Royal Government of Bhutan

Feasibility Assessment and Cost Benefit Analysis for National REDD+ Strategy & Action Plan of Bhutan

Report Edition

Mr. Lobzang Dorji, Director, Department of Forests & Park Services (DoFPS)
Ms. Sigyel Delma, Chief Forestry Officer, Watershed Management Division (WMD), DoFPS
Dr. Jigme Tenzin, Dy. Chief Forestry Officer, National REDD+ Coordinator, WMD, DoFPS

Published by: Watershed Management Division, Department of Forests and Park Services
Ministry of Agriculture and Forests, Royal Government of Bhutan

Suggested citation:
Ministry of Agriculture and Forests. 2020. Feasibility Assessment and Cost Benefit Analysis for National REDD+ Strategy & Action Plan of Bhutan, Watershed Management Division, Department of Forest and Park Services, Ministry of Agriculture and Forests, Royal Government of Bhutan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CBA	Cost-Benefit Analysis
CFMG	Community Forest Management Group
CFs	Community Forests
DD	Drivers of Deforestation and Forest Degradation
DDG	Decentralized Distributed Generation
DoFPS	Department of Forests and Park Services
EC	Environmental Clearance
EIA	Environmental Impact Assessment
ESMF	Environmental and Social Management Framework
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign Direct Investment
FMS	Fund Mobilization Strategy
FMUs	Forest Management Units
FNCCR	Forest and Nature Conservation Rules and Regulations of Bhutan
GBCL	Green Bhutan Corporation Limited
GNH	Gross National Happiness
GVA	Gross Value Added
IRR	Internal Rate of Return
MoAF	Ministry of Agriculture and Forests
NEC	National Environment Commission
NEPA	National Environmental Protection Act
NFI	National Forest Inventory
NGOs	Non-Government Organisations
NLC	National Land Commission
NPV	Net present value
NRS	National REDD+ Strategy
NWFP	Non-Wood Forest Products
PAMs	Policies and Measures
Pas	Protected Areas
PES	Payment for Ecosystem Services
PLRs	Policies, Legislations, and Regulations
RE	Renewable Energy
REDD+	Reducing Emissions from Deforestation and forest Degradation and the role of sustainable management of forests, conservation and enhancement of forest carbon stocks in developing countries
RGoB	Royal Government of Bhutan
SESA	Strategic Environmental and Social Assessment
SRF	State Reserved Forests
SRFL	State Reserved Forest Land
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

1. The Royal Government of Bhutan (RGoB) is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and is a REDD+ partner country. The objective of REDD+ is to reduce emissions from deforestation and forest degradation and the conservation, sustainable management of forests and enhancement of forest carbon stocks.

2. REDD+ participant countries are eligible for results-based payments for verifiable emission reductions and/or enhanced carbon stocks. Prior to seeking such REDD+ payments, the Bhutan REDD+ Programme is required to establish a national framework. The key elements of this framework include institutional and implementation arrangements, a National REDD+ Strategy (NRS), a National Forest Reference Emission Level, a National Forest Monitoring System, and a safeguards framework (Strategic Environmental and Social Assessment). It is also necessary for the country to undertake a thorough analysis of the drivers of deforestation and forest degradation, develop a benefit sharing framework and estimate the cost implementing the NRS.

3. The objective of REDD+ is to reduce emissions from deforestation and forest degradation and the conservation, sustainable management of forests and enhancement of forest carbon stocks. This strategy seeks to achieve these measures, but within a far broader vision that provides co-benefits, including enhancing livelihoods, protecting ecosystem services, and conserving biodiversity. The aim of this analysis is to evaluate the feasibility of the implementation of the NRS options. The results of the analysis provide the basis for the relative prioritization of the strategy options with the purpose of helping in planning and decision making. There are four key aspects that constitute the feasibility analysis.

    - **Regulatory and Policy Analysis**: This is an assessment of the interaction and coherence of the strategy options and relevant Policies, Legislations, and Regulations (PLRs).
    - **Institutional Analysis**: This is an analysis and identification of institutions that would be involved in the implementation of REDD+ to ensure roles and responsibilities are well aligned as well as the necessary capacity.
    - **Contribution to national planning objectives:** This is a qualitative assessment of the contribution of each strategy option to the outcomes under various national economic and sector development policies and strategies specifically including the Gross National Happiness (GNH) principles and the 12th FYP
    - **Cost and benefit analysis:** This is an analysis of the expected cost of implementation and potential social and economic benefits based calculation of the net present value (NPV) of the implementation of the Policies and Measures (PAMs) with baseline funding and reference benefits or impacts. These are derived from cost benefit analysis in addition to qualitative feedback from stakeholders.

4. There are four Strategy Options in the NRS. Each option focuses on priority issues and aims to build and improve forest management in Bhutan, in line with existing national economic development policies. The options are multi-sectoral and take into consideration the unique status of Bhutan being a net carbon sink. There are 10 PAMs that are proposed under the NRS. These PAMs are crosscutting and designed to create the necessary enabling environment for effective implementation of REDD+ as well as having a selection of direct intervention options.

