regarding the maintenance and repair of the facilities after the completion of construction work, it is worth involving beneficiary residents from the planning stage onwards.

e) Based on the formulated facility development plans, proceed to facility development works in the target gewog to improve the living environment in the rural area.

(3) Social and environmental issues

a) Facility development works could involve social impacts; vulnerable people are especially susceptible to such impacts. An intensive social impact assessment should be carefully carried out to determine the expected social impacts.

b) Facility development works may also cause environmental degradation if proper environmental considerations are not taken into account. With a thorough investigation into the environmental impacts, necessary measures/facilities and environmental considerations will be applied in accordance with the laws and regulations concerned.

c) Non-structural approaches should be also developed and introduced in accordance with the facility development progress because they are effective as well as less costly than structural approaches. For instance, water saving measures such as reuse of water and rainwater harvesting seem to be important to utilize the limited water resources. In Japan, faucet aerators are popularly introduced not only by public facilities but also by residential houses to conserve water in drought-prone regions.

Table 17.2.8 Project for Dzongkhag Vitalization in the Eastern Region (b-6)

Location	Trashigang, Monggar, Samdrupjongkhar, Lhuntse and Pemagatshel
Implementing body	MoEA, MoAF, MoHCA, TCB, Dzongkhag, Gewog
Objectives	(1) To enhance rural income by maximizing economic opportunities/technologies backed by strong marketing capabilities focused on regionally balanced development through regional revitalization (2) To establish strong economic production systems and promote economic self-reliance
Expected effects	(1) To identify speciality produce (agriculture, cottage industry, tourism) on an area-wise or location-specific basis (2) To develop the speciality produce in a sustainable manner (3) To disseminate information on market research and best practices from marketing (4) To develop a mechanism for community bonding and sharing common facilities (community hall, community gathering, promoting rural arts and crafts, promoting traditional cultural events, encouraging the use of farmhouses, roadside station, antenna shop etc.) (5) To disseminate information for producers and buyers (6) To build institutional linkages between agriculture-related agencies and research institutes for product innovation
Investment cost	BTN 35 million

Description

(1) Existing conditions

The Eastern Region includes Lhuentse, Monggar, Pemagatshel, Samdrupjongkhar, Trashigang and Trashiyangtse. The existing regional population was 173,116 in 2017. It will decrease to 159,620 in 2030 according to the estimated population stated in the CNDP, although a policy intervention is to be made in order to promote the region. This population decrease is due to rural-urban migration. Although the LUCs in Monggar, Nganglam, Samdrupjongkhar and Trashigang will experience an incremental population increase of 15,501 people between 2017 and 2030, the total population of the Eastern Region will decline.

There are many empty houses in the Eastern Region. Many educational institutions have been opened, such as Sherubste College (Trashigang), Jigme Namgyal Engineering College (Deothang), Gyalpozhing College of Information Technology (Monggar) and the Zorigchusum Institute (Trashiyangtse). The Dzongkhags in the east are enriched with cultural and natural resources which can be used for eco-tourism.

To mitigate the population decrease in the Eastern Region, vitalization of the Rural Area is key to the success of economic, cultural and social activities in the region. The JICA has implemented projects in the Eastern Region. Those projects are the Agriculture Research and Extension Support Project in Lhuentse and Monggar, the Agriculture Research and Development Project, the Project for the Improvement of Machinery and Equipment for the Construction of Rural Agriculture Roads (Phase 3), the Project for the Improvement of Medical Equipment at the National and Regional Referral Hospitals, and D-HOPE (Project for the De-centralized Hands-on Programme Exhibition).

(2) Project description

This project will include the following activities:

a) To study the commodities to be covered in the project area
b) To carry out pilot projects in pilot sites for specific products
c) To establish a market information and networking system
d) To conduct training and group exercises in Bhutan and Japan

(3) Social and environmental issues

The pilot project will include a roadside station, a small base and a community hall. Those facilities will require land reform. An environmental assessment will be carried out in advance to implement the pilot project according to the guidelines for environmental assessment in Bhutan.

17.2.2 Profiles of Priority Projects in Agriculture Promotion, Livestock Promotion and Forestry Promotion

Table 17.2.9 Rice Variety Improvement and Dissemination for Winter Cropping (c-1)

Location	Chhukha, Dagana, Samdrupjongkhar, Samtse, Sarpang and Tsirang
Implementing body	DoA (ARDC, NSC), FMCL
Objectives	(1) To identify appropriate rice varieties for winter cropping (2) To multiply a sufficient quantity of quality seeds (3) To improve cultivation techniques for winter cropping
Expected effects	(1) Rice self-sufficiency is improved by cultivating appropriate rice varieties for winter cropping (2) The household income of farmers is improved by increasing rice production and sale
Investment cost	BTN 456 million
Description	

(1) Existing conditions

To improve self-sufficiency in Bhutan, the promotion of double cropping is expected to produce more production. Although double cropping is possible in the southern part of Bhutan, crop intensity is slightly above 100%. One of the reasons for this concerns the insufficient appropriate rice varieties for winter cropping. Rice cultivation in the monsoon period normally starts in May and completes in December. This means that spring paddy cultivation requires varieties with harvest period of four to five months from sowing to harvesting. Currently, spring paddy varieties, such as Anand, GB-1 and GB-3, are released, but they do not fully prevail, and there is a great need to find more varieties. In general, the breeding and development of new varieties take time, e.g., seven to eight years. One of the options to shorten the development period is the application of introduction breeding by using existing varietal stocks. There is a certain amount of genetic resources of rice, either in neighbouring countries or international institutions. Hence, the project aims to select appropriate varieties for winter cropping and disseminate sufficient quantities of quality seeds.

(2) Project description

a) Selection of appropriate varieties

The first step is to search for potential varieties to be introduced with a short maturity period. For example, specific data including name, source and days to maturity are available from the International Rice Genebank. After tentative selection, a varietal test is conducted on-site and varieties to be disseminated are selected. In the course of selection, performance of the varieties including productivity, growth duration, and palatability are evaluated through farmers' participation, so-called participatory varietal selection (PVS). This can be helpful to identify suitable varieties under actual farm conditions and facilitate farmers' interests.

(Source: International Rice Genebank)

b) Preparation of a seed multiplication plan and quality seed multiplication

Once appropriate varieties are selected, the next step is to multiply the necessary amount of quality seed. Quality seed needs to be multiplied, based on a seed multiplication plan, in order to meet production targets. Currently, about 100 acres of wetland is cultivated in Yoeseltshe where irrigation is available and the temperature is suitable for growth during winter. In this case, approximately 2,000 kg of rice seeds for spring paddy and 2.5 acres of cultivated areas to produce rice seed are required. The plan should be updated year by year based on spring paddy production targets, expected yield and necessary cultivated area.

c) Improvement of cultivation techniques for winter cropping

Spring paddy normally requires more intensive cultivation compared to monsoon paddy cultivation because of its shorter maturity period. Therefore, a cultivation calendar with appropriate spring paddy techniques should be prepared. The cultivation calendar should contain nursery preparations, a schedule for sowing, transplanting, irrigation, weeding, harvesting etc. In association with preparation of cultivation calendar, technical transfer and trainings to farmers need to be conducted. At the initial stage, those who received the training may be eligible to receive the recommended varieties for winter cropping as pilot farmers. Paddy fields, where cultivation of spring paddy is available, are relatively flat, and there is a room to expand mechanized farming including power tillers, transplanters and harvesters. To fully utilize the potentiality of winter cropping, contract farming, land lease and

aggregation schemes should be taken into account.

The project period will be 10 years.

(3) Social and environmental issues

a) The application of new rice varieties will be properly assessed to confirm any possibility of causing negative impacts on the existing ecology.

b) If land reform is required for the improvement of cultivation techniques, the possibility of negative impacts on environmental conditions will be assessed to avoid them, especially the most serious.

Table 17.2.10 Improvement of Cultivation Techniques for Labour Saving (c-2)

Location	Lhuentse, Monggar, Paro, Punakha, Thimphu, Trashigang, Yangtse, Trongsa, Wangduephodrang and Zhemgang
Implementing body	DoA (ARDC)
Objectives	(1) To find effective cultivation techniques to reduce labour inputs (2) To disseminate the identified techniques for labour saving
Expected effects	(1) The work environment is improved for farmers in terms of labour saving (2) Knowledge and techniques for labour saving in the mountainous topography are identified
Investment cost	BTN 182 million
Description	

(1) Existing conditions

Currently, 53% of households face difficulties in securing labour for their farming activities. Mechanization is one of the major countermeasures to cope with the labour shortage. Mechanization is being promoted via hiring services, but agricultural machines do not fully prevail. Therefore, the development of labour-saving measures is indispensable while agricultural machines are generalized. This is regarded as a short-term countermeasure to address the labour shortage and could also lead to conservation farming.

(2) Project description

a) Selection of working items to be reduced

It is said that, among several farming activities, land preparation, transplanting, weeding and harvesting are the major costly activities in Bhutan due to high labour requirements. Hence, it is reasonable to select labour-saving cultivation techniques related to these farming activities, in order to allow farmers to reduce labour inputs. If there is any doubt about labour inputs, further study should be conducted in this regard.

b) Introduction and preliminary testing of newly developed cultivation techniques

Some of the techniques to be introduced are listed as follows:

- Non-tillage cultivation: This allows farmers to cultivate without tilling and prevents soil erosion due to the mulching of plant residue.
- Dry-seeded rice cultivation: Rice seeds are sown on the dried field, which is irrigated after the establishment of seedlings. As this avoids puddling, nursery preparation and transplanting, labour inputs are reduced.
- Weed supressing techniques: Cultivation of Chinese milk vetch, water depth control, application of rice bran, etc. proposed by one of the JICA projects ("An adaptive research trial in organic rice production without the use of synthetic weedicide).

Source: AFFRC

Normal and of Iron-Coating Seeds

Source: MAFF

Example Of Labour Saving techniques (broadcasting of seeds by drone)

c) Dissemination of cultivation techniques

Once techniques to be tested are selected, on-site trials are conducted. Modification of the contents of techniques based on growth performance, farmers' perception etc., should be pursued, if necessary. Techniques can then be disseminated via extension channels.

The project period will be five years.

(3) Social and environmental issues

Basically, the negative impacts are not assumed. On the application of labour-saving measures, environmental and social impacts will be monitored. If any environmentally and socially negative impacts are observed, countermeasures should be identified.

Table 17.2.11 Promotion of Mechanization (c-3)

Location	Lhuentse, Monggar, Paro, Punakha, Thimphu, Trashigang, Yangtse, Trongsa, Wangduephodrang, Zhemgang.
Implementing body	DoA (AMC), FMCL
Objectives	(1) To find an effective means to improve the productivity as a countermeasure against the shortage of labour (2) To disseminate small-scale machinery
Expected effects	(1) The productivity of agriculture is improved (2) The cost and time spent on dealing with agriculture jobs by farmers are reduced (3) Knowledge and technology to deal with agriculture jobs are enhanced
Investment cost	BTN 226 million
Description	

(1) Existing conditions

The shortage of labour is one of the biggest issues for farmers. Currently, power tillers are being distributed through support from Japan to all the gewogs to ease land preparation. However, there are some constraints on further promotion; the number of machines is limited, fields are located in terrain area, the size of plots is relatively small and there is poor accessibility to fields. Hence, the introduction of portable and/or small-scale machinery is required.

(2) Project description

i) Selection of small-scale machinery to be introduced such as mini-harvesters, mobile threshers, weeding robots and drones
ii) Preliminary testing for small-scale machinery.
iii) Dissemination of small-scale machinery through the Agriculture Machinery Centre (AMC) or the private sector.

Prior to dissemination, it is important to establish the quality standard for the products and for them to be authorized by the Bhutan Standard Bureau (BSB). In doing so, the quality of the product for end users will be ensured.

(3) Social and environmental issues

No environmental impact is expected.

Table 17.2.12 Establishment of Community-wildlife Coexistence (c-4)

Location	Nationwide
Implementing body	DoA (NPPC)
Objectives	(3) To find an effective means to protect cultivated areas from wildlife (4) To disseminate the identified means to manage the wildlife
Expected effects	(4) The productivity of agriculture is improved (5) The cost and time spent on dealing with wildlife conflicts by farmers are reduced (6) Knowledge and technology to deal with wildlife conflicts are enhanced
Investment cost	BTN 226 million
Description	

(4) Existing conditions

According to the statistics, 43% of households suffer from crop damage caused by wild animals. Wild animals damage 4-7% of the cultivated area for major cereals and potatoes. The affected production value of rice and maize is estimated to be BTN 150 million in total. Farmers spend an average of 53 days and 63 nights per year protecting against damage by wild animals. The MoAF has introduced electric fencing as the most effective solution to mitigate the impact of human-wildlife conflict. However, it does not make sense to encircle entire fields with electric fencing as the areas to be covered are vast. Hence, the introduction of new knowledge and technologies is required to cope with human-wildlife conflicts.

(5) Project description

a) Data collection on the ecology of wild animals

According to the National Plant Protection Centre, the major wild animals which attack crops are boar, deer and monkey. Identifying the types of animals in a particular area and learning about their ecology and habitat can be the first steps towards protecting crops against wild animals. Using drones with infrared thermography is one of the options to survey wild animals. The major advantages of using drones with infrared thermography are i) capturing the location of wild animals which are behind bushes or trees, and ii) searching for wild animals even at night.

There might be difficulties to introduce drones freely, and therefore establishment of special zone for drone where several components such as development, maintenance, and training are provided, is recommended for further promotion and dissemination. Special zone might be established nearby engineering university and provide necessary facility to the private companies, so that it can attract the interest for agriculture and improve working opportunities for youth.

Source: MAFF Source: MAFF

Image of Drone Utilization for Human-wildlife Conflicts

b) Research on human-wildlife conflict countermeasures

Once the ecology of wild animals is established, on-site trails will be conducted, for example, using drones with speakers or flashlights, drones with air guns or fire crackers, monkey dogs, and speakers or flash lights with motion sensors. If the drone with automatic operation system is applied, flying route and flying record can be submitted before and after operation to ease the resistance to drones. The establishment of a buffer zone for industrial crops, such as oil seeds, tea and medicinal plants, and the introduction of a safe system approach by the WWF in order to identify root causes are other options.

c) Dissemination of techniques for human-wildlife conflicts

Developed countermeasure techniques to address human-wildlife conflicts will be disseminated via extension channels. However, these techniques may not be fully adopted, as field conditions vary from place to place. When different needs or problem arise in the course of extension activities, this information needs to be delivered to research institutions for the purpose of further research works. To make this feasible, a monitoring and reporting system is also important.

The project period will be five years.

(6) Social and environmental issues

Basically, no negative impacts are assumed. On the application of measures to deal with wildlife conflicts, the environmental impact will be monitored. If any environmentally negative impacts are observed, countermeasures should be identified.

Table 17.2.13 Realization of the National Irrigation Master Plan (c-5)

Location	Chhukha, Dagana, Samdrupjongkhar, Samtse, Sarpang and Tsirang
Implementing body	DoA
Objectives	(1) To formulate a planning requirement to meet the target level for rice self-sufficiency (2) To formulate the National Irrigation Master Plan (NIMP) (3) To formulate an O&M plan
Expected effects	(1) An irrigation system is developed to meet the rice self-sufficiency target at a nationwide level (2) The O&M of an irrigation system are appropriately carried out
Investment cost	Soft component

Description

(1) Existing conditions

DoA agricultural statistics indicate that 28% of households have difficulties with insufficient irrigation supply. Further, irrigation is key to increasing the self-sufficiency rate of rice. An increase in the cropping intensity of the existing irrigation scheme through the construction of ponds, the rehabilitation of canals and the introduction of water-saving irrigation is one of the options to be considered. The development of a new irrigation scheme is another option to expand the area irrigated. The general orientation of irrigation development is described in the NIMP. It is now necessary to materialize the NIMP.

(2) Project description

a) Reconsideration of the necessary irrigation development area

The NIMP aims to expand irrigated land by 10,800 ha in the period to 2032. This was determined to be based on the precondition that the self-sufficiency target is 70%. However, in light of current achievements, 60% is a reasonable target for 2030. Thus, it is necessary to reconsider how much of an area needs to be irrigated in order to achieve 60% self-sufficiency. The required irrigated area is estimated, based on expected yield in irrigated paddy and rain-fed paddy fields, winter cropping areas etc. At the time of assessment, it is necessary to consider the planned irrigation development project to be implemented by JICA and the idea of watershed management.

b) Existing irrigation improvement and new irrigation development

After assessment of the necessary irrigated area, the existing irrigation area to be improved and a new irrigation development area will be determined. According to the previous survey on irrigation development implemented by JICA in 2017, the following construction works are proposed based on irrigation schemes.

Irrigation scheme	Construction works to be proposed
Hill scheme	・Pond construction, water-harvesting structure ・Construction of drainage canals, plantation of cover crops, and contour line cultivation to protect water sources and agricultural lands from gully erosion and slope failure ・Drip irrigation to economize water usage
Valley bottom scheme	・Pond construction, water-harvesting structure
Foot hill scheme	・Bank protection, water diversion structure for flooding

When construction works are planned, it is important to incorporate the idea for multipurpose utilization; irrigation water could be utilized for drinking water, daily life water such as washing clothes, etc.

c) Reinforcement of the O&M system

Once facilities are developed, it is important to operate and maintain the facilities continuously in a proper manner. Guidelines and a manual for O&M are to be prepared and training is to be given to relevant stakeholders including government officers and members of the water user association in the village area. Installation of ICT application for data collection, O&M, monitoring to facilitate the capacity should also be considered.

The project period will be 10 years.

(3) Social and environmental issues

The development of irrigation facilities requires land reform and changes to the natural environment, such as the flow direction and volume of surface water. An SEA should be carried out to identify the environmentally and socially negative impacts. Countermeasures should be recommended in order to reduce the anticipated negative impacts.

Table 17.2.14 Development of Soil Nutrition Management (c-6)

Location	Nationwide
Implementing body	DoA (NSSC)
Objectives	(1) To find appropriate soil management techniques (2) To disseminate better appropriate soil management techniques
Expected effects	(1) Rice productivity is improved by improvement in the soil management. (2) The agriculture land for rice cultivation is used in the long term.
Investment cost	BTN 620 million
Description	

(1) Existing conditions

There are some studies on soil in Bhutan, but no comprehensive information and national maps concerning soils are available. Farmers mainly manage their farmland in traditional ways without knowledge of soil fertilities. To increase the production of agro-products and to manage the soil more effectively, information on soil fertility is indispensable. This information could also be utilized as decision-making tools. Hence, a preliminary analysis of soils and the development of soil nutrition management are expected to support food and nutritional security in Bhutan.

(2) Project description

i) Preliminary analysis of soils through a series of pot trials and laboratory testing.
ii) On-site trial of soil management techniques, such as appropriate fertilizer application dosage with a focus on deficit nutrients and application techniques.
iii) Dissemination of soil management techniques.

(3) Social and environmental issues

No environmental impact is expected.

Table 17.2.15 Development of Weed Control Methodology (c-7)

Location	Chhukha, Dagana, Samdrupjongkhar, Samtse, Sarpang, Tsirang
Implementing body	DoA (AMC, NPPC)
Objectives	(1) To find appropriate weed control method (2) To disseminate better weed control method
Expected effects	(1) Rice productivity is improved by improvement in maintenance of cultivated area.
Investment cost	BTN 137million
Description	

(1) Existing conditions

Weed infestation is one of the biggest issues for farmers, as weeding is the most costly farming activity per unit area. Once weed infests in the fields, it has a negative effect on rice growth and results in decreasing yield. Thus, periodical weeding is indispensable; however, it requires considerable labour input. The development of weed control methods contributes to a reduction in labour input for weeding.