5. **Strategy option 1:** '**Strengthened Forest Management Practices'**. This strategy option aims to support existing frameworks, policies, and regulations for forest management, as well as to strengthen resource management monitoring and enforcement. This strategic aim also seeks to build capacity through improved guidance and technological innovation. There is the overall consistency of the strategy option with the objectives set in the relevant PLRs. The regulatory framework, policies, and strategies linked to forest resources in Bhutan support forest conservation, sustainable forest management and planning, and community forest management. The regulatory framework includes principles on natural resource governance, sustainable management and utilisation of forest resources, rights and duties, access to information, and equitable distribution of benefits among others. The legislative and policy framework provides a balanced pathway for implementing REDD+ mitigation measures that would strengthen natural resources management.

6. **Strategy option 2: 'Climate-Smart Primary Production'**. Climate-Smart Landscape approach is an integrated, landscape-level approach that addresses multiple objectives, including both adaptation and mitigation, as well as other dimensions, such as food security and livelihood improvement. This strategy option will result in the expansion of climate-smart plantations to support the development and provision of sustainable wood supply, the protection of livelihoods, and the sustainable management of forest growth to foster carbon storage. Climate-smart agriculture will also be developed, in order to transform and reorient agricultural systems to effectively support the development and ensure food security in a changing climate.

7. **Strategy option 3: 'Integrated Land Use Planning'**. This critical strategy option is largely about creating the necessary enabling environment for successful and effective implementation of REDD+. Development, including hydropower expansion, is important for the economy but must be undertaken in a way that limits impacts on forests. A national approach to master planning and how to evaluate sectoral trade-offs is necessary in order to have a broad national perspective. Land allotment based on a harmonized national zoning system will encourage institutional decision-making to be based on definitive land characterization and a better understanding of trade-offs. This could provide the necessary balance between socioeconomic development and conservation. The NLC is already emphasizing the importance of such policy/planning guidance because of the emerging trends in land use such as increased urbanization and climate change. The REDD+ Readiness process is the ideal opportunity to kick start this concept. But to support the land use policy concept, substantial analytical work is required to formulate a framework for improved land allocation based on robust spatial planning.

8. **Strategy option 4: 'Improved Rural Livelihoods'.** This strategy option focuses on the promotion and upscaling of livestock management and agricultural practices, nature-based enterprises, and mechanisms based on the co-benefits of forest conservation such as payment for ecosystem services schemes. Strategy Option 4 is multi-sectoral and targets improving community livelihoods, broadening opportunities for income generation through sustainable management of Non-wood Forest Products (NWFPs), ecosystem services, and climate-smart agricultural practices. As with other strategy options, there is a selection of PLRs that are important in creating the enabling environment. This strategy option focuses on improving income generation through the promotion and upscaling of livestock management and agricultural practices, nature-based enterprises, and mechanisms based on the co-benefits of forest conservation, such as Payment for Ecosystem Services (PES) schemes and creating income alternatives for the use of forest areas while incentivizing conservation.

9. There are 10 cross-cutting PAMs. In general, the four strategy options and proposed intervention actions are highly relevant and respond to the identified drivers and underlying causes of deforestation. The limitation of the CBA approach has been the availability of adequate for some components. However, both quantitative and qualitative analysis clearly suggests that a combination of regulatory and institutional strengthening would have a greater impact on reducing deforestation and forest degradation. As noted, Bhutan has a wide range of suitable policies and opportunities, but enforcement and financial capacity have been significant barriers to effectiveness.

10. The PAMs are illustrated in a theory of change in **Error! Reference source not found.**. The proposed Strategy Options and associated PAMs and Action Plan are expected to cost USD 54.5 million (Table 1.1).

Table 1.1 Strategy Option Budget Estimate

Enabling PAMs	Estimate Cost (USD)	Direct Intervention PAMs	Estimate Cost (USD)
PAM 1 Developing institutional and sectoral capacity building to achieve sustainable forest management	3 000 000	PAM 5 Achieving a highly diversified and technology-based timber supply chain	5 800 000
PAM 2 Strengthening the effectiveness of existing policies and methods across all forestry jurisdictions and areas	1 670 000	PAM 6 Adopting fire management approaches that limit impacts on the environment and communities	5 000 000
PAM 3 Strengthened cross-sectoral planning and coordination	4 600 000	PAM 7 Establish plantations to provide sustainable wood products supply, increase carbon-stock, and enhance biodiversity	21 600 000
PAM 4 Harmonized EIA process to ensure infrastructure proposals are assessed and monitored as a package	1 600 000	PAM 8 Promoting the development of enterprises that sustainably manage Non-Wood Forest Products	1 075 000
		PAM 9 Broadening opportunities for income generation from ecosystem services	2 250 000
		PAM 10 Develop climate smart approaches in agriculture	8 000 000
Total Estimate	**10 870 000**		**43 725 000**
Grand Total (USD)	**54 595 000**		

1. BACKGROUND AND INTRODUCTION

11. Climate change represents an environmental problem and a serious challenge to sustainable development and the livelihood of the Bhutanese people. Bhutan's National Environment Strategy "The Middle Path" highlights hydropower development, industrial growth and intensification of agriculture as the three major avenues for sustainable development in Bhutan. The vulnerability of hydropower development, industrial growth and intensification of agriculture to the adverse effects of climate change emphasizes the need for climate change response measures focused on a wide range and landscape level measures.

12. The Royal Government of Bhutan (RGoB) is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and is a REDD+ partner country. The objective of REDD+ is to reduce emissions from deforestation and forest degradation and the conservation, sustainable management of forests and enhancement of forest carbon stocks.

13. REDD+ represents an opportunity for Bhutan to strengthen a wide range of climate change response measures. To remain carbon neutral, growing emissions from economic development will need to be mitigated by pursuing low emission development pathways across all sectors.

14. Participant countries are eligible for results-based payments for verifiable emission reductions and/or enhanced carbon stocks. Bhutan will develop the following key elements as part of the country framework in the REDD+ readiness (Phase I): institutional and implementation arrangements to implement REDD+, a national REDD+ strategy, a national forest reference emission level, a national forest monitoring system, and a safeguards information system.

15. Bhutan has completed a technical assessment of the drivers of deforestation and forest degradation which supports the prioritization of response measures. This information coupled with broad stakeholder participation through consultation processes in each of the REDD+ thematic areas has provided the backdrop for the proposed Strategy Options and PAMs the National REDD+ Strategy (NRS).

16. The feasibility analysis conveys how REDD+ and identified strategy options fit into the context of Bhutan's national development framework and path. The aim is to understand the implications of identified strategy options on existing policies and institutional setup. Specifically, how these strategy options fill in the gaps and build on the existing policies and how existing regulatory, policy and institutional systems support REDD+ implementation.

17. The feasibility analysis and the cost-benefit analysis (CBA) both build on the prior analysis done for strategy preparation, specifically from the situational assessment of existing shortcomings affecting drivers of deforestation and forest degradation and their solutions. REDD+ strategy options need to be assessed and prioritized for their social, environmental, political and financial feasibility. This would help identify risks and opportunities in implementing strategy options especially in identifying cross-sectoral inconsistencies and level of integration of the strategy options with broader development policies.

18. The CBA offers an indicative overview of the implementation costs of identified strategy options. The results of this high-level exercise will support and guide the prioritization of the strategy options and policies and measures (PAMs) for implementation from the point of view of the most efficient use of funds. This process will inform the development of an Action Plan and a specific timeline for implementation of the strategy options.

2. FEASIBILITY ANALYSIS

2.1 Approach

19. The objectives of the NRS respond to the challenges and opportunities identified during the REDD+ readiness process, which are closely in line with the long-term national vision and support the government's drive for economic diversification. The NRS represents the vision of stakeholders who share interest REDD+ and increasing the benefits from the country's natural resources.

20. The aim of this analysis is to evaluate the feasibility of the implementation of the NRS options. The results of the analysis will provide the relative priority of the strategy options with the purpose of helping in planning and decision making. There are four key aspects that constitute the feasibility analysis.

    a) Regulatory and Policy Analysis: This is an assessment of the interaction and coherence of the strategy options and relevant Policies, Legislations, and Regulations (PLRs). This aspect also looks at the contribution of each strategy option to the outcomes under various national economic and sector development policies and strategies specifically including the Gross National Happiness (GNH) principles and the 12th FYP

    b) **Institutional Analysis**: This is an analysis and identification of institutions that would be involved in the implementation of REDD+ to ensure roles and responsibilities are well aligned as well as the necessary capacity.

    c) Cost and benefit analysis: This is an analysis of the expected cost of implementation and potential social and economic benefits based calculation of the net present value (NPV) of the implementation of the PAMs with baseline funding and reference benefits or impacts. These are derived from cost-benefit analysis in addition to qualitative feedback from stakeholders.

2.2 Proposed Strategy Options and Policies and Measures

21. The Strategy Options define the direction that Bhutan will take to address the direct drivers and underlying causes of deforestation and forest degradation. Each option focuses on priority issues that have been defined through consultations with a wide range of stakeholders. These strategic directions will help to build and improve the forest management in Bhutan in line with national economic development policies. Table 2.1 presents the strategy options for the Bhutan National REDD+ strategy.