(2) Project description

i) Data collection concerning the ecology of weed species and selection of target weeds.
ii) Research on weed control methods through pot experiments and field trials using cultural, biological, mechanical and chemical control methods.
iii) Dissemination of weed control methods.

(3) Social and environmental issues

No environmental impact is expected.

Table 17.2.16 Improvement of the Rice Milling Ratio (c-8)

Location	Chhukha, Dagana, Samdrupjongkhar, Samtse, Sarpang and Tsirang
Implementing body	DoA (AMC), BSB
Objectives	(1) To find appropriate rice milling machines (2) To disseminate better rice milling machines
Expected effects	(1) Rice productivity is improved by improvement in the rice milling ratio (2) The required land for rice cultivation is reduced
Investment cost	BTN 620 million
Description	

(1) Existing conditions

Production increases, due to yield enhancement and the expansion of cultivated areas, obviously ensure food and nutritional security. At the same time, reducing harvest losses contributes to an increase in actual white rice production for consumption. In Bhutan, it is estimated that the milling ratio is approximately 60%. It is rather low compared to the international average. It is said that quality milling machines allow users to achieve a milling ratio as high as 70%. When the milling ratio increases by 10%, it is equivalent to 8,000 tons of milled rice, with self-sufficiency increasing by 8% automatically.

(2) Project description

a) Data collection on post-harvest losses

There are many factors to be considered for post-harvest losses. These include threshing, winnowing, drying, transportation, storage and processing. Information could be collected by research institutes as well as extension channels.

b) Introduction and preliminary testing of improved rice mills

Rice mills to be introduced will be selected by considering price, size, availability, performance etc. Once the machines to be tested are selected, on-site trials will be conducted. Modifying the specification of machinery will be based on milling performance, farmers' perception etc., if necessary.

c) Dissemination of better rice milling machines

Appropriate rice mills are disseminated either by the Agriculture Machinery Centre (AMC) or by private companies. Prior to dissemination, it will be important to establish a quality standard for the products and for them be authorized by the BSB. In doing so, this will ensure the product quality for end users.

The project period will be five years.

(3) Social and environmental issues

No environmentally negative impact is assumed. On the application of milling machines, the environmental impacts will be monitored. If any environmentally negative impacts are found, countermeasures will be carried out.

Table 17.2.17 Expansion of the Certification System (c-9)

Location	Gasa, Monggar, Pemagatshel, Trashigang, Yangtse, Trongsa, Zhemgang.
Implementing body	DoA, DAMC, BAFRA
Objectives	(1) Target crops for certification are identified. (2) Requirements and grading standards are established for export products.
Expected effects	(1) To improve farmers' livelihood (2) To develop techniques for marketing (3) To develop market-oriented agriculture produce.
Investment cost	BTN 181 million

Description

(1) Existing conditions

Nowadays, producers need to produce safe and traceable agro-products as consumers are highly conscious of food provenance. There are several approaches to ensure food safety such as Good Agriculture Practices (GAP) and laboratory analyses. These take some time, but they allow farmers to expand their business opportunities. For example, organic product certification is applied to carrots, garlic and potatoes in Gasa, which are sold to five-star hotels in Thimphu at good prices. As there is a growing demand for these products, and a certification system can create high added value, an expansion of the certification system is one of the best solutions to help farmers improve their livelihood.

(2) Project description

i) Selection of target crops to be certified. It is reasonable to begin with potential crops, given that there are experienced farmers who can meet cultivation and market needs. In doing so, it is expected to consolidate production areas and formulate a wide-scale production area.
ii) Data collection concerning the export product requirements; in the case of cardamom, information to be collected could include on grading according to size, colour and weight of the pod.
iii) Establishment of grading standards based on market needs; in India, for instance, there are five different grades for cardamom, based on different sizes and weights. In addition, cardamom with the biggest pods is preferable in some countries as importers believe they carry the most flavour and fragrance. In other countries, the contrary view applies.
iv) Development of market-oriented post-harvesting machinery such as hullers, milling machines, driers and sorters.
v) Training on certification and marketing, e.g., production protocols, operation of farmers' organizations, record keeping and accounting.
vi) Formulation of farmers interest groups (FIGs) and a farmers producer organization (FPO) and their implementation. While an FPO, which consists of several FIGs, is expected to explore marketing channels and fix the sales price before production, FIGs will concentrate on the production of target crops based on information provided by the FPO.

When processing machines are installed, the FPO will also function as a processing centre to add more value. Thus, a wide-scale production area will become a cluster area covering all aspects of the agro-industry including production, processing and marketing. In doing so, more competitiveness through infrastructural improvements, strengthening bargaining power and widening the marketing network is expected. In the course of exploring marketing channels and selecting target crops, participatory decision-making tools are available to convince farmers. Learning about the organic farming and certification process as part of school education will help to foster an awareness in this regard. It will be productive to establish antenna shops, either in the border area or in India, for gathering information. Newly developed machinery will be disseminated either by the AMC and the NPHC, or by private companies. Prior to dissemination, it is important to establish the quality standard for the products and have them authorized by the BSB. In doing so, the quality of the product for end users will be ensured.

(3) Social and environmental issues

No environmentally negative impact is assumed. In the course of preparing a development plan for agriculture products, the possibility of environmentally and socially negative impacts will be assessed.

Table 17.2.18 Development of Market-oriented Post-harvesting Skills (c-10)

Location	Gasa, Monggar, Pemagatshel, Trashigang, Yangtse, Trongsa and Zhemgang
Implementing body	DoA (AMC, NPHC)
Objectives	(1) Agriculture export products are identified (2) Requirements and grading standards are established for export products (3) Machinery for market-oriented products is disseminated
Expected effects	(1) Knowledge and techniques for marketing are developed (2) Market-oriented agriculture produce is developed (3) Branding for Bhutanese products is established
Investment cost	BTN 140 million

Description

(1) Existing conditions

The JICA has continuously implemented technical cooperation projects related to horticulture production, for instance, "Agricultural Research and Extension Support Project in Lhuentse and Monggar (2004-2009)", "Horticulture Research and Development Project (2010-2015)", and "Integrated Horticulture Promotion Project in the West Central Region (2016-2021)". The project implemented in Bhutan succeeded in disseminating potential crops and enhancing production as well as quality. Farmers' mindset has started to change from subsistence farming to a market-oriented approach. Also, exports of some agro-products, such as areca nut, cardamom, ginger and potato, show increasing trends. However, the unit prices of some products are stagnant and others are declining. There are competitors dealing with the same products. To compete with them in the global market, it is important to identify qualities or standards which are required by importing countries and address these requirements.

(2) Project description

a) Data collection on the requirements for export products

This is the first step for the development of market-oriented post-harvesting skills. In the case of cardamom, information to be collected could involve grading depending on the size, colour and weight of the pod. In some countries, cardamom with the biggest pods is preferable as importers believe they carry the most flavour and fragrance. In other countries, it is the contrary. This information is useful for the preparation of strategic planning. Establishment of antenna shops either in border area or in India could be useful for information gathering. The population of large city in neighbouring area such as Guwahati and Siliguri Metropolitan region is more than one million, and therefore, high-income group in such cities could be important consumers in the future. Also, installation of ICT application for data collection and data sharing to facilitate the swiftness should also be considered.

b) Establishment of grading standards based on market needs

Currently, many agro-products are exported without grading. However, there are different grades being offered to international markets. India has five different grades in terms of size and weight: Alleppey Green Extra Bold, Alleppey Green Bold, Alleppey Green Superior, Alleppey Green Shipment 1, Alleppey Green Shipment 2. The establishment of grading standards focusing on importing countries could also create value addition.

c) Development of market-oriented post-harvesting machinery

The JICA has continuously implemented technical cooperation projects and grand aids related to agro-machinery such as "Strengthening Farm Mechanization Project (2014-2017)" and "The Project for Improvement of Farm Machinery for Hiring Services of Tillage (2016)". As a successful result of the project, some machinery has been developed which meets the requirement of importing counties and/or global standards; some examples are cardamom driers and potato sorters. Development of machineries which can be utilized for several products should be considered; for example, there are many products which require drying process such as rice, wheat, millet, chilli, ginger, etc. Newly developed machinery is disseminated either by the AMC or by private companies. Prior to dissemination, it is important to establish a quality standard for the products and for them to be authorized by the BSB. In doing so, the product quality will be ensured for end users.

The project period will be 10 years.

(3) Social and environmental issues

No environmentally negative impact is assumed. In the course of preparing a development plan for agriculture products, the possibility of environmentally and socially negative impacts will be assessed.

Table 17.2.19 Promotion of Environmentally Balanced Slope Cultivation (c-11)

Location	Chhukha, Haa, Lhuentse, Samdrupjongkhar, Thimphu
Implementing body	DoA (NSSC)
Objectives	(1) Low-cost slope cultivation techniques are identified (2) Environmentally friendly slope cultivation techniques area disseminated.
Expected effects	(1) Productivity in sloped lands are improved. (2) Conservation of natural resources is achieved.
Investment cost	BTN 131 million

Description

(1) Existing conditions

A large part of Bhutanese agricultural land is dominated by steep slopes. Sloped lands with more than a 25% gradient occupy more than 80% of agricultural land. Although a market-oriented approach helps producers to generate more income, farming activities without environmental considerations, such as monocropping plantations and over-intensive usage of land, deteriorate agricultural lands. In many countries, the lack of any protection measures results in soil erosion, soil degradation and declining natural resources. As conservation of natural resources is essential in pursing GNH, it is important to promote market-oriented farming by taking environmentally balanced slope area cultivation into account.

(2) Project description

i) Data collection on soil losses by farming activities including slope gradient, crops under cultivation, continuous cropping period and rainfall.
ii) On-site trials on environmentally balanced low-cost slope cultivation techniques; Sloping Agricultural Land Technology (SALT) has introduced 10 steps as representative techniques as follows: 1) make an A-frame, 2) locate contour lines, 3) prepare the contour lines, 4) plant seeds of nitrogen-fixing trees, 5) cultivate alternate strips, 6) plant permanent crops, 7) plant short-term crops, 8) trim nitrogen fixing trees, 9) practise crop rotation, 10) build a green terrace. Other techniques to be considered are mulching, mixed cropping, intercropping, minimum/zero tillage, incorporation of organic matters, cover cropping by perennial plants, flagstones, water harvesting, and placement of bamboo along contour lines.
iii) Dissemination of environmentally friendly slope cultivation techniques.

(3) Social and environmental issues

No environmentally negative impact is assumed.

Table 17.2.20 Strengthening of Capacity for Horticulture Production (c-12)

Location	Bumthang, Dagana, Paro, Punakha, Samtse, Sarpang, Tsirang, Wangduephodrang
Implementing body	DoA (ARDC), DAMC
Objectives	(1) Marketing channels and selection of target crops are explored. (2) Horticulture production is disseminated.
Expected effects	(1) Productivity and marketing for horticulture are improved. (2) Horticulture production is expanded.
Investment cost	BTN 174 million

Description

(1) Existing conditions

The JICA has continuously implemented technical cooperation projects related to horticulture production. The project implemented in Bhutan succeeded in disseminating potential crops and enhancing production as well as quality. Farmers' mindset has started to change from subsistence farming to a market-oriented approach. However, there is still a need to improve productivity and marketing aspects through extension activities. Hence, the strengthening of capacity, with a greater emphasis on improving marketing, is indispensable.

(2) Project description

i) Exploration of marketing channels and selection of target crops using participatory decision-making tools for marketing purposes; community resources and asset maps, farmer segmentation, crop calendars, product selection criteria, product ranking exercises, assessing market risks or products, market visits, and new product evaluation.
ii) Research on the production of horticultural crops such as varietal trials, raising nurseries, planting, grafting, pruning, weed and pest management, harvesting, and seed multiplication.
iii) Dissemination of horticulture production.

(3) Social and environmental issues

No environmentally negative impact is assumed.

Table 17.2.21 Improvement of Farm Accessibility, Transportation and Storage Facilities (c-13)

Location	Farm roads: nationwide Storage: Chhukha, Samdrupjongkhar, Samtse, Sarpang
Implementing body	DoA, DAMC
Objectives	(1) To formulate a development plan for production and marketing (2) To construct farm access roads and storage facilities
Expected effects	(1) Accessibility from farmlands to markets is improved (2) The quality of agricultural produce is improved
Investment cost	BTN 620 million
Description	

(1) Existing conditions

The JICA has continuously implemented technical cooperation projects related to horticulture production, for instance, "Agricultural Research and Extension Support Project in Lhuentse and Monggar (2004-2009)", "Horticulture Research and Development Project (2010-2015)", and "Integrated Horticulture Promotion Project in the West Central Region (2016-2021)". The project implemented in Bhutan has succeeded in disseminating potential crops and enhancing production as well as quality. Farmers' mindset has started to change from subsistence-oriented to market-oriented farming. However, it is still required to improve accessibility to the market through infrastructure development. Hence, providing necessary access from the main road to farmland will allow for the better utilization of potential land and transportation of agricultural inputs and outputs, while storage facilities will improve the further promotion of agricultural commercialization.

(2) Project description

a) Preparation of a development plan for production and marketing

The first step is to prepare a plan for infrastructure development. As the budget is limited, it is important to prioritize where to develop the road network and where to establish facilities in consideration of production potential and market access. Example items are as follows: priority area, location of the road and facilities, survey methods, typical drawing, cost norms, contract documents, construction management, and maintenance. When construction works are planned, it is important to incorporate the idea for multipurpose utilization. Drainage water could be utilized for irrigation water and/or daily life water such as washing clothes, etc, if drainage channel and culvert are installed in a planned manner. It will also contribute to the longevity of the road.

b) Rehabilitation or upgrading of existing farm access roads

The main focuses in the context of the rehabilitation or upgrading of existing roads are the installation of side drains and drainage culverts. An inventory survey, for example, concerning length, dimensions, pavements, the number and location of structures, the estimated number of users, is necessary for effective works to be carried out. Installation of ICT application for inventory survey should also be considered.

c) Construction of new farm access roads and storage facilities

As for new farm roads and storage facilities, construction works will be carried out based on priority areas and locations, as stated in the development plan. The main focuses for newly developed structures are improved transportation of faming inputs to farmland and improved connectivity between production areas and markets by maintaining quality.

(3) Social and environmental issues

Road and storage facilities will change the land format and cause environmentally and socially negative impacts during and after construction. An environmental impact assessment (EIA) will be carried out in order to study the level of those negative impacts and find countermeasures to deal with them.

Table 17.2.22 Preparation of General Guidance on Nutrition (c-14)

Location	Nationwide
Implementing body	MoH, DoA
Objectives	(1) To formulate a general guidance for nutrition (2) To gather data on food habits
Expected effects	(1) General guidance for nutrition is established. (2) Food habits is improved
Investment cost	BTN 131 million
Description	

(1) Existing conditions

The nutritional status, such as the underweight of children under five years, infant mortality and maternal mortality, in Bhutan has been improving over recent decades. However, the daily vegetable intake per capita, as well as the daily egg intake per capita, does not come close to the minimum recommendations made by international organizations. Although traditional food habits should be respected, health concerns derived from food habits need to be taken into consideration in the course of pursuing the enhancement of GNH. Currently, there is no integrated general guidance for nutrition in Bhutan. Since nutritional improvement is also stated in national policy as well as SDG targets, it is the time to prepare these documents.

(2) Project description

i) Information collection and selection of documents to be prepared; some of the documents to be considered are “Standard Tables of Food Composition”, “National Nutrient Database”, “Dietary Guideline”, “Food Balance Guide” and “Good Nutrition in the First 1,000 days”.
ii) Gathering of data on food habits.
iii) Preparation of general guidance on nutrition.

As gathering information should not involve a single survey, it will be necessary to establish a periodical information-gathering system or facilitate an alignment with existing survey schemes, such as living standards surveys or national censuses.

(3) Social and environmental issues

No environmental impact is assumed.

Table 17.2.23 Expansion of Dietary Education (c-15)

Location	Bumthang, Chhukha, Dagana, Gasa, Samtse, Sarpang, Thimphu, Trongsa, Tsirang, Zhemgang.
Implementing body	MoE, DoA
Objectives	(1) To formulate the programme for dietary education (2) To implement the dietary education
Expected effects	(1) Awareness of nutritional education is improved. (2) Nutritional education is disseminated.
Investment cost	BTN 161 million
Description	

(1) Existing conditions

In Bhutan, the School Agriculture Programme (SAP) has been running for nearly two decades. The SAP is a joint initiative of the MoAF and MoE. It started with six pilot schools in 2000 and has since expanded to 303 schools in the country. Schools involved with the SAP provide agricultural activities for students on the school campus with the objective to meet their nutritional requirements and also inculcate farming as an alternative livelihood option in later life. Nowadays, some young are showing an interest in working in agriculture because of these educational programmes. Taking this programme as a basis, it is time to expand dietary education on a much larger and integrated scale.

(2) Project description

i) Selection of content to be included in the SAP; while knowledge of production techniques is the starting point for agricultural education, it is also important to understand how to utilize harvested products effectively for a better diet and how to sell agro-products for more income.
ii) Implementation of activities such as nutritional education with reference to existing documents and general guidance to be developed; trial marketing during sports and cultural festivals; visits to observe fields and exchange ideas with farmers; inviting farmers to act as supervisors for the SAP in order to enhance local communication.

(3) Social and environmental issues

No environmental impact is assumed.

Table 17.2.24 Establishment of Community Centres (c-16)

Location	Nationwide
Implementing body	DoA, LG
Objectives	(1) To prepare a management plan for a community centre (2) To establish the community centre
Expected effects	(1) Nutritional information is shared in the community centre. (2) The community centre is managed by villagers.
Investment cost	BTN 67 million
Description	

(1) Existing conditions

Due to Bhutan's steep geographical conditions, it is difficult for villagers to obtain agricultural technical guidance, marketing information and nutritional information in a timely and proper manner. It is important to overcome these issues for livelihood improvement in the rural area. One of the options is to establish village-level community centres where all the stakeholders, including villagers and government officers, can exchange information. In particular, nutritional information needs to be shared not only via school education, but also via a regional information-sharing system, since parents are responsible for the care of their children and normally control their food diet in the household. Hence, the establishment of community centres which all stakeholders are free to use is reasonable.

(2) Project description

i) Preparation of a community centre utilization and management plan.
ii) Establishment and utilization of community centres.

(3) Social and environmental issues

No environmental impact is assumed.

Table 17.2.25 Promotion of High-nutrition Food and Fortified Food (c-17)

Location	Bumthang, Chhukha, Dagana, Gasa, Samtse, Sarpang, Thimphu, Trongsa, Tsirang, Zhemgang.
Implementing body	DoA, MoH
Objectives	(1) To identify high-nutritional crops to be promoted (2) To disseminate high-nutritional crop production
Expected effects	(1) Nutrition for mothers and children is improved. (2) Income of farmers is improved.
Investment cost	BTN 131 million
Description	

(1) Existing conditions

Nutritional improvement is achieved not only by awareness campaigns involving the establishment of general guidance on nutrition, school education, sharing information and using community centres, but also by diversification of the food diet. There are some highly nutritious crops, such as quinoa, glutinous wheat and chia seeds. These can help to improve the health of the population. It is also claimed that improving nutrition for mothers and children during the first 1,000 days following birth helps to ensure that children get the best start in life and the opportunity to reach their full potential. In case it is difficult to take in the full amount of nutrients from available foods, using fortified food is one of the options. Fortified food contains necessary vitamin and minerals for children's health, while the promotion of fortified food is expected to improve indices on children's health.