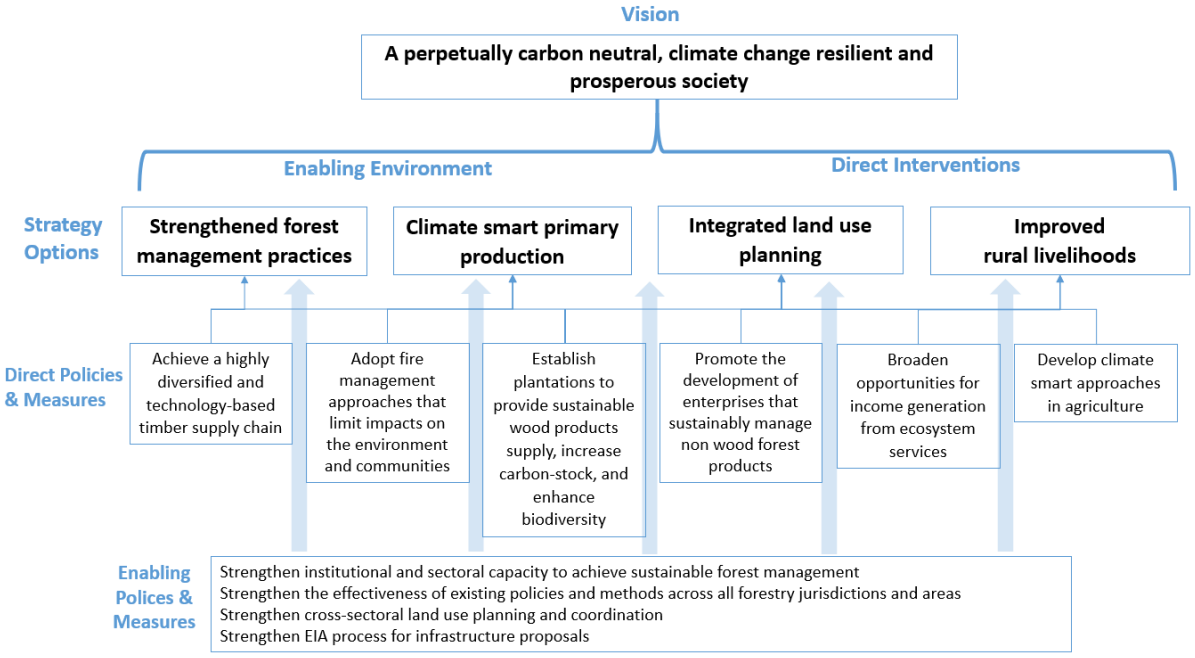
Table 2.1 Strategy Options

Strategy Option	Details
Strengthened forest management practices	To support the existing frameworks, policies, and regulations for forest management, this option focuses on strengthening resource management monitoring, law-enforcement, and governance and builds capacity for more effective management.
Climate smart primary production	The increase in demand for timber will continue to create pressure on the forests, as well as planned deforestation from drivers such as infrastructure development. The development of plantations offers an opportunity to increase sequestration and mitigate emissions from these activities and help alleviate timber demand. Combined efforts for the development of plantations in degraded areas will ensure forest restoration at the landscape level. The demand for firewood is considerable and contributes to forest degradation of natural forests. Promoting alternative sources for firewood supply such as plantations of fast-growing and multipurpose species can help to reduce forest degradation. Further assessment and demonstration of technologies for efficient firewood use is necessary to reduce demand and hence pressure on natural forests.
Integrated land use planning	The existing legislation has provisions to address the environmental impacts from various infrastructure projects, however broader impacts affecting forest environmental services are not included or adequately addressed. The implementation of remediation measures would require a stricter monitoring and enforcement regime to achieve forest restoration.
Improved rural livelihoods	Rural communities depend on agriculture activities, livestock management and forest resources for their livelihoods. Improving efficiency and diversification will improve sector productivity, therefore, increasing alternative income and reducing pressure on the forest. Exploring more opportunities from Payment for Ecosystem Services schemes will encourage broader participation in natural resources management and enhance livelihoods through re-investment in local communities.

22. The Strategy Options will be delivered via a number of cross-cutting policies and measures (PAMs). Under each PAM is a set of proposed actions, which will be the responsibility of different organizations. A number of PAMs are devised to develop the enabling environment, in order to ensure that policies, laws, regulation, approaches are strengthened and all work in harmony. These PAMS also address capacity and resource needs. This enabling environment is essential in addressing many of the underlying drivers of deforestation and forest degradation, and in providing the platform for direct interventions. Other PAMS provide direct interventions, which will reduce the impacts of deforestation and forest degradation, while improving livelihoods and other co-benefits. Some of these interventions are entirely new, while others seek to build on existing initiatives. Figure

2.1 below summaries the Strategy, including the Vision, Strategy Options, and cross-cutting Policies and Measures.

Figure 2.1 NRS Visions, Strategy Options and PAMs



23. Table 2.2 illustrates a theory of change for NRS, in which outcomes of the vision are the proposed Strategy Options and interventions refer to the proposed PAMs.

Table 2.2 NRS Theory of Change

Goal To promote a perpetually carbon neutral, climate change resilient and prosperous society			
↓			
ENABLING ENVIRONMENT		**DIRECT INTERVENTIONS**	
↓			
Outcomes			
Strengthened Forest Management Practices	**Integrated Land Use Planning**	**Climate Smart Primary Production**	**Improved Rural Livelihoods**
↓			
Interventions			
Developing institutional and sectoral capacity building to achieve sustainable forest management		Achieving a highly diversified and technology-based timber supply chain	
Strengthening the effectiveness of existing policies and methods across all forestry jurisdictions and areas		Adopting fire management approaches that limit impacts on the environment and communities	
Strengthened cross-sectoral planning and coordination		Establish plantations to provide sustainable wood products supply, increase carbon-stock, and enhance biodiversity	
Harmonized EIA process to ensure infrastructure proposals are assessed and monitored as a package		Promoting the development of enterprises that sustainably manage Non-Wood Forest Products	
		Broadening opportunities for income generation from ecosystem services	
		Develop climate smart approaches in agriculture that address adaptation, mitigation, food security, and livelihood improvement	
↑			
Indicators			

3. FEASIBILITY ASSESSMENT

3.1 Regulatory and Policy Analysis

24. The analysis looks at the consistency of the strategy options with the PLRs provisions, objectives, processes and the complementarity that REDD+ will bring. The assessment includes the following steps:
    - Identification of PLRs, strategies and policies that are relevant to each strategy option
    - Evaluation of the strengths and gaps/ weaknesses that could arise through the implementation of the strategy options
    - Proposal of alternatives to address the gaps/weaknesses identified

25. The analysis of **strengths** identifies the provisions in the regulatory framework that support the implementation of the Strategy Options, and if this helps to meet the objectives of existing policies and strategies. In other, this assessment looks at the enabling environment for REDD+ implementation and any aspects that may limit the effectiveness of proposed interventions.

26. The identification of **gaps** assesses the existing challenges that could affect or limit the effective implementation of the proposed strategy options. These may be minor gaps such as the lack of precise guidelines to major gaps as contradictory objectives that would require amending the legislation or regulations.

27. The strengthening of forest management practices requires a combination of actions that support existing policies, regulations and guidelines. However, it is necessary to assess the relationship between the proposed strategy options and activities against all relevant policies to determine the measure of relevance. This is a subjective process but one that has been undertaken in consultation with a large number of stakeholders. For each strategy option, relevant policies and laws are assessed with regards to the degree of relevance of each PAM (Table 3.1).

Option 1: Strengthened Forest Management Practices

28. Strategy Option 1 is designed to address the gaps in the sustainable management of forest resources within FMUs, PAs, CFs noting the findings of the analysis of drivers of deforestation and forest degradation. State Reserved Forests (SRFs) outside planned management regimes constitute the major source of timber supply, but there are identified weakness. The fundamental challenge with current forest management in areas outside PAs and other management regimes is the absence of management plans for local forests and watersheds that enable adequate community participation and stewardship. In addition, the absence of adequate data and information to determine sustainable levels of timber allocation in relation to current and future demand is a significant policy gap. Therefore, a combination of efforts to strengthen the implementation of management plans, revising zonation guidelines, implementing monitoring systems is feasible and practical.

29. Based on findings in the Drivers of Deforestation and Forest Degradation (DD) study (WMD, 2015) there is an opportunity to reduce the inefficiencies in current forest management that leads to increased forest degradation and loss of carbon, and opportunities for improved management to increase forest quality and carbon storage. Bhutan has over 50% of its land area dedicated as protected areas (PAs), and other forest defined as Forest Management Units (FMUs), Working Schemes, Local Forest Management areas, Community Forests (CFs), and there are also Watershed Management Plans and Wetland Management Plans.

30. Table 3.1 illustrates a list of relevant policies and regulations whose purpose and objectives already support REDD+.

Table 3.1 Strategy Option 1 Ranking of most relevant policies and laws

Polices and laws	Subject	PAM 1	PAM 2	PAM 3
Constitution of Bhutan 2008	Overarching legislation			
Forest and Nature Conservation Act 1995	Forests			

Forest and Nature Conservation Rules and Regulations 2017	Forests			
Forest Fire Rules 2012	Forests			
Biosafety Act 2015	Food and Livestock			
Draft Access and Benefit Sharing Policy 2014	Other			
Draft Mineral Development Policy 2011	Other			
Bhutan Gender Policy Note 2013	Other			
Draft Renewable Natural Resources Marketing Policy 2016	Energy			
Economic Development Policy 2010	Land			
Economic Development Policy 2016	Land			
Economic Development Policy 2017	Land			
Electricity Act 2001	Energy			
Environmental Assessment Act 2000	Overarching legislation			
Environmental Standards 2010	Overarching legislation			
Final Draft National Land Policy 2010	Land			
Food Act 2005	Food and Livestock			
Food and Nutrition Security Policy 2012	Food and Livestock			
Land Act 2007	Land			
Livestock Act 2001	Food and Livestock			
Livestock Rules and Regulations 2008	Food and Livestock			
Local Government Act 2009	Land			
National Biodiversity Strategies and Action Plan 2014	Biodiversity			
National Environmental Protection Act 2007	Overarching legislation			
National Environmental Strategy, the Middle Path 1998	Overarching legislation			
National Forest Policy 2010	Forests			
Regulation for Environmental Clearance of Projects 2016	Overarching legislation			
Renewable Energy Policy 2011	Energy			
Waste Prevention and Management Regulation 2012	Waste			
Water Act 2011	Water			
Water Policy 2007	Water			
Water Regulation of Bhutan 2014	Water			

Highly relevant	
Relevant	
Complementary	
Contradictory	

31. Within FMUs, there are varying degrees of compliance failures. Post-harvest reforestation efforts seem to be yielding low success due to low average survival rates, and this is attributed in part, to inadequate application of scientific principles in silvicultural operations largely due to lack of funding. Addressing such challenges is therefore a matter of providing additional funding resources as policies and regulatory measures are already in place.

32. A substantial amount of degradation is occurring in SRF areas without any management plans, and this, therefore, the simplest measures would be to develop management plans underpinned by robust data collection systems. This need is recognized by the Department of Forests and Park

Services (DoFPS), and some planning has been initiated by the field offices, but progress has been limited by lack of funds.

33. There is the overall consistency of the strategy option with the objectives set in the relevant PLRs. The regulatory framework, policies, and strategies linked to forest resources in Bhutan support forest conservation, sustainable forest management and planning, and community forest management. The regulatory framework includes principles on natural resource governance, sustainable management and utilisation of forest resources, rights and duties, access to information, and equitable distribution of benefits among others. The legislative and policy framework provides a balanced pathway for implementing REDD+ mitigation measures that would strengthen natural resources management.

34. The key procedural features of the related PLRs in Bhutan[1] further underline the strengths of existing practices of forest management and reiterate the need to continuously improve these practices based on the monitoring and evaluation results from forest management plans. These procedural features include:

- detailed provisions on enforcement, trade, transport, allotment, control, standards, planning, monitoring and evaluation of forest resources
- the role and use of Forest Management Plans
- consultations and participation of communities and relevant stakeholders at all levels, for example, Community Forest Management Group (CFMG) at the community level, in decision-making on forest resource management
- coordination and roles of authorities and other bodies in the governance of the forest sector, among others.