(2) Project description

i) Selection of high-nutritional crops to be promoted, such as quinoa, glutinous wheat and chia seeds, and conducting cultivation trials.
ii) Selection of items to be fortified, based on the information from food dietary experts, field interviews and children's health indices, as well as the nutritional gap between recommended amounts of nutrients and actual intake; common issues related to poor nutrition relate to vitamins, energy, micronutrients, minerals, protein, iodine and iron.
iii) Dissemination of high-nutritional crop production and fortified food.

Demands for high-nutrition food have been increasing in the context of international trade, while there is potential for export of such food. Promotion of high-nutrition foods is expected to contribute to nutrition improvement as well as income generation.

Prior to fortified food dissemination, it is important to establish the quality standard for products and have them authorized by the BSB. In doing so, the quality of the products for end users will be ensured. Community centres can be utilized as distribution points.

(3) Social and environmental issues

No environmental impact is assumed.

Table 17.2.26 Productivity Improvement of Livestock (d-1)

Location	Gewogs with active livestock farming
Implementing body	DoL, MoAF
Objectives	(1) To develop a productive breed that is adaptive to local conditions (2) To develop a better feeding system according to rearing conditions (3) To improve the income of livestock farmers through increased livestock productivity
Expected effects	(1) A new productive breed is widely disseminated among local livestock farmers (2) A better feeding system is adopted by many local livestock farmers (3) Livestock production increases in value and quantity (4) The income of livestock farmers is improved by the introduction of the new breed and better feeding system
Investment cost	BTN 151 million

Description

(1) Existing conditions

In Bhutan, there is a variety of livestock activities. Dairy farming is one of the most significant activities because dairy products, especially butter and cheese, are important components of the Bhutanese diet. The regional distribution of livestock depends on animal type. Cattle and equines (including horses, mules and donkeys) are widely distributed across the country. Other livestock animals are unevenly distributed. For instance, more than 50% of poultry is raised in Sarpang and Tsirang. The unevenness of livestock distribution seems to largely result from suitable living conditions for each livestock animal. This indicates that livestock development should be planned by dzongkhags and/or gewogs in consideration of various factors, such as natural conditions, the distribution of the current animal population, and market accessibility.

It should be noted that, in Bhutan, there is a persistent dilemma between improving self-sufficiency in terms of livestock products and religious sentiment against slaughtering animals. Therefore, dairy livestock activities tend to be more acceptable than meat production activities.

(2) Project description

There has been a steady increase in the country's total milk production, mainly due to the increased number of cross-bred cattle, although domestic demand for milk has not been met by domestic production to date. Meat products have also been among the trade deficit items in Bhutan for many years. Improving the self-sufficiency rate for livestock products has been a policy target of the MoAF for a long time. However, the livestock population has stagnated since 2007, except for poultry and goats. This project intends to: 1) identify target livestock animals by gewog and/or dzongkhag in consideration of marketability and technical feasibility, 2) develop a new productive breed that is adaptive to the designated gewog and/or dzongkhag, mainly through a cross-breed method, which was successful in achieving steady milk production increases in the past, 3) develop a better feeding system by introducing good-quality fodder as well as concentrates, and 4) disseminate the newly developed productive breed and feeding system to local livestock farmers through livestock extension activities organized by the DoL in the gewog and/or dzongkhag. Project activities are as follows:

National Jersey Breeding Centre in Samtse released a dairy breed called 'Karan Fries' by crossing Holstein Friesian with Tharparkar, an Indian breed in 2014.
Photo: Obtained from MoAF website (http://www.moaf.gov.bt/karan-fries-a-new-dairy-breed-in-bhutan/)

a) Based on the latest statistics and field survey results, candidate livestock animals are selected by the designated gewog and/or dzongkhag.
b) For the candidate livestock animals, market surveys are conducted. Priority is given to the domestic market because of the intent to pursue import substitution. Information on the required quality of livestock products is also gathered. The best approaches to post-harvest operations, processing, food safety and distribution chains are discussed and clarified in order to meet the needs of markets.
c) Taking into consideration the characteristics of local breeds, a new productive animal breed is developed through various breeding methods including cross-breeding.
d) Research and development concerning a better feeding system are conducted to improve productivity. The normal feed resources available to livestock farmers are common property resources (forest and community

grazing grounds around settlements), forest, cultivated fodder and crop residues, which are regarded as less nutritious for achieving better productivity. (Normally, fodder improvement brings about a cost increase for livestock farmers; but, if the production increase exceeds the cost increase, this will counterbalance the increased cost.)

e) To disseminate the new productive animal breed and better feeding system, participation by local livestock farmers in activities will be promoted.

(3) Social and environmental issues

a) In many countries, large-scale animal-rearing facilities often cause water pollution and odour. In Bhutan, such large-scale animal farms are still unpopular, while these environmental issues in the livestock subsector do not become seriously apparent. If large-scale livestock rearing is planned, necessary measures/facilities and environmental considerations will be pursuant to the laws and regulations concerned.

b) For breed improvement, exotic animals may be imported into Bhutan. To prevent spread of disease, which is not prevalent in Bhutan, strict quarantine procedures should be applied.

c) Considerations on animal heath conditions are very important not only from healthy livestock production but also from environmental protection. Appropriate animal shed management is crucial to both aspects. As for poultry, JICA starts new activities (JICA Partnership Program) on poultry production utilising effective micro-organism in 2019, which may provide useful information.

d) In case dairy products are processed, full attention should be paid to sanitary conditions to avoid food poisoning. It may include 1) to scald tools before using, 2) to avoid intrusion of pests like insects and mice, 3) to avoid mixture of different germs, 4) to be processed with accurate time period and appropriate temperature at each stage of the processes, and so forth.

Table 17.2.27 Further Research and Marketing for Non-wood Forest Products and Medicinal and Aromatic Plants (e-2)

Location	Forestry and NWFP promotion area across the country
Implementing body	DoFPS, MoAF
Objectives	(1) To promote further research into NWFPs and MAPs (2) To accelerate marketing activities for NWFPs and MAPs based on the research results (3) To enable rural residents to utilize NWFPs and MAPs not only for themselves but also for income generation
Expected effects	(1) Useful NWFPs and MAPs are scientifically identified (2) Distribution of useful NWFPs and MAPs is clarified (3) Stable supply of useful NWFPs and MAPs is realized (4) Income generated through increase in NWFPs and MAPs
Investment cost	BTN 180 million

Description

(1) Existing conditions

Bhutan is regarded as one of the most forest conservation-oriented countries in the world. However, the sustainable utilization and management of forest resources are actually encouraged by the Bhutanese government. The country's forest vegetation is diversified, mainly due to its wide range of national territory, ranging from 100 m a.s.l. at the lowest point to nearly 7,000 m a.s.l. at the highest peak. As a result, various kinds of plants that are adaptive from sub-tropical to alpine environments are observed across the country.

For centuries, NWFPs such as bamboo and cane have been widely used by local people, but knowledge about them, particularly on MAPs, has not been systematically organized so far. Hence, research and marketing for NWFPs should be further promoted to achieve sustainable management and utilization of NWFPs and MAPs.

(2) Project description

Currently, the utilization of NWFPs in Bhutan is expanding, mainly due to the DoFPS' initiative to organize NWFP groups. The recent National Forestry Inventory results reveal that there are 76 MAPs grown in the country, but it seems that this kind of academic information on NWFPs and MAPs is not well disseminated to local people. This project intends to: 1) identify useful and profitable target NWFPs and MAPs in terms of marketability and the technical feasibility of domestication and/or cultivation, 2) clarify the distribution and amount of existing resources by species, 3) establish a stable supply system for target NWFPs and MAPs, either through sustainable gathering and/or cultivation, and 4) encourage local people to participate in income generation activities related to NWFPs and MAPs. Project activities are as follows:

a) Based on the National Forestry Inventory results, candidate target NWFPs and MAPs are selected in the designated forest area.
b) For the candidate NWFPs and MAPs, domestic and international marketability surveys are conducted. (As for bamboo products, it may be useful to collect information on the activities of the National Bamboo Mission in the North Eastern Region of India.)
c) In parallel with the marketability surveys, information on 1) the amount of current resources and the distribution of the candidate NWFPs and MAPs, 2) the required quality of the candidate NWFPs and MAPs, and 3) the possible domestication/cultivation of the candidate NWFP and MAP species is also collected. After integration of all kinds of data, a feasibility study on the candidate NWFPs and MAPs is conducted to formulate an adequate implementation plan. (For product designers, it seems that they need to have more creative ideas so training opportunities would be effective to incorporate more sophisticated designs.)
d) Coordination with the agencies and institutions concerned is conducted for smooth implementation of the activities.
e) If the target NWFP and MAP species can be cultivated, a stable material supply will be realized. Together with local people and administrations, the cultivation promotion of the target NWFPs and MAPs is conducted with technical assistance from the DoA.
f) If the target NWFP and MAP species cannot be cultivated, a system for the sustainable gathering of target NWFPs and MAPs species will be indispensable to avoid excessive gathering. For incorporation into the LFMP, appropriate gathering procedures (including permitted locations, permitted gathering period, eligible persons and royalty fee) are discussed and formulated with various stakeholders.
g) To disseminate the benefits of the target NWFPs and MAPs, participation by local people in activities is promoted.

There seem to be several potential products across the country. Some of them are listed below for reference.

- Bamboo handicraft products in Panbang, Zhemgang
- Herb oil products in Nubi Gewog, Trongsa
- Mushroom in Chhoekhor Gewog, Bumthang
- Chinese medicinal plants in Mothithang, Thimphu
- Honey in Phobji and Gangteng Gewogs, Wangduephodrang
- Wooden products (Dappa) in Yangtse
- Others (pottery in Gangzur Gewog, Lhuentse, hand-woven textiles in Adang, Wangduephodrang)

(3) Social and environmental issues

a) Basically, the activities related to NWFPs and MAPs should not be environmentally harmful. However, if the gathering of target NWFP and MAP species is done on a large scale, their extinction is possible. Hence, the establishment and implementation of an appropriate system for sustainable gathering are indispensable to conserve these species.

b) If any processing factories are planned to produce quality products made from the target NWFPs and MAPs, necessary legal procedures and environmental considerations will be pursued in accordance with the laws and regulations concerned.

Fig. 5 Medicinal plants representing seven different life forms (courtesy: P.W collection). *Lepisorus contortus* representing epiphytes (**a**). *Arisaema kansuensis* and *Rheum nobile* representing herbaceous form (**b**, **c**). *Usnea* species representing lichen (**d**). *Boschniakia himalaica* representing parasitic form (**e**). *Rhododendron glaucophyllum* representing a shrub (**f**). *Juniperus* species representing a tree form (**g**). *Clematis acutangula* representing a vine (**h**)

Source: Wangchuk, P. et al. 2016. Medicinal Plants of Dagala Region in Bhutan: Their Diversity, Distribution, Uses and Economic Potential. *Journal of Ethnobiology and Ethnomedicine*, 12:28.

17.2.3 Profiles of Priority Projects in Tourism Promotion Including CSI

Table 17.2.28 Project for Strengthening the Capacity for Tourism Promotion in the Eastern Region (f-1)

Location	Monggar, Trashigang, Yangtse and Lhuentse
Implementing body	Dzongkhags in Monggar, Trashigang, Yangtse and Lhuentse, and the Tourism Council of Bhutan (TCB)
Objectives	(1) To establish an Eastern Region brand (2) To develop a marketing and promotion strategy (3) To implement the tourism master plan prepared by the TCB (4) To support establishment of a Destination Management Organization (DMO) in each dzongkhag (5) To establish a cooperation system among the dzongkhags (6) To create unique and valuable souvenirs and handicrafts
Expected effects	(1) The number of international tourists and revenue will be increased (2) The benefits from tourism for locals and job opportunities will increase. (3) The DMOs will be established and responsible for the marketing and promotion strategy under a unified vision with the dzongkhags and the TCB (4) Related sectors such as CSI and agriculture will be promoted
Investment cost	BTN 215 million
Description	

(1) Existing conditions

Western areas, such as Paro, Thimphu and Punakha, have succeeded in tourism development to some extent by attracting international tourists. On the other hand, eastern areas have received fewer international tourists compared to western areas, although the former offer a lot of tourism potential. In addition, strategic and proactive marketing and promotion activities for eastern areas have not been sufficiently conducted. Under current circumstances, the TCB is formulating a tourism master plan, including the promotion of tourism development in eastern areas. To exploit regional tourism potential and attract international tourists, extensive cooperation between the dzongkhags is required.

(2) Project description

The overall goals are to increase the number of international tourists and tourism revenue. The project aims to: 1) establish an Eastern Region brand by distinguishing unique local tourism resources, 2) develop a marketing and promotion strategy, 3) implement a tourism master plan, 4) support the establishment of DMOs, 5) establish a cooperation system for the dzongkhags, and 6) create unique and valuable souvenirs and handicrafts. The proposed activities are mentioned below:

a) A baseline survey of tourism statistics and tourism resources is conducted to determine the exact situation and potential.
b) Key information on tourism resources is integrated and visualized by GIS.
c) Based on the baseline survey, a marketing plan is formulated with the setting of target countries.
d) Tourism contents and services are listed for potential international tourists.
e) An Eastern Region brand is formulated based on tourism resources, contents and services at the destination.
f) SNS marketing is introduced with support from experts.
g) The establishment of DMOs is supported with the identification of an umbrella organization.
h) As for the pilot projects, unique and valuable souvenirs and handicrafts are created.

(3) Social and environmental issues

Basically, there will be no significantly adverse social or environmental effects. Pilot projects have the potential to utilize natural resources such as trees, plants, rivers and mountains. In this context, careful consideration of the relevant social and environmental issues is required.

Table 17.2.29 Artist-in-residence Programme (f-2)

Location	Yangtse
Implementing body	Dzongkhags in Monggar, Bumthang, Trashigang, Yangtse and Lhuentse, and the TCB
Objectives	(1) To install another type of art to the dzongkhags (2) To connect tourism promotion with artistic dzongkhags (3) To raise local people's awareness of culture and art (4) To develop Yangtse by utilizing artistic work
Expected effects	(1) Increase of the number of tourists and revenue (2) Establishment of towns' international image as artistic dzongkhags (3) Improvement in Yangtse's international profile (4) Conservation of existing cultural sites and tradition
Investment cost	BTN 7 million
Description	

(1) Existing conditions

Yangtse Dzongkhag is characterized by unique handicrafts such as wooden bowls and recognized as the most sacred place in Eastern Bhutan. Furthermore, Yangtse has a special vocational training centre specializing in traditional arts such as Buddhist paintings, sculpture, chasing, lacquerware and sewing. In sum, Yangtse offers unique art and culture, which can be further exploited. However, the level of international tourist arrivals in Yangtse is just 0.3% of the total number of international tourists, mainly due to poor transportation access and undeveloped tourism resources.

(2) Project description

The aim of this project is to contribute to regional development and tourism development in Yangtse. The content of the project is to invite talented artists from around the world and to create artistic work with sufficient community support. The artists will be selected, based on their compatibility with the culture, history and local industry of Yangtse. In other words, regional development will be conducted by the artists and through their art. These artists will communicate with local people and tourists in open studios and workshops. There will be benefits for local people by being able to engage with outstanding international artists and developing local resources. The key issue is to promote dzongkhags as creative towns. The assumed project activities are as follows:

a) The artistic image for Yangtse will be identified
b) International artists will be selected based on Yangtse's artistic image
c) Yangtse will prepare for its role as a host village
d) Yangtse will support the activities of artists
e) Tourism promotion events will be organized to facilitate engagement with artists and their work
f) Yangtse will summarize the first batch of artists-in-residence and learn lessons for the next batch
g) Antenna shop and information centre in Thimphu

(3) Social and environmental issues

Basically, there will be no significantly adverse social and environmental effects. However, the artists will introduce different forms of art and culture to Bhutanese society. In addition, there are possibilities that the number of tourists visiting the host communities will be overwhelming due to the excellence of the artistic works on display. Preliminary discussions and preparations involving the host communities and local people are essential.

17.2.4 Profiles of Priority Projects in Information Technology and Mechanical Promotion

Table 17.2.30 Development of Gyalpozhing Tech Park (g-1)

Location	Gyalpozhing and Monggar
Implementing body	MoEA, DHI, Gyalpozhing College of Information Technology, RGoB, Monggar Dzongkhag, MoIC
Objectives	(1) To develop a second tech park in the Eastern Region as an ICT base (2) To attract investors (3) To contribute to regional development in the Eastern Region (4) To create information technology-related job opportunities in the Eastern Region
Expected effects	(1) Increased number of entrepreneurs in the information technology sector (2) Increased job opportunities in the information technology sector (3) Attract promising students to Gyalpozhing College of Information Technology
Investment cost	BTN 287 million
Description	

(1) Existing conditions

According to the Economic Development Policy, the ICT industry is emphasized as a core sector in the realization of the national development objective of a "green knowledge-based economy". Specifically, software development, animation, research and development, and a data processing centre are promoted. As an example of an ICT development project, Thimphu Tech Park was established in 2012 and has succeeded in creating 700 job opportunities. The ICT sector is considered as one of the promising sectors for further development.

(2) Project description

The project is aimed at the development of a second tech park in Monggar. Gyalpozhing College of Information Technology has neighbouring land, which can be used for the tech park. The park will become the basis of a domestic ICT industry and young entrepreneurship. Foreign teachers at the college, who are practitioners from the ICT industry, will provide practical advice and support to these entrepreneurs. The project will include the construction of necessary basic infrastructure such as the Internet, electricity, water and other utilities. The tech park will comprise office premises, an incubation centre and a data centre. In addition to the physical construction, promotional activities to attract investors will be implemented.

(3) Social and environmental issues

The development of the tech park will require the levelling of ground and the development of utilities, although the college is already in possession of the land for the park. An EIA should be conducted before construction. River bank erosion occurs in Gyalpozhing. The site selection will be examined to avoid the risk from the bank erosion.

Table 17.2.31 Formulation of a Plan for ICT Application Projects (g-2)

Location	Monggar
Implementing body	MoEA, DHI, Gyalpozhing College of Information Technology, RGoB, Monggar Dzongkhag, MoIC
Objectives	(1) To formulate a plan for ICT application (2) To validate its effectiveness in dealing with social issues (3) To confirm possible negative impacts (4) To create an ICT application package model for other dzongkhags
Expected effects	(1) Improved image for Monggar as an ICT town (2) Improvement in Monggar's international profile as an ICT town (3) Identification of the direction for issue resolution using ICT (4) Attracting investment including FDI
Investment cost	BTN 215 million

Description

(1) Existing conditions

ICT application is expected to resolve several social issues concerning, for example, education, health, disaster prevention and agriculture. For instance, if the health sector pursues online medical examinations, a health information network and electronic health records, some health issues such as a lack of doctors, access and information sharing could be resolved to some extent. ICT application for sectors has not yet become popular in Bhutan, although some activities have been started. In addition to conventional sectoral approaches in dealing with social issues, further ICT application including planning is expected.

(2) Project description

ICT application may have some negative impacts on society, as well as positive impacts. Thus, social experiment projects such as the pilot projects will be conducted to validate effectiveness in the specified area and the duration. This project will be implemented mainly by Gyalpozhing College of Information Technology and the tech parks in Monggar.

The project is aimed at the formulation of an ICT application plan in order to resolve social issues based on the results of social experiments. The project activities will be to develop a social experiment plan with key performance indicators, implement social experiment such as the pilot projects, identify lessons learned, construct an ICT application model and suggest a future vision for ICT application in Bhutan. The target sectors are education, health, remote working, disaster prevention, construction, tourism, agriculture and the fab lab. The social experiment includes use of drones and UAVs for human-wildlife conflict countermeasures, transport to a remote area, and labour-saving agricultural tools. The plan is finalized based on the results of the pilot projects in several sectors.

(3) Social and environmental issues

The pilot projects will conduct social experiment using drones and UAVs. Thus, regulations should be confirmed and announcements made to local people in advance.

17.2.5 Profiles of Priority Projects in Mining and Manufacturing Promotion

Table 17.2.32 Formulation of a Mining Master Plan Project

Location	Thimphu, Zhemgang and Sarpang (tungsten-reserved places)
Implementing body	MoEA
Objectives	(1) To formulate a mining master plan which recommends strategically competitive products for the market (2) To develop human resources for planning, marketing and GIS data management
Expected effects	(1) To identify competitive final products for foreign and domestic markets (2) To create a value chain which promotes local industries (3) To develop a planner and GIS specialist required for the preparation and implementation of the mining master plan (4) To develop an institutional system for resource management and environmental management
Investment cost	BTN 215 million
Description	

(1) Existing conditions

Mineral resources in Bhutan are important natural and non-renewable resources for sound socio-economic development. Only 40% of Bhutan has been geologically mapped to date, despite the endowment of abundant mineral resources. Long-term strategies have not been formulated in the mining sector, although the Mineral Development Policy was enacted in 2017.

(2) Project description

A mining master plan, which sets out the long-term prospects including international demand, will be formulated. The completion of the mapping of mineral resources and the formulation of data management will be essential preconditions to the formulation of the strategic master plan. An outline of the project is shown below.

- To prepare an inventory map of mineral resources
- To carry out marketing to identify further value addition of existing mineral resources such as limestone, dolomite and gypsum for export and domestic uses
- To prepare a proposal to develop a new mineral resource
- To prepare recommendations to establish a data management system for mineral resources
- To prepare recommendations to attract foreign resource companies
- To carry out human resource development in order to identify a planner to create a mining strategy based on the international market, a GIS specialist to create a GIS database and a specialist to carry out efficient environmental management

(3) Social and environmental issues

Tungsten is reserved in the wildlife sanctuary. If the development of tungsten is decided, approval should be obtained from the NEC, the GNHC and the related ministry in order to proceed with development via study and discussion.

Measures to evaluate contributions to local society, such as job creation and return on profits to be used for social activities, will be studied.

Table 17.2.33 Project for Improving the Management of Investments

Location	Thimphu
Implementing body	MoEA
Objectives	(1) To improve the management of investment promotions in the manufacturing sector (2) To develop human resources for marketing and investment promotion
Expected effects	(1) To improve the investment environment on industrial estates in the Southern Economic Corridor (2) To identify prospective markets and foreign investors (3) To create a specialist for investment promotion and management
Investment cost	BTN 36 million

Description

(1) Existing conditions

Industrial estates will be developed in Motanga, Jigmeling, Dhamadum and Bondeyma. These industrial estates cover vast land areas; in particular, Jigmeling in Sarpang will become the largest estate in Bhutan with 755 acres. The types of industries are mainly assumed to be mineral-, agro- and forest-based. The main issue is how to attract both domestic and foreign investors.

Bhutan's business development is better than that of neighbouring countries, although there are critical issues, such as its geographical location as well as being a small-scale market for foreign investors. In the Doing Business Report from the World Bank, lower-level items such as dealing with construction permits (ranked 97th), obtaining credit (ranked 82nd), protecting minority investors (ranking 114th) and resolving insolvency (ranked 169th) should be improved. Improvements to the business environment are required to promote the Southern Economic Corridor.

(2) Project description

The project aims to improve the management of investment including foreign direct investment. The content of the project includes the development of an internal manual, the analysis of prospective investors, and marketing activities for attracting foreign investors. The project will include the following activities:

- To prepare recommendations to improve legal and institutional arrangements including the formulation of an energy policy in order to deliver stable and cheap energy prices
- To prepare a development plan to improve the living environment in neighbouring areas of the industrial estates
- To prepare a development plan to improve urban functions and facilities in neighbouring areas of industrial estates
- To prepare a development plan to establish a one-stop service window for each industrial estate
- To prepare recommendations to improve the lower-level items estimated for Bhutan in the Doing Business Report
- To carry out human resource development in order to identify a planner with experience of SEA development and a planner who can attract foreign investors

(3) Social and environmental issues

No negative impact is expected.

17.2.6 Profiles of Priority Projects in Inland and Air Transport Development

Table 17.2.34 Arterial Road Network (i-5~i-8)

Location	East-west route (north): Wangdue-Trongsa, Trongsa-Bumthang, Bumthang-Monggar, Monggar-Trashigang
Implementing body	DoR, MoWHS
Objectives	To formulate a ladder-type arterial road network with efficient travel times (six north-south routes taking eight hours or less and two east-west routes taking 16 hours)
Expected effects	To develop an efficient and reliable transport system in order to ensure economic development by interlinking different regions and areas within a region
Investment cost	BTN 16,354 million
Description	

(1) Existing conditions

The proposed ladder-type arterial road network, comprising six north-south routes with a target travel time within eight hours and two east-west routes within 16 hours, will connect four longitudinal regions, regional centres and most of the district centres. However, the travel time on some sections of the road network is still less than the target speed in the design standards. There are multiple issues to be resolved in order to improve the travel time. Thus, appropriate targets for this improvement should be set. Reliability is also important.

This project comprises four road sections on the east-west route (in the north) as shown in the table below. The target travel speed is estimated to be the travel time over two days from west to east (or Paro-Trashigang) along the east-west routes. The estimated target travel speed is 37.8 km/h for the east-west routes. Considering the target travel speeds and the importance of the routes, the target design speed is proposed as 40 km/h based on the road design standard in Bhutan. The average travel speed on all four sections is lower than the target design speed. Improving these sections will help to improve the average travel speed.

Type	Routes		Route Length (k Km)	Average Travel Time (H)	Average Travel Speed (Km/h)
	ID	Name			
East-west route (north)	**EW-1**	**Paro-Trashigang:**	**605**	**20**	**30.2**
		a. Paro-Chuzom	24	0.6	36
		b. Chuzom-Thimphu	30	0.5	60
		c. Thimphu-Mesina	59	2	29.5
		d. Mesina-Wangdue	11	0.3	33
		e. Wangdue-Trongsa	129	4.5	28.6
		f. Trongsa-Bumthang	68	2	34
		g. Bumthang-Monggar	193	7	27.5
		h. Monggar-Trashigang	91	3	30

(2) Project description

This project is critical to the formulation of the East-West Corridor (in the north). In particular, improved road accessibility will have a direct impact on the development of the Eastern Region. In addition, district centres and SDCs along the project routes will be also connected by more reliable roads. This improvement will also contribute to the development of towns and villages in the areas surrounding the project routes. An outline of the project is shown below.

Title of Project	Project Cost (BTN Million)	Project Outline
EW-1-e: Wangdue-Trongsa	4,386	129 km, double laning
EW-1-f: Trongsa-Bumthang	2,312	68 km, double laning
EW-1-g: Bumthang-Monggar	6,562	193 km, double laning
EW-1-h: Monggar-Trashigang	3,094	91 km, double laning

(3) Social and environmental issues

Only a minor impact on roadside residents is anticipated due to road widening. An EIA will be carried out in order to study the assumed impacts and identify countermeasures in line with the related acts and regulations.

Table 17.2.35 Arterial Road Network (i-9~i-10)

Location	East-west route (south): Samtse-Phuntsholing, Gelephu-Panbang
Implementing body	DoR, MoWHS
Objectives	To formulate a ladder-type arterial road network with efficient travel times (six north-south routes taking eight hours or less and two east-west routes taking 16 hours)
Expected effects	To develop an efficient and reliable transport system in order to ensure economic development by interlinking different regions and areas within a region
Investment cost	BTN 7,684 million
Description	

(1) Existing conditions

The proposed ladder-type arterial road network, comprising six north-south routes with a target travel time within eight hours and two east-west routes within 16 hours, will connect four longitudinal regions, regional centres and most of the district centres. However, the travel time on some sections of the road network is still less than target speed in the design standards. There are multiple issues to be resolved to improve the travel time. T Thus, appropriate targets for this improvement should be set. Reliability is also important.

This project comprises four road sections on the east-west route (in the south), as shown in table below. The target travel speed is estimated to be the travel time over two days from west to east (or Samtse-Samdrupjongkhar) along the east-west routes. The estimated target travel speed is 30.5 km/h for the east-west routes. Considering the target travel speeds and the importance of the routes, the target design speed is proposed as 40 km/h based on the road design standard in Bhutan. The average travel speed on all the four sections is lower than the target design speed. Improving these sections should help to improve the average travel speed.

Type	Routes		Route Length (Km)	Average Travel Time (H)	Average Travel Speed (Km/h)
	ID	Name			
East-west route (south)	**EW-2**	**Samtse-Samdrupjongkhar (without environmentally negative impact)**	**488 (231)**	**-**	**-**
		a. Samtse-Phuntsholing	61	-	-
		b. Phuntsholing-Monitor	48	-	-
		c. Monitor-Raidak	35	-	-
		d. Raidak-Llamoizingkha	18	-	-
		e. Llamoizingkha-Sarpang	(87.5)	-	-
		f. Sarpang-Gelephu	39	-	-
		g. Gelephu-Panbang	(70)	-	-
		h. Panbang-Nganglam	55.6	-	-
		i. Nganglam-Dewathang	(74)	-	-

(2) Project description

This project is critical to the formulation of the East-West Corridor (in the south). In particular, improved road accessibility will have a direct impact on the development of the Eastern Region. In addition, district centres and SDCs along the project routes will be also connected by more reliable roads. This improvement will also contribute to the development of towns and villages in the areas surrounding the project routes. Feasibility of improvement of missing sections on the East-West Corridor should be studied prior to implementation of this project because the missing sections will significantly impair benefit to be obtained from networking of the corridor. The feasibility study should include environmental impact assessment for the sections of Lamozingkha-Sarpang and Nganglam-Dewathang. An outline of the project is shown below.

Title of Project	Project Cost (BTN Million)	Project Outline
EW-2-a: Samtse-Phuntsholing	2,074	61 km, double laning
EW-2-g: Gelephu-Panbang	5,610	165 km, double laning of the existing route

(3) Social and environmental issues

Only a minor impact on roadside residents is anticipated due to road widening. An EIA will be carried out in order to study the assumed impacts and identify countermeasures in line with the related acts and regulations.

Table 17.2.36 Technology Transfer Programme for Slope Protection and Tunnels (i-15)

Location	Entire country
Implementing body	DoR, MoWHS
Objectives	Elimination of road closures due to landslides and slope failures
Expected effects	To secure transportation throughout the year on the arterial road network in order to ensure travel safety (interregion)
Investment cost	Soft component
Description	

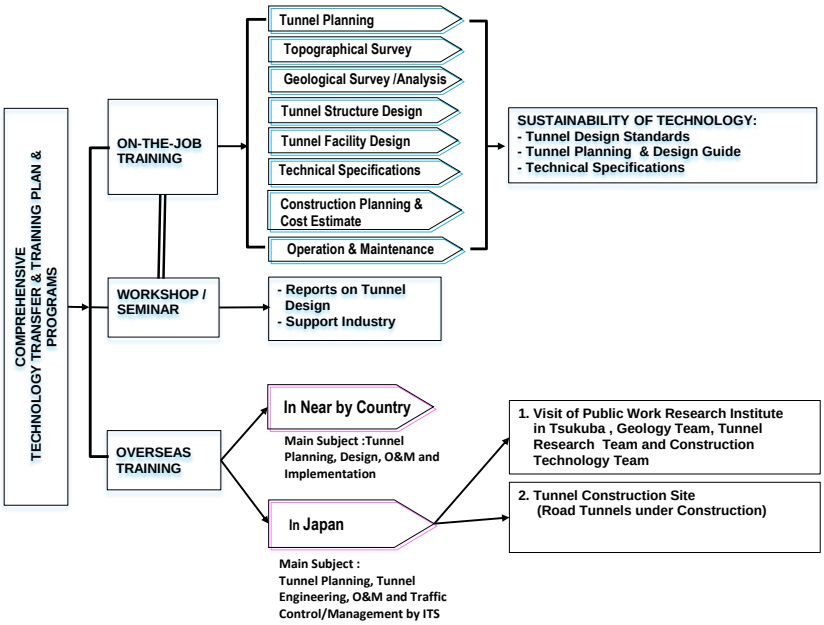
(1) Existing conditions

Roads in Bhutan are geologically fragile due to a very steep mountainous terrain and there are no end of slopes and landslides along the roads. Previous major slope failures have been recorded by the DoR, most of which overlap with the proposed network. The elimination of road closures due to landslides and slope failures is required in order to achieve a stable road network.

Countermeasures for landslides include stabilization by physical means and bypasses with structures such as tunnels and bridges. Massive structures for stabilization and bypasses generally require advanced technology and large amounts of cost. Tunnels especially require more advanced technologies and larger budgets compared with other countermeasures. Given that current practices regarding landslide stabilization and bypass structures are at an early stage in Bhutan, stepwise implementation planning, which starts with technology transfer, is essential.

(2) Project description

The construction of landslide treatments and bypass structures, such as tunnels and bridges, needs considerable investments and a lengthy implementation period. Moreover, current practices in landslide treatment and tunnel technology are far from mature in Bhutan. Therefore, stepwise implementation, starting with technology transfer, is essential. Technology transfer in the context of tunnel engineering will include geological investigations and analysis, structure design and construction, and O&M. Adopting a comprehensive technology transfer plan and related programmes is required for surveying, planning, designing, constructing, maintaining and operating mountainous tunnels, as outlined in the following figure.



Comprehensive Tunnel Technology Transfer Plan/Programmes

(3) Social and environmental issues

This programme involves technology transfer in order to design, construct, operate and maintain a tunnel. No environmentally and socially negative impacts are assumed at the time of writing this report.

Table 17.2.37 Technology Transfer Programme for the Development of Road Structure Design Standards (i-18)

Location	Entire country
Implementing body	DoR, MoWHS
Objectives	To maintain and improve the rural road network in order to provide socio-economic services
Expected effects	Securing road surface properties in order to improve travel conditions
Investment cost	Soft component
Description	

(1) Existing conditions

The formulation of a proposed service delivery network linking GCs and service facilities on the road network is essential. However, the budget for road improvements is limited to covering the large number of existing feeder roads, such as GC roads and farm roads. Therefore, the prioritization of roads for improvement must be consider the following issues:

- Prioritization of road sections to be improved on GC roads and farm roads
- Review and update design and construction standards and methods in order to ensure the durability of improved structures

Practical pavement design standards, which are appropriate for various conditions, should be developed based on a review of improved GC roads.

(2) Project description

Financial resources for GC roads are limited. A simple standardized pavement and drainage design for GC roads is not economical. Therefore, practical pavement design standards to reflect the various local conditions should be developed, based on a review of constructed GC roads.

(3) Social and environmental issues

This programme involves technology transfer in order to formulate design standards for rural roads, which are appropriate for the local conditions in Bhutan. No environmentally and socially negative impacts are assumed at the time of writing this report.

Table 17.2.38 Intercity Bus Terminal Development (i-19)

Location	Dzongkhags/thromdes
Implementing body	Dzongkhags/thromdes
Objectives	Improvement of bus-related facilities (terminal, bay, fuel station etc.) to provide an efficient and comfortable service to passengers
Expected effects	Improved interregional public transport system and infrastructure
Investment cost	BTN 500 Million/location
Description	

(1) Existing conditions

Regional centres are mostly connected by frequent long-distance interregional bus services. However, the service level of long-distance interregional buses is still low because of the existence of an old and uncomfortable bus fleet, dysfunctional bus terminals, unreliable bus operations etc. To improve long-distance interregional bus services, improvements in the above conditions are essential. Terminals for interregional buses are not functional in terms of ticket sales, waiting spaces, provision of information about bus operations and transfers, etc. Therefore, the availability of appropriate terminal facilities for major hubs in the interregional bus network is an important issue.

(2) Project description

Developing the provision of appropriate terminal facilities for major hubs in the interregional bus network.

(3) Social and environmental issues

a) Only a minor impact on project sites is anticipated, such as resettlement.

Table 17.2.39 City Bus Terminal Development (i-23)

Location	Dzongkhags/thromdes
Implementing body	Dzongkhags/thromdes
Objectives	Improvement in bus-related facilities (terminal, bay, fuel station etc.) in order to provide an efficient and comfortable service to passengers
Expected effects	Improved intercity public transport system and infrastructures
Investment cost	BTN 500 million/location
Description	

(1) Existing conditions

Regional centres are mostly connected by frequent long-distance interregional bus services. However, the service level of long-distance interregional buses is still low because of the existence of an old and uncomfortable bus fleet, dysfunctional bus terminals, unreliable bus operations etc. To improve long-distance interregional bus services, improvements in the above conditions are essential. Terminals for intercity buses are not functional in terms of ticket sales, waiting spaces, provision of information on bus operations and transfers, etc. Therefore, providing appropriate terminal facilities for major hubs in the intercity bus network is an important issue.

(2) Project description

Developing the provision of appropriate terminal facilities for major hubs in the interregional and intercity bus networks.

(3) Social and environmental issues

Only a minor impact on project sites is anticipated, such as resettlement.

Table 17.2.40 Comprehensive Master Plan for the Second International Airport Development and Improvements to Domestic Airports (j-1)

Location	Gelephu, Bumthang, Yonphula,
Implementing body	MoIC
Objectives	(1) To formulate a comprehensive master plan for a second international airport (2) To carry out a feasibility study for a second international airport (3) To formulate an improvement plan for domestic airports
Expected effects	(1) The feasibility of a second international airport is clarified (2) Possibility of internationalization of domestic airports is clarified (3) A holistic air transport system is established to supplement land transport
Investment cost	BTN 9 million
Description	

(1) Existing conditions

An alternative study for the development of a second international airport is necessary. There is a special focus on Gelephu Airport because it is planned to be an international airport by the RGoB. In line with regional promotion in the Eastern Region, Yonphula Airport is a suitable location; however, a hilly topography is a constraint in terms of creating a runway with an adequate length. The unforeseeable weather is an obstacle to securing the reliability of airline schedules. Another option is to expand the existing domestic airport into a second international airport in Bumthang. This option would contribute to the development of the Central Region, but this would be far from the case in the Eastern Region. Flatland is not available to an adequate extent around Bumthang Airport. Each candidate location has advantages and disadvantages.

As proposed in the holistic service system in the CNDP, UAVs are alternative means of transport to supplement land transport, especially in remote areas. An integrated air transport network is necessary to improve the public service delivery system.

(2) Project description

The project will include the following activities:

(a) To estimate the demand of international and domestic air passenger and aerial transportation
(b) To select the most suitable location of a second international airport
(c) To study the needs and potential to operate a third and fourth international airport
(d) To carry out a feasibility study for a second international airport
(e) To prepare recommendations for an integrated air transport network including international and domestic air flights and UAVs

(3) Social and environmental issues

Land development will be required to construct the second international airport. An initial environmental examination will be carried out to recommend the necessary measures to prevent environmental impacts.

Table 17.2.41 Development of Subsidies to Promote Domestic Air Transport Use by Local People (j-4)

Location	Entire country
Implementing body	MoIC
Objectives	Supplemental transport service for the arterial road network and promotion of the domestic air transport service
Expected effects	To make the air transport service more affordable to the national population
Investment cost	BTN 72 million
Description	

(1) Existing conditions

Advanced services in various sectors disproportionately exist across the country. Widening accessibility to advanced services in each region is essential to the promotion of balanced national development. In this regard, improving the service and affordability of air transport should centre on the Eastern Region, as it has poor accessibility to the nation's industrial integrated area and international portals. The number of domestic air transport passengers is low, especially on the Paro-Trashigang route because local people are not aware that air transport is available or because of the relatively high ticket prices of flights, comparing with those of bus transport. Private airlines find it difficult to participate in domestic air transport services because of low profitability. Thus, the introduction of government subsidies to promote domestic air transport services, as well as enabling the participation of private airlines, is important.