35. There are gaps in policies that have been identified by the various analysis. For a more detailed analysis of gaps, reference should be made to the DD Study Report which outlines the leading causes of forest loss. The critical point is that forest loss is generally a result of planned activities except in a few instances, such as fire damage. Some gaps exist that should be addressed in improving governance practices of forest management. The underlying drivers of deforestation and forest degradation in Bhutan range from governance challenges, law enforcement, economic, social poverty and tenure aspects, and demographic factors. The key aspects further unpacked in the analysis of deforestation and degradation drivers include:

- Decisions without integrated planning and guidelines, particularly related to cross-sector alignment or conflict arising from lack of spatial planning guidance
- Implications of expanding hydropower
- Capacity constraints, including law enforcement and controlling illegal activity
- Rural timber allotment and pricing/subsidies
- Climate change is not yet fully mainstreamed into development planning

36. The challenge encompasses some complex processes for local communities[2] outlined in regulations and policies, such as in the Forest and Nature Conservation Rules and Regulations of Bhutan 2017 (FNCCR) 2017. These processes require robust monitoring systems that are proving hard to maintain due to the amount of resources and efforts needed. As a result, the laws should include better standards for monitoring and evaluation processes, highlighting who and how often and in which aspects.

37. Despite the existence of policies, effective management plans are lacking. A critique in the National Biodiversity Strategies and Action Plan notes that while forestry legislations require all areas under state forest to be strategically guided by sustainable management plans, as of 2014, only 6.4% of the SRFL under Forest Management Units and Working Schemes and 2.2% under Community Forests have well-formulated resource management plans (RGoB, 2014). [20 FMUs, 193 821.77 hectares total, 138 321.33 hectares of forest (as of 12/2017) - 731 CFs, 82 879.163 hectares. - 30 LFMPs, 83 172.6 hectares, 79 893 AAC m^3/year.]

[1] FNCCR 2017, Forest and Nature Conservation Act 1995, National Forest Policy 2011, Subsidised Timber and Nonwood Forest Produce Allotment Policy 2011, Economic Development Policy 2017, The Local Government Act 2009, National Environmental Protection Act 2007, Environmental Assessment Act 2000, The Land Act 2007, Local Government Rules and Regulations 2012, Protocol for Policy Formulation of Royal Government of Bhutan.

[2] such as timber allocation processes and requirements in FNCCR 2017, which can be difficult to manage by rural communities in CF

38. In terms of SRF, a holistic land use planning approach with a strong monitoring framework would enable optimal and sustainable resource use which is currently viewed as weak. It has been noted that the capacity for broader stakeholder and community participation remains limited due to limited guidance on forest management. The strategy option and the corresponding PAMs support Bhutan's forest policies and the mandates of the instructions of the relevant legislation and regulations.

39. Part of this Strategy Option is also to support renewable energy as an alternative to firewood for cooking. The Renewable Energy Policy 2011 promotes renewable energy through Foreign Direct Investment (FDI)/alternative funding sources, generation of power through renewable energy (RE) technologies, community-based initiatives on priority, use of modern energy services in rural areas, and standalone project initiatives by communities/ non-government organizations (NGOs)/ individuals. In remote locations and rural areas, community-based initiatives in the form of Decentralized Distributed Generation (DDG) or any other initiative leading to promotion of RE sources, shall be dealt on a priority basis. The policy shall strive to ensure the adequate provision and extensive use of modern energy services in rural areas, which have been largely dependent on firewood and kerosene for cooking, heating and lighting. Communities/NGOs/Individuals can initiate and undertake the standalone projects based on the renewable energy technologies or combination of such technologies depending upon the available resources and demand of the location. Resource mobilization through FDI venture to augment the resource needs is important. Nationwide implementation of PAM can have significant positive impacts.

40. The PLR relate well to the PAMs under this strategy option. The PAMs propose direct and indirect interventions that will have a positive impact on the overall management of forest and enhance biodiversity conservation.

Option 2: Climate-Smart Primary Production

41. The demand for construction timber in rural areas is high and is increasing, but the overall resource base of forests in Bhutan for commercial timber production is very limited given the large area of protected areas, and very remote and very steep mountain terrain. Only about 14% of the total forest area is considered capable of supplying quality construction timber. With the rapid economic development taking place in various parts of the country, the need for housing has gone up. Houses are constructed particularly in suburban areas for rental and commercial purposes.

42. The practicality and complementarity between strategy options and PAMs are important. Strengthening sustainable forest resource management requires additional actions to strengthen measures to reduce demand and increase the supply of specific types of timber. State Reserved Forest Land (SFRL) allotments result in planned forest loss are part of national development policies. A re-dress for the forest loss involves some of offset mechanism that identifies alternative areas to afforest or reforest. But this also presents the opportunity to influence market demand for certain types of species (leading to climate-smart plantation development).

43. The FNCRR 2017 supports the establishment of plantation forests, outlines principles of developing plantations like appropriate vegetation composition and focuses on local and native species based on site conditions. It provides guidance on procedures to be followed in research planning and implementation. The Act supports science-based management planning with sustainable resource use regimes and activities including reforestation requirements where necessary. This provision empowers the ministry to issue necessary rules to permit the conduct of scientific research in the forests relevant to implement PAM 4 for instance. Overall, the legislative provisions support relevant research for plantation program in general.

44. At the institutional level, National Environment Commission (NEC) is responsible for ensuring and promoting the use of clean energy and alternative technologies to reduce the use of fuelwood/timber from the primary forest. The National Environmental Protection Act (NEPA) 2007, outlines adequate provisions in terms of guiding policies supporting legislation and implementation. It sets out four options in which the government will provide fiscal incentives to ensure compliance to ensure that firewood demand can be balanced by providing alternative energy resources, which includes the option of energy plantations. The incentives are tax incentives for environmentally friendly products and services, reduction of customs duties for imports of such products and services, grants or co-financing for projects with this aim, and incentives for sustainable waste management.

45. On the other hand, the National Forest Policy 2011 emphasizes the application of good science and research in forest planning and management to support policy implementation. As such, it is practical and coherent to consider a REDD+ strategy option that will improve plantation norms and standards, identify suitable species for different ecological zones to support mass plantation development as part of the national climate change mitigation and economic measures to improve livelihoods.

46. This strategy option is also a continuation of previous efforts such as the Reforestation Strategy 1996 and the Strategy Document for Plantation Program 2008 that aimed to address the increasing demand for timber which is now driving some degree of illegal felling of trees. The demand for valuable timbers is identified by the Anti-Corruption Commission of Bhutan as one of the main reasons for illegal felling of trees. This is further facilitated by the abundance of chainsaws, which enable illegal or unauthorized felling. The Anti-Corruption Commission of Bhutan recommended that the DoFPS consult with the Ministry of Economic Affairs to identify how to control ownership of power chainsaws in villages and suggested that introduction of a licensing system for chainsaws as an option. The FNCRR 2017 contain provisions in Section 20.3 mandating the registration of power chainsaw with the Department, and all registered sawmill/portable saw millers/power chainsaw owners shall saw rural timber only after obtaining sawing permission from the nearest Range Office (RGoB, 2017). These are important measures, but they will need to be effective, but this can only be determined by effective monitoring tools to identifies shortcomings and opportunities for improvement.

47. An expanded plantation program will increase carbon stocks and help address forest degradation. The REDD+ program provides an opportunity to identify forest land that is of relatively low ecological value for plantation development and enrichment planting. The DoFPS has been carrying out plantation programs across the country, and REDD+ could add value and focus as more data is available to support suitability analysis and targeting. In accordance with the National Forest Policy 2011, plantation programs are to be out-sourced and accordingly DoFPS has developed a guideline for outsourcing plantation and nursery activities. These guidelines provide an important basis to enable the implementing of activities under REDD+. The National Biodiversity Strategies and Action Plan 2014 focuses on rehabilitation of prioritised degraded areas and ecosystems and sets out actions and indicators that could be followed to prioritise degraded lands, as well as including plantations as a potential rehabilitation measure. National target 4 of the document recognises the pressure on natural resources from the increased demand for timber and fuelwood hence it also aims at promoting the use of efficient technologies for harvesting, processing and marketing of forest resources including timber plantations.

48. There is the Local Government Act 2009 which states the functions of Local Governments to conserve and enhance the environment under their jurisdiction. Local Government might negotiate on behalf of the local communities with the project proponents to enable the development of plantations for the use of local communities if it were to become a project objective. The Land Act of Bhutan 2007 focuses on the lease of SRF for community forests to the rural communities for development of plantation for wood fuel sufficiency. Rules and Regulations for Lease of SRF and GL 2009 is directly related to this Act as it provides how an environmental issue should be resolved with a given time frame. The main point is that the enabling environment for plantation development is in fact present. REDD+ could, therefore, be an important vehicle for targeted fund mobilization to compliment government fiscal allocations.

49. The establishment of the Green Bhutan Corporation Limited (GBCL) with a mandate to take over plantation and nursery operations from DoFPS will require significant financial support. Therefore, additional funding is proposed to support the strategic planning necessary for GCBL and the DoFPS to translate the National Plantation strategy into local level activities. Some of the key activities include i) Review of National Strategy on Plantation and Nursery of Bhutan, ii) Map and identify degraded areas for plantations, iii) Build capacity for plantation and nursery techniques, and iv) develop afforestation business plan.

50. Table 3.2 lists policies, laws and regulations relevant to Strategy Option 2.

Table 3.2 Strategy Option 2 Ranking of most relevant policies and laws

Policies and laws	Subject	PAM 4

Bhutan Gender Policy Note 2013	Other	
Bhutan Vision 2020 I & II	Overarching legislation, biodiversity	
Biosafety Act 2015	Food and Livestock	
Constitution of Bhutan 2008	Overarching legislation	
Draft Access and Benefit Sharing Policy 2014	Other	
Draft Mineral Development Policy 2011	Other	
Draft Renewable Natural Resources Marketing Policy 2016	Energy	
Economic Development Policy 2010	Land	
Economic Development Policy 2016	Land	
Economic Development Policy 2017	Land	
Electricity Act 2001	Energy	
Environmental Assessment Act 2000	Overarching legislation	
Environmental Standards 2010	Overarching legislation	
Final Draft National Land Policy 2010	Land	
Food Act 2005	Food and Livestock	
Food and Nutrition Security Policy 2012	Food and Livestock	
Forest and Nature Conservation Act 1995	Forests	
Forest and Nature Conservation Rules and Regulations 2017	Forests	
Forest Fire Rules 2012	Forests	
Land Act 2007	Land	
Livestock Act 2001	Food and Livestock	
Livestock Rules and Regulations 2008	Food and Livestock	
Local Government Act 2009	Land	
National Biodiversity Strategies and Action Plan 2014	Biodiversity	
National Environmental Protection Act 2007	Overarching legislation	
National Environmental Strategy, the Middle Path 1998	Overarching legislation	
National Forest Policy 2010	Forests	
Regulation for Environmental Clearance of Projects 2016	Overarching legislation	
Renewable Energy Policy 2011	Energy	
Waste Prevention and Management Act 2009	Waste	
Waste Prevention and Management Regulation 2012	Waste	
Water Act 2011	Water	
Water Policy 2007	Water	
Water Regulation of Bhutan 2014	Water	