(2) Project description

Air transport services are mainly limited to tourism or governmental business use. To promote air transport services in Bhutan, it is necessary to encourage local passengers away from land transport options. Improving cost competitiveness is key issue. Therefore, it is necessary to develop a subsidy system for domestic air transport operations, based on performance-based evaluation criteria for unprofitable routes. This should promote the use of domestic air transport as well as the participation of private airlines.

(3) Social and environmental issues

This project aims to make institutional improvements in order to support domestic air routes. No environmentally negative impacts are assumed at the time of writing this report.

Table 17.2.42 Promotion of Electric Vehicles for Private and Public Transportation (k-1)

Location	Thromdes
Implementing body	Thromdes
Objectives	Promotion of electric cars and quick charging stations, electrification of public transportation
Expected effects	Reduction in CO_2 and an environmentally symbiotic habitation free from oil
Investment cost	BTN 202 million
Description	

(1) Existing conditions

A transport sector produces a certain proportion of CO_2 emissions compared to other sectors in Bhutan. EVs have been introduced in Bhutan in order to reduce discharges of CO_2. Hydroelectric power generation is the dominant electric generation system in Bhutan. The promotion of EVs should contribute to the transition to an all-electric society and an environmentally symbiotic habitation free from oil, which will be effective in supporting sustainable development in Bhutan.

In the context of the above, promotion of EVs and quick charging stations, the electrification of public transportation and the introduction of drone-based freight transport systems for remote areas are proposed as solutions for a better transport system.

The introduction of EVs in Bhutan started with relevant promotion activities conducted by a car company. About 70 EVs were registered in 2015 for government use, private use and taxi use. However, the number of EVs has not especially increased, as there were only 93 registered EVs in 2017. There are several reasons for this at an institutional and infrastructural level, as per below:

- Prohibitive initial costs of EVs
- Insufficient performance by EVs in terms of driving distance
- Limited performance and number of quick charging stations
- Low resale price due to having to replace the expensive battery
- Poor customer service system due to absence of proper EV mechanic

(2) Project description

Considering the current low level of EV ownership, practicalities in terms of driving range and charging time, and affordability, the promotion of EVs needs a stepwise approach in relation to environmental measures, especially for private use. Therefore, public use along with government subsidies should be promoted in advance.

The following measures for private EV use are proposed:

- Promotion of initial demand (preferential taxation, subsidies, service promotion etc): Subsidies and tax cuts have played a major role in the rapid spread of EVs around the world. The subsidies offered for purchasing EVs vary by country, while the EV penetration rate tends to be high in countries with high subsidies. Introduction of EV for private in initial period requires promotion of customer service in terms of physical service (inspection, adjustment, repair) and instruction to drive the EV. of use service. Therefore, human resource development for those services is essential.
- Installation of quick charging stations: Most users normally charge their EVs at home or the workplace, followed by public charging and, in rare cases, quick charging station in the course of long-distance driving. It is necessary to install quick charging station so as to meet the needs of EV owners.
- Establishment of an autonomous market: In addition to measures for the promotion of initial demand and the installation of quick charging stations, a major initiative from the government regarding the EV share target is essential.

The following measures for public EV use are proposed:

- Promotion of initial demand (preferential taxation, subsidies, service promotion etc): Subsidies and tax cuts for EV bus operations are essential to encourage private bus operators in this regard in Bhutan.Human resource development for service promotion is also essential.- Installation of quick charging stations: EV bus charging stations to be located at bus depots in addition to public charging facilities. Subsidies for the installation of quick charging stations at appropriate location are important.

(3) Social and environmental issues

a) Treatment of discarded vehicle with an internal-combustion engine is required to prevent the environmentally negative impacts.
b) Human resource for IoT technology is required for effective use and maintenance of EVs.

Table 17.2.43 Drone-based Freight Transport System for Remote Areas (k-2)

Location	Remote areas
Implementing body	MoIC
Objectives	Introduction of drone-based freight transport system for remote areas
Expected effects	Reduction of CO_2 and an environmentally symbiotic habitation free from oil
Investment cost	BTN 72 million
Description	

(1) Existing conditions

Cargo delivery to remote area has been highly burdensome for cargo distributers because delivering cargo to remote areas is not efficient in terms of fuel consumption. Therefore, alternative means for cargo delivery to remote areas have been being investigated, with UAVs among the alternatives. However, the practical use of UAVs is still in its infancy, with technical and environmental solutions needed to bring about commercialization.

(2) Project description

UAVs have not been commercialized even in developed countries; thus, environmental initiatives for commercialization are important.

The following measures for UAV use are proposed:

Technical Issues

- Realization of out-of-sight flight: The development of technology for efficient long-distance flights, with a reliability equivalent to manned aircraft, and automatic operation management methods is necessary.
- Prevention of unauthorized use: The development of technology for automatic operation management methods and an automatic authentication system, as well as the utilization of image and communication data, is necessary.
- Utilization technology: The development of technology for automatic operation management methods and an automatic authentication system, as well as the utilization of accident failure data and image and communication data, is necessary. Exploring fields of use is also necessary.

Environmental issues

Regarding non-technical measures, environmental measures for the following are necessary:

- Piloting licences
- Type certification
- Airworthiness certification
- Flight applications/permissions
- Safety management system
- Accident reporting and related improvements
- Insurance
- Mapping and navigation

(3) Social and environmental issues

No environmentally negative impacts are predicted. Environmental and social impacts will be monitored when UAV usage is expanded.

CHAPTER 18 ENVIRONMENTAL IMPACT ASSESSMENT OF THE COMPREHENSIVE NATIONAL DEVELOPMENT PLAN

18.1 Environmental Impact Assessment Application Target

An Environment Impact Assessment (EIA) was applied to general guidance given under Chapters 14-16 and high priority projects and programmes given under Chapter 17 because these components highlight the nation's development direction and, therefore, contain actions and initiatives that should be the targets of an impact assessment.

The general guidance was presented so as to set out the direction of sustainable development in priority sectors such as 1) urban and rural development, 2) agriculture, livestock and forestry, 3) tourism, 4) information technology and mechanization, 5) mining and manufacturing, and 6) transport.

The high priority projects and programmes were selected from among the candidate projects and programmes as proposed in the course of the formulation of general guidance. In order to select the high priority projects and programmes, four assessment standards and 14 assessment criteria were developed as screening standards and applied. Detailed methodology on how to apply these assessment standards and criteria was described in Section 17.1.

As a result of screening, a total of 22 priority projects and programmes was selected from the priority sectors as shown in Table 18.1.1.

Table 18.1.1 List of 30 Priority Projects/Programmes

Sector	Priority Projects and Programmes
a. Urban development	a-2. Eastern Region Development Programme
	a-4. Formulation of Regional Plan for Sarpang-Gelephu Linked Urban Centre
	a-6. Project for Institutionalising Land Use Control Measures in Urbanization Management Areas of Thimphu, Phuentsholing, and Gelephu
b. Rural development	b-1. Development of a Comfortable Rural Living Environment
	b-6. Project for Dzongkhag Vitalization in Eastern Region
c. Agriculture promotion	c-2. Improvement of Cultivation Techniques for Labour Saving
	c-4. Establishment of Community-wildlife Coexistence
d. Livestock promotion	d-1. Improvement of Livestock Productivity
e. Forestry promotion	e-2. Further Research and Marketing for Non-wood Forest Products and Medicinal and Aromatic Plants
f. Tourism promotion including CSI	f-2. Artist-in-residence Programme
g. Information technology and mechanical promotion	g-1. Development of Gyalpozhing Tech Park
	g-2. Formulation of a Plan for Social Experiment Projects
h. Mining and manufacturing promotion	h-1. Formulation of a Mining Master Plan
i. Inland transport development	i-5. Arterial Road Network of EW-1-e: Wangdue-Trongsa
	i-6. Arterial Road Network of EW-1-f: Trongsa-Bumthang
	i-7. Arterial Road Network of EW-1-g: Bumthang-Monggar
	i-8. Arterial Road Network of EW-1-h: Monggar-Trashigang
	i-15. Technology Transfer Programme for Slope Protection and Tunnels
	i-18. Technology Transfer Programme for the Development of Road Structure Design Standards
j. Air Transport development	j-1. Comprehensive Master Plan for a Second International Airport Development and Improvements to Domestic Airports
	j-4. Development of a Subsidy Scheme to Promote Domestic Air Transport Use by Local People
k. Transport using advanced technology	k-2. Drone-based Freight Transport System for Remote Areas

18.2 Environmental Impact Assessment Methodology

18.2.1 Impact Assessment Process

An impact assessment of general guidance and priority projects and programmes was conducted by the following process:

(a) Confirmation of target guidance/high priority projects and programmes for EIA purposes
(b) Identification of impact sources and factors included in the target guidance and high priority projects and programmes
(c) Identification of potential impacts of the target guidance and high priority projects and programmes through the analysis of the impact sources and factors identified above
(d) Evaluation of the potential impacts through an analysis of the nature of the potential impacts
(e) Identification of environmental management measures including both enhancement measures for positive impacts and mitigation measures for negative impacts

The identified impact sources and factors are examined in consideration of not only primary (direct) impacts but also secondary impacts based on exercising expert judgement. In this regard, the identified potential impacts were discussed in the second stakeholder meeting (SHM) and confirmed.

18.2.2 Range of Environmental Areas

The range of environmental areas for the identification of potential impacts is the same as that set in the SEA of development alternatives (refer to Chapter 10), namely, the following nine areas:

(a) Land
(b) Water
(c) Air
(d) Biodiversity
(e) Waste management
(f) Climate change
(g) Socio-economic aspect
(h) Culture and tradition
(i) Health and sanitation

These individual environmental areas and social settings are not exactly the same as those stipulated in the National Guidelines for SEAs in Bhutan (2016) or the JICA Guidelines for Environmental and Social Considerations (2010), but the above nine areas practically cover those stipulated in the two guidelines.

18.2.3 Limitation of the Assessment

There are limitations to the impact identification and assessment in the SEA of the development alternatives, as itemized in Section 17.1.2, namely: difficulty in identifying potential impacts because of no clear actions/initiatives set out in the development alternatives; limited availability of baseline conditions; and uncertainties in cause-and-effect relationships.

For the impact assessment of the CNDP, these limitations are still in existence, but they are alleviated to some extent, thanks to the provision of actions/initiatives contained in the general guidance and priority projects and programmes, even though they are not sufficiently clear. However, there are still some limitations to carrying out an impact assessment of the CNDP: level of the analyses of the identification and evaluation of the potential impacts is a primary limitation, which is inevitably in line with the planning level of the general guidance and high priority projects. In other words, the general guidance and high priority projects are planned without specifying such conditions as location, scale/dimension of the structures, or activities involved in most cases. Therefore, there are still several uncertainties about the identification of potential impacts of the guidance and high priority projects attributable to these conditions.

18.3 Environmental Impact Assessment of General Guidance

18.3.1 Target Guidance in the Environmental Impact Assessment

The target general guidance for the EIA is described in Chapters 14 to 16 and covers the following sectors:

(a) Urban and rural development
(b) Agriculture, livestock and forestry
(c) Tourism,
(d) Information technology and mechanization
(e) Mining and manufacturing
(f) Transport

Table 18.3.1 summarizes the target general guidance for the EIA, highlighting the purpose and

actions/initiatives included in the individual guidance (refer to Chapters 14 to 16).

Table 18.3.1 Summary of Target General Guidance in the Environmental Impact Assessment

No.	Aim	Purpose	Major Actions/Initiatives Included
Sector: Urban and rural development			
1	Formulation of liveable and vigorous urban area	Preparation for in-migration from the rural area and provide well-organized public services and job opportunities	• Preparation of urban management plans (spatial plan, structure plan, local area plan) • Study to establish an efficient service system in each town and linked urban centre • Establishment of planning committee in thromdes and towns
2	Formulation of liveable and beautiful rural area	Improvement of living conditions in the rural area	• Public facility development (infrastructure, education and health facilities, utilities etc.) • Measures for job creation (promotion of agro-processing, green tourism, construction, etc., i.e., eco-friendly jobs) • Measures for making primary industry more attractive to young people
Sector: Agriculture, livestock and forestry			
3	Agriculture promotion	• Improvement of self-sufficiency rate for rice • Promotion of market-oriented farming • Nutritional improvement	• Area expansion for winter cropping and yield increase • Realization of the NIMP • Improvement of accessibility (farm roads) and storage facilities • Establishment of community centre
4	Livestock promotion	• Increase of livestock population • Productivity improvement	• Breeding improvement • Encouragement of animal shed improvement • Support for effective artificial insemination
5	Forestry promotion	• Sustainable management and utilization of forest resources	• Encouragement of LFMP formulation, • Promotion of NWFPs and MAPs • Improvement of forest roads and the cable crane network for promotion of wood-based industry • Renewal of old trees by effective thinning
Sector: Tourism			
6	Tourism promotion including CSI	• Establishment of sustainable tourism • Increased number of tourists visiting the Eastern Region	• Conducting research and marketing activities for tourism • Development of tourism resources (regional brand, themes, tourist sites etc.) • Collaboration with CSI for narrative- and theme-based tourism.
Sector: Information technology and mechanization			
7	Information technology and mechanical promotion	• Promote ICT development as a key enabler for sustainable economic development	• Foundation and development of ICT networks and stable platform • Development of ICT model town and Gyalpozhing Tech Park in Monggar
Sector: Mining and manufacturing			
8	Mining and manufacturing promotion	• Development of mining and manufacturing through a proper management system	• Surveys on existing mining resources and mapping • Formulation of a mining strategic plan • Development of the business environment for attracting investment in the SEZ
Sector: Transport			
9	Inland transport development	• Development of an efficient and reliable transport system for economic	• Formulation of ladder-type arterial road network by constructing new roads and/or widening for double laning

No.	Aim	Purpose	Major Actions/Initiatives Included
		activity and travel safety throughout the year	• Technology transfer for slope protection, tunnelling and road structure design • Development of bus terminal • Construction of new roads within Protected Areas
10	Air transport development	• To ensure a hierarchical national air transport network and economic development	• Preparation of a comprehensive master plan for both domestic and international air transport • Promotion of the domestic air transport service
11	Transport using advanced technology (UAVs and EVs)	• Promotion of sustainable development through the utilization of renewable natural resources (i.e., hydropower generation)	• Promotion of initial demand for UAVs/EVs and installation of quick charging stations • Development of technical and environmental arrangements

18.3.2 Findings of the Environmental Impact Assessment of General Guidance

The findings, following the identification and evaluation of major potential impacts, as well as the examination of strategic management measures related to individual general guidance items, are described in Table 18.3.2. Among the anticipated impacts, the following are important in terms of the magnitude and nature of impacts:

- Physical alternation of land due to infrastructure/facility development, which may induce earth-related disasters, such as slope failure, erosion and deforestation, which are practically irreversible and therefore difficult to be recovered
- Conflicts between stakeholders during the planning stage in urban and rural development and/or due to the necessity of land acquisition for infrastructure/facility development
- Risk of extinction of plant species due to over gathering of NWFPs and MAPs, which has an irreversible nature
- Tourism promotion will further require development of infrastructure and service facilities, which will cause secondary impacts, such as increased pollution loads on air, water, forest and generation of wastes
- Mining and manufacturing may cause various types of negative impacts, including the physical alteration of land, increased pollution loads on air, water, noise, generation of wastes etc.
- Inland transport development for the formulation of a ladder-type arterial road network will require new road construction in the Protected Areas and Biological Corridors, which may cause serious negative impacts on the natural environment.

Table 18.3.2 Summary of Assessment Results on General Guidance

Major Potential Impacts	Evaluation of Impacts	Strategic Management Measures
1. Formulation of a liveable and vigorous urban area		
• Some conflicts might occur between stakeholders/local governments and among local governments in the planning stage for spatial plans, structure plans and local area plans (formulation of plans itself will not cause any physical impacts) • Establishing UCAs, which will control/regulate land use, may cause conflict between landowners and the government • Increased demand for land in preparation of in-migration from the rural area, including development of settlement areas	• Conflict between stakeholders is related to the socio-economic aspect, especially the interest of individuals, entities and/or relevant governments, which might lead to a complex situation unless appropriate action is taken • Demand increase of land would lead to the conversion of land use from agricultural and forest lands to settlement areas, which would adversely affect food self-sufficiency and forest ecology	• Urban management to prepare for in-migration, especially for the planning of spatial plans, structure plans and local area plans, will reflect local conditions (culture, tradition, landscape etc.) to arrive at a consensus • An SEA should be conducted during the planning stage aimed at the coordination of socio-economic issues and the mitigation of negative impacts • A pilot project should be launched aimed at the clarification of effectiveness and the likely impacts of the intended project
2. Formulation of a liveable and beautiful rural area		
• Some negative impacts could occur during facility development due to the physical alteration of land, such as increased pollution loads on air and water, and the generation of noise and construction wastes • Measures for job creation aimed at the promotion of eco-friendly job areas, such as agro-processing and green tourism, thus avoiding any conspicuously negative impacts	• Impacts due to the physical alteration of land will be temporary during the construction stage • Impact magnitude will not be large and therefore the impacts are manageable	• Proper planning and design of public facilities to minimize the alteration of land • Adoption of an appropriate construction method to minimize the physical impacts as well as dissemination of construction activities to the local community in advance in order to obtain an agreement
3. Agriculture promotion		
• Winter cropping will contribute to improvements in the landscape and water retention capacity in paddy fields	• Conservation/improvement of land (landscape and water retention) is a permanent positive impact	• Careful planning and design of the location, route and dimension of roads/facilities to minimize land alteration
• Included actions will physically alter the land (improvement of road and storage facilities, rehabilitation/new construction of irrigation facilities), which will generate several negative impacts (air pollution, generation of noise, wastes, erosion and landslides etc.).	• Increased pollution loads on air and water, and generation of noise and wastes will be a negative but temporary impact during the construction stage. • Impacts due to the physical alteration of land (erosion, landslide, etc.) are cumulative by nature, which can adversely affect tourism resources	• Proper maintenance after construction is indispensable to avoid the expansion of erosion, landslides etc. • As for the realization of an irrigation master plan, the selection of facilities (pond, canal, well etc.) which complement local conditions is required at the detailed planning stage for sustainable use
4. Livestock promotion		
• Improvement of animal sheds may require the physical alteration of land, which will generate pollution loads on air/water, noise and waste generation, etc.	• The impact of the improvement to animal sheds will be temporary during the construction stage, while that related to an increased livestock population will be permanent	• Impacts during the construction stage will be managed/mitigated using planning, design and construction methods • Impacts during the operation stage, such as odour and

Major Potential Impacts	Evaluation of Impacts	Strategic Management Measures
• Development of livestock can cause a nuisance to surrounding areas, including foul odour, pollution loads on rivers and generation of wastes • Improvement of breeding might cause disease dissemination due to the introduction of a new breed • An increased livestock population might require a larger grazing area, which could damage natural land including forest and destabilize the slope • An increased livestock population will increase the emission of greenhouse gases, especially CH_4	during operation stage • The impact magnitude of the above impacts could become large depending on the scale of the animal sheds • The potential impacts (disease dissemination) of breed improvement are secondary, which might cause economic damage • The generation of greenhouse gases from livestock is a cause of climate change, and thus a negative impact, but it is an inevitable phenomenon of promoting livestock	pollution loads on water, will be managed by the installation of a mitigation facility • Impacts on disease dissemination will be managed by establishment of a proper quarantine system
5. Forestry promotion		
• The LFMP will help to develop location-specified management • Promotion of NWFPs and MAPs involves a risk of over gathering plants • Possibility of generating forest fire during the gathering of NWFPs and MAPs • Possible increase in invasive plants due to people entering forests for gathering NWFPs and MAPs • Negative impacts will be generated by improvements to forest roads and the cable crane network on land (landslide, erosion, degradation of landscape etc.) due to the alteration of land • Improved accessibility by forest roads might increase the risk of illegal forest activity • Renewal of old trees by effective thinning will contribute to increasing the capacity of CO_2 absorption	• LFMP formulation will lead to positive impacts contributing to the sustainable management and utilization of forest resources • Risk of overgathering NWFPs and MAPs can lead to the extinction of plant species, which is an irreversible impact • Risk of degradation/destruction of forest by forest fire • Risk of causing an ecological imbalance in the forests • Risk of increased illegal forest activity is a secondary adverse impact • The sustainable use of forest resources through the promotion of NWFPs and MAPs will contribute to the creation of job opportunities for local people, which is a positive effect	• A sustainable gathering system of NWFPs and MAPs will be established through agreement/consensus among stakeholders, including local people • Cultivation of NWFPs and MAPs is also be required for sustainable use • Environmental education on how to prevent/minimize the risk of forest fire and ecological imbalance due to invasive plants to people who enter the forest • Careful planning and design of forest roads and cable cranes in terms of the selection of route, length etc. are necessary. • An effective patrol system for illegal forest activity in collaboration with local farmers, if possible, should be established and operationalized • The renewal of old trees can provide a good opportunity to declare/promote Bhutan as a carbon-negative country
6. Tourism promotion including CSI		
• Both positive and negative impacts can be generated through tourism resource development depending on the appropriateness of the branding strategy • Tourism development will entail many impacts; it will require the development of infrastructure, such as roads, accommodation and other service facilities, which will generate various	• The branding strategy for tourism resources is key to the direction of impacts whether positive (enhancement of the value of resources) or negative (spoiling the value of resources) • Secondary impacts will increase pollution loads on land, air, water, forest, ecology, and increase solid and liquid wastes when tourist numbers significantly rise, which might	• The branding strategy shall be refined by outside experts because they can evaluate tourism resources from a different point of view • Secondary impacts from tourism development shall be managed through pollution control and careful planning/design to minimize pollution, erosion/landslides, ecology, etc. • A new regulation shall be

Major Potential Impacts	Evaluation of Impacts	Strategic Management Measures
types of secondary impacts	become damage risk for tourism resources	provided if current legislation does not cover the anticipated impact
7. Information technology and mechanical promotion		
• Development of an ICT model town and tech park will require physical alteration of land, which might generate some negative impacts on land • There could be some disparity between those who are ICT literate and those who are not (often between younger and older generations, between urban and rural people), which may generate a conflict between the two • Impacts such as the possible increased risk to cyber security and the proliferation of fake news	• Impacts due to the development of an ICT model town, causing the alteration of land, will be temporary during the construction stage • Disparity/conflict between those who are ICT literate and those who are not is inevitable to some extent • Issues related to cyber security and fake news are new types of social impact, which, in the worst-case scenario, could cause a risk to the whole nation	• Impacts during the construction stage shall be managed/mitigated using planning, design and construction methods • Issues relayed to cyber security and fake news are new types of social impact, and there is no single effective/complete measure to deal with them, but it is necessary to monitor global action/movement in this regard
8. Mining and manufacturing promotion		
• Formulation of a mining strategic plan itself will not cause any negative impact • Realization of the plan will cause pollution loads on land, air and water, and the generation of wastes including hazardous types • Increased threat of causing/amplifying flash flooding during heavy rainfall due to large-scale deforestation for mining and/or development of industrial estates • Industrial estate development will generate pollution in many aspects: land degradation, air pollution, water pollution, noise, waste generation, soil contamination, risk of overpumping of groundwater, etc. • Mining and manufacturing will require the development of economic infrastructure, utilities, residences for workers, etc., which may generate many secondary impacts on the environment, although job opportunities will be created	• Mining could cause irreversible, large-scale negative impacts on land, which may damage forest, wildlife habitats, ecology, etc., and, in the worst-case scenario, devastation of land • Development of mining and manufacturing has both positive and negative impacts; the positive impact is that it can be a powerful driver of economic development; the negative impact is that it can generate pollution loads, increase the risk of depleting natural resources, and increase the threat of flash flooding • Mining and manufacturing could increase pollution loads, which can further generate secondary impacts such as a threat to the health of the surrounding population due to increased pollution loads on air, water and soil, and hazardous wastes, unless any appropriate measure is taken	• An EIA should be applied to individual mining development projects and industrial development projects for the better management of potential negative impacts and the enhancement of positive effects, including public involvement to gain agreement
9. Inland transport development		
• The construction and improvement of roads will require physical alteration of land, which may cause negative impacts such as slope failure and erosion (see Figure 18.3.1),	• Roads are necessary for economic development but road construction may cause negative impacts on land, nature, ecology etc., in which there is a kind of a trade-off between road	• Careful planning and design are necessary for road construction and improvement in order to minimize the physical impacts on land • An EIA should be applied to

Major Potential Impacts	Evaluation of Impacts	Strategic Management Measures
deforestation and disturbance of wildlife habitats • Completion of a ladder-type arterial road network will require new road construction in Protected Areas and Biological Corridors, such as Phibsoo Wildlife Sanctuary, Royal Manas National Park and Khaling Wildlife Sanctuary, which will cause deforestation and disturbance to wildlife habitats • Technology transfer on this theme itself will contribute to environmental protection in the future	construction and negative impacts on land • Impacts on land such as landslides, erosion, as well as impacts on forest and ecology, are practically irreversible and pose the risk of causing the critical devastation of national land • New road construction in Protected Areas will cause irreversibly serious impacts on natural ecology and biodiversity	individual road construction/improvement projects • In the case of the construction of new roads in/close to a Protected Area and Biological Corridor, a strict assessment of the impacts of the project including 'no action' on the natural environment is required by applying an SEA • Since there is a trade-off between new road construction and negative impacts on land in Bhutan, reaching a consensus on road projects with stakeholders is indispensable
10. Air transport development		
• The promotion of domestic air transport will increase the physical impacts on surrounding areas including air pollution and noise • Land acquisition and involuntary resettlement might be necessary in the case of airport expansion • Development of air transport will mitigate the load on land transport, especially physical pressure on roads built on fragile geological conditions, in Bhutan • Development of a second international airport will contribute to tourism promotion and vitalization of other sectors in the Eastern Region • Promotion of domestic air transport will improve fail-safe functions/resilience from disaster in the national transport system	• Physical impacts such as air pollution and noise caused by the promotion of air transport are permanent during the operation stage, but their impact magnitude is not large because of the low frequency of flights at the initial stage • Development of air transport (both domestic and international) will positively affect economic activities, including creating job opportunities in the Eastern Region as well as the redundancy of the transport network in the country	• Both domestic and international air transport is essential for economic development in the Eastern Region, but an EIA will be applied when airport expansion • Thorough consultation is necessary with landowners for fair compensation as per prevailing rules if land acquisition is needed for airport expansion • Air transport development will be more effective if it is aligned with tourism promotion for the purposes of vitalizing the Eastern Region
11. Transport using advanced technology (UAVs and EVs)		
• Promotion of transport using UAVs and EVs should contribute to an eco-friendly society, which in turn will be effective in establishing the identity of the Bhutan brand, in terms of being a carbon-negative country • There might be some unrest/conflict involving local people who are conservatively minded in general about the introduction of advanced technology and fearful of accidents	• There is an aspect of uncertainty about the anticipated impacts because of the introduction of new technology • Promotion of EVs is well matched with the energy policy of Bhutan in terms of the high potential of hydroelectric power generation, which supports the sustainable use of RNR, and UAVs will act as a supplementary measure to deal with labour shortages in the rural area	• New technology involves much uncertainty in terms of anticipated impacts, so it is desirable to conduct an experiment/pilot project to clarify the strengths, weaknesses, opportunities and threats prior to actual introduction

Photo 1: Slope failure along the Primary Highway (EW-1) in Tongsa

Photo 2: Slope failure along the road from Paro to Haa

Figure 18.3.1 Examples of Slope Failure Along Roads

18.4 Environmental Impact Assessment of High Priority Projects

18.4.1 Target High Priority Projects in the Environmental Impact Assessment

High priority projects are selected from the candidates proposed in the course of formulating general guidance by applying screening standards (four assessment standards and 14 assessment criteria) as described in Section 17.1. As a result of the selection, 22 high priority projects were selected for the CNDP. Table 18.4.1 sets out the selected 22 high priority projects along with clarification of the actions/initiatives to be involved in each project.

Table 18.4.1 List of 22 High Priority Projects/Programmes with Actions/Initiatives

Sectors and Priority Projects and Programmes	Actions/Initiatives Involved
a. Urban development	
a-2. Eastern Region Development Programme	• To formulate a structure plan for linked urban centres with specialized objectives • To promote human resource development to support rural development • To establish a system to promote the brand of the Eastern Region
a-4. Formulation of Regional Plan for Sarpang-Gelephu Linked Urban Centre	• To formulate a plan of linked urban centres • To formulate a holistic service system for linked urban centres and their vicinities • To formulate an infrastructure development plan for or linked urban centres and their vicinities
a-6. Project for Institutionalising Land Use Control Measures in Urbanization Management Areas of Thimphu, Phuentsholing, and Gelephu	• To formulate a structure plan including a land use plan comprised UMAs and guidelines and regulations • To formulate a new land use/development control measures
b. Rural development	
b-1. Development of a Comfortable Rural Living Environment	• To establish appropriate standard development levels for the rural area by facility • To formulate an appropriate facility development plan based on the established standards • To implement facility development works • To promote human resource development to support rural development
b-6. Project for Dzongkhag Vitalization in Eastern Region	• To develop the speciality product on a sustainable manner • To disseminate information on market research • To develop mechanism for community bonding and sharing of common facilities
c. Agriculture promotion	
c-2. Improvement of Cultivation Techniques for Labour Saving	• Selection of working items to be reduced • Introduction and preliminary testing of newly developed cultivation techniques • Dissemination of cultivation techniques
c-4. Establishment of Community-wildlife Coexistence	• Data collection on ecology of wild animals • Research works on human-wildlife conflict countermeasures • Dissemination of techniques for human-wildlife conflicts.
d. Livestock promotion	
d-1. Productivity Improvement of Livestock	• Selection of a candidate animal breed • Prioritization of candidate animals based on a market survey • Development of a new productive animal breed • Research and development of a better feeding system • Dissemination of a new productive animal breed and improved feeding system to livestock farmers
e. Forestry promotion	
e-2. Further Research and Marketing of Non-wood Forest Products and Medicinal and Aromatic Plants	• Selection of candidate target NWFPs and MAPs • Conduct a marketability survey and feasibility study for the candidate NWFPs and MAPs and formulation of an implementation plan • Coordination with the agencies and institutions concerned

Sectors and Priority Projects and Programmes	Actions/Initiatives Involved
	• Promotion of the cultivation of the targeted NWFPs and MAPs • Development of a sustainable gathering system for the targeted NWPFs and MAPs • Dissemination of the benefits of the targeted NWFPs and MAPs
f. Tourism promotion including CSI	
f-2. Artist-in-residence Programme	• To promote innovative art to the town • To improve the cultural image of the town • Promotion to the world by the artist • Contribution to tourism development
g. Information technology and mechanical promotion	
g-1. Development of Gyalpozhing Tech Park	• Earthworks (levelling, cut and embankment, hauling, etc.), • Infrastructure and facility construction (utilities, laboratories etc.), (Note: Land procurement has been completed by Gyalpozhing College)
g-2. Formulation of a Plan for Social Experiment Projects	• Pilot projects to utilize ICT for resolution of social issues in such sectors as education, health, remote work, disaster prevention, construction, tourism, agriculture and fab lab • The pilot project will conduct a social experiment using UAVs including drones
h. Mining and manufacturing promotion	
h-1. Formulation of a Mining Master Plan	• To formulate the mining master plan • To identify competitive products in the market • To develop human resource for planning, marketing and GIS data management
i. Inland transport development	
i-5. Arterial Road Network of EW-1-e: Wangdue-Trongsa	• Widening of existing roads for double laning
i-6. Arterial Road Network of EW-1-f: Trongsa-Bumthang	
i-7. Arterial Road Network of EW-1-g: Bumthang-Monggar	
i-8. Arterial Road Network of EW-1-h: Monggar-Trashigang	
i-15. Technology Transfer Programme for Slope Protection and Tunnels	• Technology transfer on tunnel engineering including geological investigation and analysis, structure design and construction, and O&M (comprehensive technology transfer programme)
i-18. Technology Transfer Programme for the Development of Road Structure Design Standards	• Review and update design and construction standards and methods for Dzongkhag roads and farm roads
j. Air transport development	
j-1. Comprehensive Master Plan for a Second International Airport Development and Improvements to Domestic Airports	• To formulate a comprehensive master plan for the second international airport • To carry out a feasibility study for the second international airport • To formulate an improvement plan for domestic airports
j-4. Development of a Subsidy Scheme to Promote the Use of Domestic Air Transport	• To establish performance-based evaluation criteria for

Sectors and Priority Projects and Programmes	Actions/Initiatives Involved
by Local People	unprofitable routes • Development of a subsidy system • Promotion of domestic air transport and participation of private airlines
k. Transport using advanced technology	
k-2. Drone-based Freight Transport System for Remote Areas	• Realization of out-of-sight flights • Prevention of unauthorized use • Utilization of technology • Establishment of environmental arrangements for UAVs including legislation.

18.4.2 Findings of the Environmental Impact Assessment of High Priority Projects

An EIA was applied to the 22 high priority projects. The results of the EIA are summarized in Table 18.4.2. It should be noted that the individual objectives of the high priority projects, which are regarded as positive effects for the development of society and the economy of the country, are not included as anticipated impacts and not itemized in the table below, accordingly. This is because they are the aims of individual projects and therefore not categorized as environmental impacts of the projects. The details of the individual anticipated impacts by the high priority projects are shown in Table 18.4.3.

Table 18.4.2 Summary of Impact Assessment of 22 High Priority Projects and Programmes (1/3)

Sector and Priority Projects and Programmes	Potential Impacts from the Viewpoints of Nine Environmental Areas									Description of Potential Impacts
	1	2	3	4	5	6	7	8	9	
	Land	Water	Air	Biodiversity	Waste management	Climate Change	Socio-economic aspect	Culture and tradition	Health and sanitation	
a. Urban development										
a-2. Eastern Region Development Programme							-			Conflict among stakeholders regarding planning
a-4. Formulation of Regional Plan for Sarpang-Gelephu Linked Urban Centre							--			Conflict among stakeholders regarding planning
a-6. Project for Institutionalising Land Use Control Measures in Urbanization Management Areas of Thimphu, Phuentsholing, and Gelephu							--			Conflict among stakeholders regarding planning.
b. Rural development										
b-1. Establishment of a Rural Living Environment Comparable to That of the Urban Area	-	-	-		-		-+		-	Several negative impacts due to facility development
b-6. Project for Dzongkhag Vitalization in Eastern Region	-				-		-+			Several negative impacts due to facility development
c. Agriculture promotion										
c-2. Improvement of Cultivation Techniques for Labour Saving							-			Unrest/worry of farmers about the introduction of new technology
c-4. Establishment of Community-wildlife Coexistence										No conspicuous impact is expected

Note: × negative impact, ○ positive impact. The number of symbols in each cell refers to the number of anticipated impacts (positive or negative).

Table 18.4.2 Summary of Impact Assessment of 30 Priority Projects and Programmes (2/3)

Sector and Priority Projects and Programmes	Potential Impacts from the Viewpoints of Nine Environmental Areas									Description of Potential Impacts
	1	2	3	4	5	6	7	8	9	
	Land	Water	Air	Biodiversity	Waste management	Climate Change	Socio-economic aspect	Culture and tradition	Health and sanitation	
d. Livestock promotion										
d-1. Improvement of Livestock Productivity	--	-	-	-	-+	-	-		-	Several negative impacts, including that on climate change due to increase in greenhouse gases, in the case of large-scale animal rearing
e. Forestry promotion										
e-2. Further Research and Marketing of Non-wood Forest Products and Medicinal and Aromatic Plants	-			-			-			Negative impacts due to gathering NWFPs and MAPs on a large scale and non-systematic manner
f. Tourism promotion including CSI										
f-2. Artist-in-residence Programme							-	-+		Possibility of generating conflict between artists and local people in the worst-case scenario
g. Information technology and mechanical promotion										
g-1. Development of Gyalpozhing Tech Park	-	-	-		-		- ++			Several negative impacts during the construction stage; positive impacts on economic and cultural aspects
g-2. Formulation of a Plan for Social Experiment Projects							-		-	Social impacts such as unrest/conflict among local people about the experiment
h. Mining and manufacturing promotion										
h-1. Formulation of a Mining Master Plan	-	-	-	-	-		- +		-	Several negative impacts during the construction stage; positive impacts on economic aspects

Note: × negative impact, ○ Positive impact. The number of symbols in each cell refers to the number of anticipated impacts (positive or negative).

Table 18.4.2 Summary of Impact Assessment of 22 High Priority Projects and Programmes (3/3)

Sector and Priority Projects and Programmes	Potential Impacts from the Viewpoints of Nine (9) Environmental Areas									Description of Potential Impacts
	1	2	3	4	5	6	7	8	9	
	Land	Water	Air	Biodiversity	Waste management	Climate Change	Socio-economic aspect	Culture and tradition	Health and sanitation	
i. Inland transport development										
i-5. Arterial Road Network of EW-1-e: Wangdue-Trongsa	-	-	-	-	-		-			Several negative impacts during the construction stage due to the physical alteration of land for road widening; negative impacts might cause disturbance to wildlife in the Protected Areas and induce slope failure due to fragile geology
i-6. Arterial Road Network of EW-1-f: Trongsa-Bumthang										
i-7. Arterial Road Network of EW-1-g: Bumthang-Monggar										
i-8. Arterial Road Network of EW-1-h: Monggar-Trashigang										
i-15. Technology Transfer Programme for Slope Protection and Tunnels	+									A positive impact (contribution to the protection of mountain slope) is expected in the future
i-18. Technology Transfer Programme for the Development of Road Structure Design Standards	+									A positive impact (contribution to the protection of mountain slope along feeder roads) is expected in the future
j. Air transport development										
j-1. Comprehensive Master Plan for a Second International Airport Development and Improvements to Domestic Airports	-	-	-		-		-+			Several negative impacts during construction stage; a positive impact on economic aspect thanks to increase of international passengers in Central and Eastern Region;
j-4. Development of Subsidies to Promote the Use of Domestic Air Transport by Local People	+		+				+ --			Positive impacts thanks to a decrease in land traffic; a negative impact on government finances and the possibility of land acquisition and involuntary resettlement
k. Transport using advanced technology										
k-2. Drone-based Freight Transport System for Remote Areas			+			+	-			Positive impact in terms of a decrease in emission gases compared with traditional cargo delivery

Note: × negative impact, ○ positive impact. The number of symbols in each cell refers to the number of anticipated impacts (positive or negative).

Table 18.4.3 Results of Impact Assessment of 30 Priority Projects and Programmes

	Project/Programme	1. Land	2. Water	3. Air	4. Biodiversity	5. Waste Management	6. Climate Change	7. Socio-economic Aspects	8. Culture and Tradition	9. Health and Sanitation	Description of Potential Impacts/Evaluation
a.	**Urban development**										
a-2	Eastern Region Development Programme							Conflict among stakeholders in the planning stage			Potential impact of conflict among stakeholders is related to the land use plan which affects their interests
a-4	Formulation of Regional Plan for Sarpang-Gelephu Linked Urban Centre							Conflict among stakeholders in the planning stage/ possibility of land acquisition and involuntary resettlement for facility development			Potential negative impacts of conflict among stakeholders is related to the land use plan which affects their interests, and possibility of land acquisition and involuntary resettlement
a-6	Project for Institutionalising Land Use Control Measures in Urbanization Management Areas of Thimphu, Phuentsholing, and Gelephu							Conflict among stakeholders in the planning stage/ possibility of land acquisition and involuntary			Potential negative impacts of conflict among stakeholders is related to land use plan which affects their interests and possibility of land acquisition and involuntary resettlement

	Project/Programme	1. Land	2. Water	3. Air	4. Biodiversity	5. Waste Management	6. Climate Change	7. Socio-economic Aspects	8. Culture and Tradition	9. Health and Sanitation	Description of Potential Impacts/Evaluation
								resettlement for conversion of land use			
b.	**Rural development**										
b-1	Development of a Comfortable Rural Living Environment	Alteration of topography, land use, landscape etc.	Risk of increased pollution load on waterbodies	Possibility of generating emission gases and dust		Generation of construction wastes during facility development works		Possibility of land acquisition and involuntary resettlement for facility development /creation of job opportunities along with facility development		Risk of increased psychological stress in the worst-case scenario	Several negative impacts of facility development are anticipated, but their impact magnitude is not estimated to be significant because the area for facility development such as local public facilities is not large; a positive impact (creation of job opportunities) is also expected along with facility development
b-6	Project for Dzongkhag Vitalization in Eastern Region	Alteration of topography, land use, landscape etc.				Generation of construction wastes during facility development works		Possibility of land acquisition and involuntary resettlement for facility development /creation of job opportunities along with facility development			Several negative impacts of facility development are anticipated, but their impact magnitude is not estimated to be significant because the area for facility development such as local public facilities is not large; a positive impact (creation of job opportunities) is also expected along with facility development
c.	**Agriculture promotion**										

	Project/Programme	1. Land	2. Water	3. Air	4. Biodiversity	5. Waste Management	6. Climate Change	7. Socio-economic Aspects	8. Culture and Tradition	9. Health and Sanitation	Description of Potential Impacts/Evaluation
c-2	Improvement of Cultivation Techniques for Labour Saving							Unrest/worry of farmers about the introduction of new technology			Unrest/worry of farmers about the introduction of new technology is anticipated because local farmers have a conservative mindset in general
c-4	Establishment of Community-wildlife Coexistence										No conspicuous impact is expected due to research activities
d.	**Livestock promotion**										
d-1	Productivity Improvement of Livestock	Alteration of land for the development of livestock farms and animal sheds/ risk of over-grazing on grassland and/or in forest	Possibility of pollution load increase (from livestock farms/animal sheds).	Foul odour from livestock farms/animal sheds	Possibility of disease dissemination to animals	Generation of faeces from livestock farms/animal sheds	Increase in the generation of greenhouse gases	Possibility of land acquisition for facility development of farms/animal sheds		Risk of increased psychological stress in the worst-case scenario	Several negative impacts, including on climate change due to increased greenhouse gases, are anticipated in the case of large-scale animal rearing facilities are produced; generation of organic waste (excreta) have both positive and negative aspects because it can be used as fertilizer
e.	**Forestry promotion**										
e-2	Further Research and Marketing of Non-wood Forest Products and Medicinal and Aromatic Plants	Risk of damage to forest including forest fire during gathering activities			Risk of overgathering of NWFPs and MAPs, which can cause a			Possibility of conflicts about the gathering and/or cultivation among local people			Several negative impacts are anticipated, especially due to gathering NWFPs and MAPs if it is done on a large scale and in a non-systematic manner; there might be conflicts about gathering/cultivation among stakeholders because of this

	Project/Programme	1. Land	2. Water	3. Air	4. Biodiversity	5. Waste Management	6. Climate Change	7. Socio-economic Aspects	8. Culture and Tradition	9. Health and Sanitation	Description of Potential Impacts/Evaluation
					risk of extinction for plant species and an ecological imbalance due to invasive plants			including agencies and/or institutions (stakeholders)			activity is related to their interests
f.	**Tourism including CSI**										
f-2	Artist-in-residence Programme							Possibility of conflict between the invited artist and local people	Contribution to the establishment of a new Bhutan brand/risk to the Bhutan brand		A conflict between the artist and local people can be anticipated in the worst-case scenario; a new Bhutanese brand can be developed when the project is successfully completed, but, at the same time, there is a risk of undermining the brand at the worst
g.	**Information technology and mechanical promotion**										
g - 1	Development of Gyalpozhing Tech Park	Small scale of levelling works (alteration of land) and soil erosion	Increase of pollution load on rivers	Emission gases, dust, noise and vibration during construction works		Generation of construction wastes/risk of hazardous wastes during the operation stage		Vitalization of local economy/risk of conflict between local community/ creation of job opportunities	Expectation for the integration of traditional culture and new technology for the new Bhutan brand		Negative impacts are anticipated during the construction stage of the park; positive impacts can also be expected in economic and cultural respects

	Project/Programme	1. Land	2. Water	3. Air	4. Biodiversity	5. Waste Management	6. Climate Change	7. Socio-economic Aspects	8. Culture and Tradition	9. Health and Sanitation	Description of Potential Impacts/Evaluation
g-2	Formulation of a Plan for Social Experiment Projects							Unrest/worry of local people and the possibility of conflict between local people and the project owner about the experiment		Risk of increased psychological stress in the worst-case scenario	Social impacts such as unrest/conflict among local people about the experiment project; there is also a risk of safety problems (UAV or drone crashes)
h.	**Mining and manufacturing promotion**										
h-2	Formulation of a Mining Master Plan	Change of topography due to mining development	Pollution load on rivers due to mining development	Emission gases, dust, noise and vibration due to mining development	Risk of habitat disturbance,	Generation of wastes from mining development		Necessity of land acquisition for mining development			Several negative impacts during the construction stage; positive impacts on economic aspects Several negative impacts are anticipated during the mining development due to the physical alteration of land
i.	**Inland transportation development**										
i-5	Arterial Road Network of EW-1-e: Wangdue-Trongsa	Risk of increased slope failure, erosion, due to alteration of land, especially	Pollution load on rivers due to construction works	Emission gases, dust, noise and vibration due to construction works	Risk of habitat disturbance, especially along Route i-6 (Trongsa-Bumthang	Generation of construction wastes		Necessity of land acquisition for road widening			Several negative impacts are anticipated during the construction stage due to the physical alteration of land for road widening to create double lanes; Route i-6 partly goes along the border with Jigme Singye Wangchuck National Park, Route i-7 partly goes within Thrumshing
i-6	Arterial Road Network of EW-1-f: Trongsa-Bumthang										
i-7	Arterial Road Network of EW-1-g: Bumthang-Monggar										

	Project/Programme	1. Land	2. Water	3. Air	4. Biodiversity	5. Waste Management	6. Climate Change	7. Socio-economic Aspects	8. Culture and Tradition	9. Health and Sanitation	Description of Potential Impacts/Evaluation
i-8	Arterial Road Network of EW-1-h: Monggar-Trashigang	along Route i-8 (Monggar - Trashigang) because of the fragile geology of the Central Thrust			) and Route i-7 (Bumthang-Monggar) because they partly go along the border of or within Protected Areas						La National Park, and Route i-8 goes across fragile geology, therefore, there is a risk of adversely affecting biodiversity and inducing earth-related disaster
i-15	Technology Transfer Programme for Slope Protection and Tunnels	Contribution to the protection of mountain slopes									No direct impact is expected because this project has a soft component; a positive effect is expected as a secondary impact regarding the protection of mountain slopes during road construction in the future
i-18	Technology Transfer Programme for the Development of Road Structure Design Standards	Contribution to the protection of mountain slopes along feeder roads									No direct impact is expected because this project has a soft component; a positive effect is expected as a secondary impact regarding the protection of mountain slopes along feeder roads
j.	**Air transport development**										
j-1	Comprehensive Master Plan for a Second International Airport Development and	Alteration of land for airport expansion	Increased pollution loads to rivers	Emission gases, dust, noise and vibration		Generation of construction wastes		Necessity of land acquisition for land to expand an			Several negative impacts during the implementation stage of the Master Plan; positive impacts on economic aspects

	Project/Programme	1. Land	2. Water	3. Air	4. Biodiversity	5. Waste Management	6. Climate Change	7. Socio-economic Aspects	8. Culture and Tradition	9. Health and Sanitation	Description of Potential Impacts/Evaluation
	Improvements to Domestic Airports			due to construction works				airport/contribution to tourism promotion and vitalization of other sectors in the Eastern Region			
j-4	Development of a Subsidy Scheme to Promote Domestic Air Transport Use by Local People	Decrease of physical load on existing roads due to shifting road traffic onto air transport		Decreased emission gases from vehicles/increased emission gases from aircraft				Increased outlay by the government for subsidies/improvement in fail-safe functions and resilience from disaster/possibility of land acquisition and involuntary resettlement in the case of airport expansion			Positive impacts are expected due to a decrease in land traffic thanks to conversion to air transport; increased outlay by the government for subsidies, which will affect the financial status of the government; promotion of air transport will improve fail-safe functions and resilience from disaster in terms of alternative transport means; there will be a possibility of land acquisition and involuntary resettlement if airport expansion is necessary
k.	**Transport using advanced technology**										
k-2	Drone-based Freight Transport System for Remote Areas			Decrease in emission gases compared			Contribution to a decrease in greenhou	Safety problems (risk of crashes) and unrest			Positive impact of a decrease in emission gases is expected; safety problem (risk of crashes) and unrest/worry of local people about new technology are

	Project/Programme	1. Land	2. Water	3. Air	4. Biodiversity	5. Waste Management	6. Climate Change	7. Socio-economic Aspects	8. Culture and Tradition	9. Health and Sanitation	Description of Potential Impacts/Evaluation
				with traditional cargo delivery			se gases (CO_2)	among local people are anticipated/ unrest or worry of local people about the instructions for new technology (drones)			anticipated; promotion of EVs can provide a good opportunity to declare/promote Bhutan as a carbon-negative country; unrest/worry of local people about the introduction of new technology is anticipated

18.4.3 Environmental Management of Anticipated Potential Impacts

Based on the potential impacts of 22 high priority projects described in detail in the previous section, the major potential impacts and corresponding possible management measures in relation to nine environmental area, are briefly itemized in Table 18.4.4. It is desirable to launch these management measures when implementing the high priority projects in order to mitigate the negative impacts and enhance the positive impacts.

Table 18.4.4 Results of Impact Assessment of 22 High Priority Projects

Environmental Area	Major Potential Impacts	Environmental Management/ Mitigation Measures
1. Land	**Negative impacts:**	
	• Physical alteration of land (topography), increased risk of landslides/erosion • Risk of degradation of landscape (Bhutan brand) • Risk of damage to forest land by over gathering of NWFPs and MAPs • Risk of overgrazing by livestock	• Consideration at the planning and design stages of minimizing the area of land alteration • Measures to prevent/minimize landslides/erosion based on a thorough geological investigation in advance and the adoption of a proper construction method • Formulation/establishment of sustainable gathering system for NWFPs and MAPs • Provision of a better feeding system and proper management
	Positive impacts:	
	• Conservation/improvement of land use, landscape of paddy fields • Decreased physical load on existing roads due to the promotion of domestic air transport • Contribution to the protection of mountain slopes	• Area expansion for winter cropping as much as possible • Proper operation and management of inland and air transport means • Continuous study of an effective slope protection method and its application
2. Water	**Negative impacts:**	
	• Increased pollution load on rivers including sedimentation and degradation of water quality	• Consideration at the design stage of minimizing the area of land alteration and location of facility construction • Installation of proper drainage facility/sedimentation pond on construction work sites • Installation of a proper water treatment facility
	Positive impacts:	
	• Increased water retention capacity in paddy fields	• Area expansion for winter cropping as much as possible
3. Air	**Negative Impacts:**	
	• Generation of emission gas and dust during construction works for roads, facilities etc. • Noise and vibration from construction works • Foul odour from livestock rearing	• Proper O&M of construction equipment/vehicles • Environmental education to construction workers including operators of construction equipment and vehicles on minimizing public nuisance and the generation of pollution loads • Proper management of pollution loads (dust, noise, vibrations etc.) during the construction stage • Closure/covering of odour generation area where applicable
	Positive impacts:	
	• Decrease in emission gases from vehicles thanks to the introduction of new transport means, i.e., EVs, UAVs etc.	• Proper operation of the new transport means through adequate coordination with stakeholders including local people
4. Biodiversity	**Negative impacts:**	
	• Possible removal of vegetation and disturbance to wildlife habitats within or along Protected Areas • Possibility of disease dissemination to animals • Overgathering of NWFPs and MAPs and risk of extinction of plant species	• Consideration at the design stage of minimizing the physical alteration of land and vegetation removal • Management through the establishment of a proper quarantine system. • Formulation/establishment of a sustainable gathering system for NWFPs and MAPs

Environmental Area	Major Potential Impacts	Environmental Management/ Mitigation Measures
	Positive impacts:	
	• Contribution to the conservation of biodiversity	• Dissemination of the positive aspect of tourism in order to contribute to the conservation of natural resources
5. Waste management	**Negative impacts:**	
	• Generation of construction wastes due to construction works for roads and facilities • Generation of faeces due to livestock promotion • Increase in wastes from tourists	• Reusing and recycling wastes generated on construction work sites • Effective utilization of faeces as fertilizer, • Establishment of an appropriate waste management system by type of waste including segregation, incineration (in the future) and its dissemination.
	Positive impacts:	
	• Possibility to utilize faeces from livestock as fertilizer	• Establishment of an effective utilization system for faeces as fertilizer, such as matching demand with supply
6. Climate change	**Negative impacts:**	
	• Increased generation of greenhouse gases	• Generation of greenhouse gases from promotion of agriculture and livestock is inevitable in a sense. Compensation measure such as forestation, etc. to increase absorption of CO_2 is necessary.
	Positive impacts:	
	• Contribution to a decrease in greenhouse gases (CO_2) by use of UAVs for transport and trimming of old trees	• Promotion of transport using advanced technology
7. Socio-economic aspect	**Negative impacts:**	
	• Conflict among stakeholders regarding spatial planning • Unrest/worry of local people about the introduction of new technology/systems • Necessity of land acquisition and possibility of involuntary resettlement • Conflict among stakeholders about gathering NWFPs and MAPs • Possible conflicts between the invited artist and local people • Increased outlay, which might impose a financial burden on the government • Safety problems involving UAVs including drones	• Thorough discussion and coordination in order to reach an agreement about the plan • Sufficient explanation of the necessity of the project, including activities and prevention measures to be launched to avoid accidents, to stakeholders including the local community, landowners • Fair compensation for land acquisition and involuntary resettlement, where necessary • Thorough discussion and coordination concerning the establishment of a sustainable gathering system for NFWPs and MAPs • Careful planning to determine subsidy rates so as not to undermine government finances • Cautious planning/design to establish using new technology including pilot projects
	Positive impacts:	
	• Creation of job opportunities for local people for construction works • Vitalization of the economy in the Eastern Region through tourism	• Information sharing with local people about the job opportunities • Involving other sectors such as CSI for the development of tourism resources
8. Culture and tradition	**Negative impacts:**	
	• Risk of ruining local cultural resources and traditions and the existing Bhutan brand	• Careful design of tourism promotion, so as not to ruin but maximize the value of existing cultural resources and traditions
	Positive impacts:	
	• Contribution to the conservation of cultural resources and traditions	• Careful design of tourism promotion, so as not to ruin but maximize the value of existing cultural resources and traditions

Environmental Area	Major Potential Impacts	Environmental Management/ Mitigation Measures
	• Contribution to the integration of traditional cultures and new technology for the Bhutan brand	• Coordination with the invited artist to support the integration of traditional cultures and new technology for branding
9. Health and sanitation	**Negative impacts:**	
	• Risk of increased psychological stress in the worst-case scenario • Risk of dissemination of infectious disease due to increased numbers of tourists	• Enough explanation and coordination among stakeholders about the intended action/initiative/project • Continuous dissemination activity about the risk of infectious disease and prevention measures

18.5 Conclusion and Recommendations

18.5.1 Overarching Planning Principles for The Comprehensive National Development Plan

The CNDP for Bhutan 2030 is composed of the following: Vision and Objectives, National Spatial Structure, National Land Use and Holistic Services, General Guidance for Urban and Rural Development, General Guidance for Industrial Development, General Guidance for Transport Development, and Priority Projects and Programmes.

The vision of the CNDP suggests the concept of a "GREENIST Country" , where 'GREENIST' is an acronym of the eight strategic objectives of the CNDP, i.e., 1) Global happiness centre for people, 2) Rich and diversified value of life, 3) Environmental management of livelihoods and the economy, 4) Eco-friendly green technology, 5) Network society for integrated communication, 6) Innovative economic model, 7) Self-reliant society, and 8) Tradition and cultural life. These strategic objectives are set to be pursued in support of the national identity declared in the Constitution and Bhutan 2020. They are aimed at the realization of sustainable development based on all stakeholders' understanding and concerted efforts (refer to Chapter 11).

The strategic objectives give importance to symbiosis with environmental conservation in their accomplishment. In other words, the concept of environmental conservation overarches the individual development initiatives proposed in each component of the CNDP. Thus, it should be noted that the planning for the CNDP for Bhutan 2030 aims to accomplish the strategic objectives by taking environmental conservation into account to a maximum extent.

18.5.2 Conclusion and Recommendations Based on the Results of Environmental Impact Assessment

In the previous sections, the EIA of the CNDP for Bhutan 2030 was carried out by focusing on general guidance in the priority sectors and a total of 22 high priority projects, although the level of impact assessment is preliminary because a lot of uncertainty remains in the individual planning. The following conclusion and recommendations are obtained, based on the results of the EIA:

(a) Most of the anticipated negative impacts of the implementation of general guidance and high priority projects are manageable; they can be avoided and/or mitigated if appropriate prevention measures are provided in a timely manner.

(b) Among the potential negative impacts, those caused by the physical alteration of land will be significant in terms of the generation of various types of negative impacts, such as erosion, landslides/slope failure, deforestation and increased pollution load on rivers, including sedimentation and dust generation. In addition, the impacts of land devastation have a cumulative nature and are practically irreversible if appropriate measures are not taken. Addressing this matter as early as possible is indispensable if land degradation is to be prevented.
(c) New road construction within the Protected Areas will be required for the completion of a ladder-type road network. A strict EIA shall be applied to individual new road construction projects by comparing alternatives routes, dimensions etc. including the option of 'no action'.
(d) As for potential impacts regarding the socio-economic aspect, the escalation of conflict among stakeholders and unrest/worry of local people is anticipated in the planning stages of the spatial plan and the introduction of new technology/systems. These impacts might lead to psychological stress among stakeholders in the worst-case scenario. Adequate discussion and consultation with a tactful explanation will be effective in minimizing the negative impacts at the planning stage.
(e) Regarding the necessity of land acquisition and involuntary resettlement for the development of infrastructure, public facilities etc., adequate consultation with a tactful explanation regarding the necessity of development is indispensable in order to obtain the agreement of stakeholders, especially landowners. Fair compensation shall be provided in the case of land acquisition will inevitably be pursuant to relevant laws and regulations in Bhutan, including the Land Act (2007) and the Land Rules and Regulations (2007).
(f) Forestry promotion could cause both positive and negative impacts; positive impacts include a contribution to the sustainable management and utilization of forest resources and the promotion of NWFPs and MAPs, which will further contribute to the creation of job opportunities, while negative impacts include overgathering of NWFPs and MAPs, which could lead to the extinction of plant species. The establishment of a sustainable gathering system and the cultivation of NWFPs and MAPs are required.
(g) Tourism promotion is an important enabler of economic development especially in the Eastern Region in Bhutan. It will, however, cause various types of negative impacts because tourism development will require such initiatives as infrastructure development and service facilities development, which may increase the pollution load on rivers, air and the generation of wastes. Careful planning and management to minimize such negative impacts are expected during facility development.
(h) Mining development within the Protected Areas will be required for the exploration of tungsten. A strict SEA shall be applied to compare alternatives including the option of 'no action' in the mining master plan.
(i) Finally, concerning the individual plans and priority projects/programmes proposed in the CNDP, an SEA and/or EIA should be applied during their planning and feasibility study stages, as per the requirements under the Environmental Assessment Act (2000) and other related legislations, if necessary at the discretion of NEC.

CHAPTER 19 RECOMMENDATIONS FOR THE IMPLEMENTATION OF COMPREHENSIVE NATIONAL DEVELOPMENT PLAN

19.1 Institutional arrangements

19.1.1 Implementation Structure and Monitoring System

(1) Implementation Structure

The CNDP for Bhutan has set 2030 as its target year and presents a vision that concretely depicts a balanced way of developing the national land to maximize GNH in Bhutan, while proposing policies and projects for achieving this vision.

The government of Bhutan is expected to approve the CNDP, to share the vision of the future it presents, and to implement the policies and projects proposed in the plan. The proposals discussed in the CNDP should be reflected in various types of long-term visions, plans and strategies formulated by the government in the future. Among other things, the CNDP encompasses a national spatial structure, national land use, transportation and a holistic service delivery system. The National Spatial Plan, which conforms to the National Spatial Planning Act and is scheduled to be enacted in the near future, is expected to be formulated based on the CNDP. The legal endorsement is indispensable to the process to officially authorize the Urban Area; therefore, it is recommended that the Urban Area be legally stipulated within the framework of the Spatial Planning Act, rather than that of the Local Government Act, as it comprises commercial centres and projects towns which are not within the remit of local governments and thus not within the scope of the Local Government Act. Figure 5.2 of this report indicates how the proposed land use categories in the National Land Use Plan are interrelated with the existing legal system. The NLCS is considering the formulation of national land use zoning. The National Land Use Plan of the CNDP will be a useful reference to guide the planning direction of national land use zoning.

The policies and projects are expected to be further reviewed by central and local governments, depending on which are responsible for them, and to be implemented in a way that is appropriate for Bhutan. It is hoped that the government of Bhutan will formulate action plans to direct these.

The 12th FYP (2018 to 2023) has started. The proposals in the CNDP are expected to be studied and reflected in the course of the implementation of the 12th FYP.

To implement the CNDP, it will be necessary for relevant ministries and agencies of the central government to cooperate with each other, and for local governments to fulfil their roles. It is also hoped that private-sector businesses, non-profit organizations (NPOs) and local residents will actively participate. GNHC will perform the core roles of coordinating with and monitoring the relevant organizations.

To promote the CNDP effectively, it is suggested to allow management organizations to have control over special budgets (to be used only for surveys, software projects and pilot projects), to allocate budgets for policy formation involving several ministries and agencies, and to prioritize the projects to be executed by local governments.

One way of obtaining good results would be to experimentally execute policies and projects as

model or pilot projects in order to identify the effects and emerging issues, to make improvements and to generate successful examples based on experience. They could then be applied widely, rather than spending long periods of time formulating plans and strategies and authorizing.

(2) Organization

The GNH Commission is a likely candidate to be the management organization that will coordinate with and monitor the relevant organizations when implementing the CNDP. The GNH Commission, which has control over the 12th FYP, could additionally act as the CNDP management organization, thus integrating progress management and monitoring both plans and implementing them efficiently.

The roles played by local government, and especially the dzongkhag, will be extremely important in implementing the CNDP. Each dzongkhag will assume an important role in actively promoting priority projects and other matters mentioned in the CNDP, while coordinating with gewogs and private-sector entities. The organization and human resources of local governments need to be enhanced for that purpose.

(3) Monitoring System

Monitoring of the CNDP should be performed comprehensively and efficiently. Monitoring will be performed on the basis of the following two types of indicators. The first type concerns socio-economic indicators that are specific to each region.

(a) Population including the resident population and population inflows and outflows
(b) The economy including gross regional product and unemployment and poverty rates
(c) Society including the GNH Index level and social services related to its constituent elements
(d) Land use including land use by area and land use conversion

The second type concerns the progress and issues relating to major policies and projects proposed in the CNDP. Data are to be provided by the central ministries or local governments in charge of each policy and project.

The monitoring indicators will be prepared based on statistical surveys and operational materials. It would be desirable to conduct supplementary sampling surveys and produce estimates, as required.

Monitoring should be performed on a regular basis and the results published widely for public consumption, instead of shared only among government personnel.

19.1.2 Legal Framework and Authorization of the Comprehensive National Development Plan

The CNDP is expected to be approved by the government of Bhutan.

It is also expected that the proposals in the CNDP, regarding spatial planning and national land use, will be reflected in the National Spatial Plan and the Regional Spatial Plans, which conform to the National Spatial Planning Act, to be enacted in the near future. By formulating Local Spatial Plans, which are regulatory plans in conformance with the Act, it is anticipated that appropriate national land use and a holistic service delivery system will be brought to fruition.

The CNDP would be meaningful if it were not only approved by the government with a legal framework, but if it also had a promotional structure with several proposals implemented. The outcomes of these could then be disseminated widely among the people, and it would be

especially significant if people in the rural area found hope and were motivated to take part in the projects.

19.1.3 Integration with Related Policies, Strategies and Plans

In order to achieve the goals of the CNDP, close collaboration between the 12th FYP and other relevant policies, strategies and plans will be required.

An SEA was performed during the formulation process of the CNDP. When giving form to the proposed projects, an environmental assessment should be performed on each project as necessary.

19.1.4 Budget and Financial Resources

The 12th FYP (2018 to 2023) forecasts the average annual economic growth rate to be 4.6%. Thereafter, the economy of Bhutan is predicted to continue developing at an average annual rate of 6% until 2030 (see Chapter 11).

The 12th FYP estimates the increase in the scale of the budget to be by 54%, compared to the previous FYP. However, the increase in capital expenditure mentioned in the FYP will only be 5%. This is because a significant increase is foreseen in the government's current expenditures on the maintenance and management of existing infrastructure, the enhancement of social services, principal and interest repayments for hydroelectric power plant facilities, as well as a decrease in grants from international organizations. The trend is predicted to continue and fixed capital formation by the government is likely to stay at around the current level until 2030.

Under these circumstances, the government's spending on the implementation of the policies and projects proposed in the CNDP would be paid out of the budgets of central government ministries/agencies and local governments as laid out in the 12th FYP and within the framework of the Flagship Programmes. The Flagship Programmes of the 12th FYP include themes that are highly compatible with the proposals in the CNDP, such as "economic diversification". As such, there is ample reason to use some of these budgets for implementing the projects proposed in the CNDP.

In line with actualizing the projects, additional support from international organizations and through bilateral cooperation should also be sought.

Coordination is required between the FYPs and budget systems if special budgets are to be allocated to the management organization.

19.2 Human Resource Development for Regional Development

19.2.1 Enhancement of Local Administration

(1) Enhancement of Dzongkhag Government

Local governments play an important role in implementing the balanced development of national land, as targeted in the CNDP.

The overall objective of the 12th FYP is a "just, harmonious and sustainable civil society through enhanced decentralization". The FYP further states that the capital allocation ratio to local governments will be expanded significantly from 30% to 50%. The decentralization of authority and human resources needs to be promoted in order to implement the FYP. The government of Bhutan is currently formulating a National Decentralization Policy, with the details likely to be specified in its implementation plan. A large-scale shift of human resources

and authority from central to local governments is foreseen during the period of the 12th FYP.

Under the circumstances, the roles played by the dzongkhag governments will be rather important in promoting regional development pursuant to the CNDP. Economic development officers were recently assigned in every Dzongkhag government. Although their knowledge and abilities need to be improved, they could be human resources to take roles in the regional promotion. The dzongkhag governments should function as autonomous local governments and leaders in regional development, instead of local branches of central ministries.

This plan proposes the establishment of a section in each dzongkhag government in order to comprehensively promote regional development. One way of doing this would be to reorganize the current planning sections into planning and promotion sections. The mission of the new section would be to proactively and strategically promote projects for regional development and job opportunity creation in cooperation with relevant sections, rather than merely formulating plans and monitoring indicators.

The personnel of the new section should preferably include the following staff:

(a) Promising civil servants dispatched from central government – They will engage in activities to realize the objectives of regional development, from a wide viewpoint and free from obligations to their parent ministry.
(b) Civil servants who have worked as National Civil Servants for a certain period and returned to their hometown on their own initiative – They will contribute towards regional development by drawing on their knowledge of the local community.

The dzongkhag government will promote regional development with the planning and promotion section playing a central role, in collaboration with, among others, relevant sections, gewogs, residents of local communities, NPOs and private-sector business entities.

Although local governments might consider hiring local civil servants or contract workers on their own to execute tasks that are continuing to expand, compact and efficient government needs to be maintained. Rather, it is extremely important that they foster and utilize private-sector entities, including NPOs.

So far, regional development in Bhutan has been promoted with a focus on planning and implementing policies that respond to the basic needs of residents, including basic education and health and medical services. These efforts have steadily yielded results. From now on, it is important that they utilize local resources to either produce high-value products and sell them to markets outside their region, or attract tourists from outside their region, and that they provide high-level services in addition to the above. This is the reason why the focus has been placed on the dzongkhag. Needless to say, the roles played by the gewogs will be most important for grass-roots democracy and reflecting local needs.

(2) Enhancement of Self-reliance of Local Government through Own-source Revenue Generation

In order to promote decentralization, local governments will need to increase their own sources of revenue and enhance fiscal independence. This point is also discussed in the National Decentralization Policy. In reality, however, independent sources account for less than 1% of local government revenue. Even though it is understood to be difficult for the dzongkhag and gewog in the rural area to create large-scale sources of revenue, there is sufficiently high potential in the Urban Area.

Today, four A-class thromdes, including Thimphu, collect land tax as their own source of revenue. However, the land tax is uniform (without a land price evaluation system), the tax

revenue is minimum, and the system has not been reviewed or revised over a long period. Land taxation system reform was proposed for revision by the government of Bhutan, including the adoption of value-based taxation, but the reform has not yet been implemented.

Land holding tax and real estate tax are among the major sources of revenue for municipalities in many countries, including Japan. The function of these types of tax is to secure fiscal resources for urban development and infrastructure improvement, suppress land speculation, and return the profits from development to society (i.e., unearned incomes). Furthermore, they are generally effective in reducing the divide between the wealthy class who own land, and the middle and poorer classes who do not. Land lots with high economic value should be taxed heavily, which would also help to eliminate dissatisfaction among landowners whose lands are designated as UCAs, proposed in the CNDP, and subject to strict control.

Furthermore, an increase in burden should also be considered for those who possess an automobile, use petrol and park their automobile in public spaces, in order to control automobiles that crowd the Urban Area. This would be effective in helping to secure fiscal resources for improving road maintenance and public transportation systems and improving the urban environment, in addition to curbing precious foreign exchange outflows.

As Thimphu and other cities build up their own sources of revenue, budgets for urban development and urban infrastructure improvement may be secured, making it possible to allocate national budgets with a priority for developing the parts of the rural area where the level of GNH is low. Consequently, a contribution may be expected to narrow the gap between the urban and the rural area, and for promoting the balanced development of national land. It is necessary to look into revision taxes and other fiscal incentives as the first thing to consider if those suggestions are acceptable in the taxation system in Bhutan.

19.2.2 Enhancement of Higher Education

(1) Fundamental Higher Education Policy

1) Tertiary education

The Royal University of Bhutan has introduced a policy to set up distinctive colleges in each region. In each college, students need to select one course and take compulsory classes on each course.

In order to utilize the limited cohort of talented personnel effectively, it is necessary to shift to a cross-disciplinary or inter-disciplinary system. Towards that shift, modifications, such as the introduction of a credit transfer system between courses, the promotion of double major education, the expansion of four-year courses and the establishment of new graduate schools, are required. By 2030, the target year, a major revision of the university education curriculum should be completed.

For developing human resources that will contribute to regional development, the policy of pursuing equilibrium nationwide without concentrating colleges in specific regions is somewhat important. In addition, the number of teachers should be increased. In particular, structural reforms for sustainably securing full-time Bhutanese teachers, such as the active recruitment of practitioners (including civil servants) and retirees, are required.

2) Technical education

In Bhutan, the Technical Training Institute (TTI) has been positioned as a higher education institution (it was previously called the Vocational Training Institute). The main role of the TTI has been to train specialists in civil engineering, electrical engineering and mechanical

engineering.

In the future, the TTI will aim to train human resources in each region based on the issues and strengths of the region. It is necessary to create places for collecting and training talented people who are interested in manufacturing, even if the scale is small (e.g., a fab lab) in each region. Each of these places will be positioned as the base for a regional industrial incubation centre. It is particularly important to expand training bases for the priority sectors discussed below.

However, the limitation of national budgets and the shortage of national human resources should be considered. Therefore, collaboration with other facilities, such as colleges, higher secondary schools, medical facilities or industrial facilities, can be one of the solutions. The TTI will be the supplier of human resources in return for sharing facilities and dispatching lecturers. This kind of coexistence relationship should be built in each region.

(2) Enhancement Plan for Priority Sectors

1) Engineering sector

The development of infrastructure is an endless national project, and the training of engineers including for civil engineering, electricity and machinery must be carried out continuously. The TTI has contributed to training needed engineers to date. The future task will be to create an environment where engineers become respected and can work with pride. For example, it will be necessary to improve the social value of engineers through holding manufacturing workshops in collaboration with primary schools and lower secondary schools, or commending them as talented manufacturing creators.

- Engineer: An up-to-date curriculum should be developed. For example, ICT-based civil engineering, including surveying by drone, can be the one of the classes.
- Disaster prevention experts: Specialists in sediment disasters and floods should be trained as soon as possible.

2) Medical sector

Healthcare workers have been developed by Khesar Gyalpo University of Medical Sciences of Bhutan. However, the chronic shortage of medical staff, especially in local health facilities, is serious. To improve such a situation, technical health staff should be trained in each regional training institute on a continuous basis.

- Medical doctors: There is no medical department in any university in Bhutan at present. By 2030, medical doctors should be trained inside the country.
- Nurses and care workers: Establish training institutes for nursing adjacent to the regional referral hospital, which is the base for regional medical care.

3) Tourism sector

In recent years, foreign-affiliated hotels have been opened, one after another, to provide a high-quality, five-star service. Needless to say, tourism is one of the most important industries in Bhutan, and continuing to create employment opportunities will ensure the sustainable development of tourism. The Royal Institute of Tourism and Hospitality under the TCB produced 104 trainees in 2017. However, greater human resource development capacity in tourism is needed. The training of local staff is especially needed.

- Chefs: It is necessary to improve the quality of cooking in hotels for tourists who are looking for high-quality local dishes. In particular, training local chefs urgently needs to take place.
- Service staff: To train hospitality service personnel, such as receptionists, concierge staff and room clerks by inviting experienced practitioners to become lecturers.

4) ICT sector

ICT, such as mobile phones, has spread all over the country, and the quality of ICT is comparable to that of neighbouring countries. On the other hand, most ICT-related products, services and contents consumed in Bhutan are produced overseas. The vulnerability of the domestic ICT industry is quite high. As the ICT industry is one of the few industries in which emerging countries, exemplified by India, can compete with developed countries, creative human resources should be trained at the TTI in cooperation with the tech park in Thimphu and the information technology college in Monggar.

- Programmers: There is an urgent need to train ICT engineers who can play a key role in the development of network-based services and smartphone applications.
- System engineers: Training ICT engineers, who will be responsible for the development and operation of systems used in government agencies, schools and medical institutions in Bhutan, is also vital.
- Graphic designers: Artistic talents, including computer graphic designers, animators and film-makers, are required, not only by the film industry but also by the education and health sectors.
- Business entrepreneur: This will be beneficial in the training of human resources with entrepreneurial skills required by the new ICT industry and integrating ICT with existing industries (such as ICT-driven medical plant cultivation, ICT-driven mining).

5) Regional development sector

Recently, providing human resources for regional development has been pursued in many countries, including Japan, and many undergraduate departments have been set up to train experts in regional economics and regional policy. Unlike the experts who have specialized skills as stated above, regional development experts need to learn management skills and gain extensive knowledge from politics to culture. Therefore, it is desirable to offer at four-year course in college, not the TTI.

- Regional development experts: It is obvious that such specialists will be required, not only by government agencies but also by private consulting firms or NPO/NGOs.

CHAPTER 20 WAY FORWARD

The Comprehensive Development Plan (CNDP) for Bhutan was formulated through technical examination by the JICA Project Team and the Bhutanese counterpart team especially Department of Human Settlements of Ministry of Works and Human Settlements and through supports by a Steering Committee and a Working Group comprised of ministries and national committees. The final report complies outcomes derived from technical analysis and discussions done by those members and representatives of Dzongkhag and local residents. The subsequent step to realize the outcomes of the CNDP are recommended as below.

(1) Officialization of CNDP

GNHC will approve the CNDP as an official document to guide the national development. The proposals of the CNDP will be reflected into the long-term vision (or Bhutan 2045), the 12th Five Year Plan and the sector policy and plans of line ministries.

(2) Implementation of Priority Projects for Regional Development in Eastern Region

The regionally balanced development is one of the upmost issues in Bhutan. To tackle the issue, the comprehensive approach is required comprising the high priority projects below. Those cover the regional development, linked urban centre, tourism promotion and ICT development as well as improvement of air transport. In implementation of those projects, the initiatives by the local residents, communities and companies are crucial to ensure the expected achievement towards the regional development. Dzongkhag is recommended to establish a section for the regional development to specify the development direction of Dzongkhag and coordinate the related sections and departments.

- Eastern Region Development Program (a-2)
- Project for Dzongkhag Vitalization in Eastern Region (b-6)
- Artist-in-residence Programme (f-2)
- Development of Gyalpozhing Tech Park (g-1)
- Formulation of Plan for Social Experiment Project (g-2)
- Development of a Subsidy Scheme to Promote Domestic Air Transport Use by Local People (j-1)
- Development of Subsidy to Promote Domestic Air Transport Use by Local People (j-4)

(3) Formulation of Capital Region and Regional Centre

As estimated in the planning framework of the CNDP, the population increase is unavoidable in towns. To create the town areas properly, the following projects are recommended. Those aim at formulation of national capital region and regional centres. The introduction of the urbanization management area in the structure plan contributes to manage the environment, landscape and settlement.

- Capital Region Development Programme Including Inland Transport Improvement (a-1)
- Formulation of Regional Plan for Sarpang-Gelephu Linked Urban Centre (a-4)

- Project for Institutionalising Land Use Control Measures in Urbanisation Management Areas of Thimphu, Phuentsholing, and Gelephu (a-6)