Highly relevant	1
Relevant	2
Complementary	3
Contradictory	4

51. The existing regulatory framework[3] contains many relevant aspects that are in line with this strategy option. The existing forestry regulations reiterate relevant principles for developing plantations with appropriate vegetation composition with the NEPA (2007) providing options and incentives for plantations development for timber production. Principles governing plantation forests are present in the National Forest Policy 2011 provisions where the focus is on plantations for rehabilitation, compensatory social forestry, and wood-based industries. There is further encouragement of diversified uses and purposes for plantation establishment such as the establishment of bamboo plantations. Compensatory plantations link to infrastructure development activities which could be linked to ecosystems services and biodiversity offsets.

52. The DD study identifies some important gaps in relation to Strategy Option 2. While there are requirements for forest restoration from land leased to mining[4], it is not clear how much re-vegetation is required to allow regeneration of forests and/or actual establishment of plantations. It is also not clear what is the quality of the restoration plans approved and if these will allow substantive re-vegetation/plantation establishment.

53. The National Biodiversity Strategies and Action Plan 2014 focuses on rehabilitation of prioritized degraded areas and ecosystems and sets out actions and indicators that could be followed to prioritize degraded lands, as well as including plantations as a potential rehabilitation measure. National target 4 of the document is also relevant for this PAM. This target recognizes the pressure on natural resources from the increased demand for timber and fuelwood that entails remedial interventions. Overall, it also aims at promoting the use of efficient technologies for harvesting, processing and marketing of forest resources, which also could include timber plantations.

54. The Forest and Nature Conservation Act 1995 focuses on forestry leases. Lease of forests (SRF) is provided with the main objectives of improvement, protection and sustainable use of forest in accordance with the applicable management plan, and these objectives would include the development of plantation programs as one of the components of the overall objectives. For preservation/conservation of degraded land (other purposes), the Government can declare any land as a protected area and initiate restorative activity programs. These provisions are relevant for undertaking plantation activities within the scope of community and private forestry rules framed for the purpose of the strength of this legal provision.

Option 3: Integrated Land Use Planning

55. This Strategy option is largely about creating the necessary enabling environment for successful and effective implementation of REDD+. Strengthening land use planning could be considered as one of the critical measures of the NRS. Harmonizing land use planning is a critical part of this Strategy noting the main drivers of deforestation. The projected SFRL, hydropower development plans, road construction, agricultural expansion and powerlines require significant improvement in the national planning process if deforestation and continued degradation are to be avoided. The preeminent law guiding land use is the Land Act of 2007. The Act defines the mode of decision-making on land use, allowing for subdivision and leasing, and provides procedural guidance, but criteria for evaluating allotments or leases of SRFL sits with each sector. In general, there are significant policies, laws and regulations that would enable reduction of forest loss or at least incentives measures to restore or replace lost forest.

56. The Environmental Assessment Act of 2000 focuses on environmental clearance (EC) to minimize environmental damage from projects or activities. The Act also sets the process for compliance, notifications, as well as corrective measures. EC is a prerequisite for the issuance of a development consent by the government outlining compliance requirements for minimizing environmental impact and necessary mitigation and restorative measures.

57. The regulation for Environmental Clearance of Projects 2016 outlines the process for Environmental Clearance according to sectoral guidance, including the potential to be subject to an Environmental Impact Assessment (EIA). It sets out the process for public consultations, provides the power to

[3] FNCCR 2017, Forest and Nature Conservation Act 1995, National Forest Policy 2011, National Environmental Protection Act 2007, National Re-afforestation Strategy 1996, Strategy document for plantation program of Bhutan 2008, National Biodiversity Strategies and Action Plan 2014, Environment Assessment Act 2000

[4] Mines and minerals management regulations 2002

relevant authorities to evaluate findings and make a binding decision, and sets out the process for monitoring and inspection.

58. Noting that hydropower expansion is inevitable as it is an important part of the economy because of its primary role as a source of foreign exchange and economic development, the financial commitment associated with hydropower expansion is a potent underlying driver that will put pressure on the country's forests. It is becoming increasingly clear that the expansion of hydropower facilities will have increasing impacts on forests due to facility siting and related infrastructure. While efforts to address forest loss due to hydropower projects, such as requiring the establishment of compensatory plantations, are in place, they need to be complemented with strong policy and governance measures to ensure long-term compliance. This analysis shows that all the necessary regulatory measures are in place, but the capacity for enforcement and cross-sectoral coordination is weak.

59. Infrastructure and plant development cause vast areas to be deforested bur under the *Gross National Happiness Accounts*, an offset mechanism to compensate for the negative impacts of infrastructure development exists. The law requires ploughing back at least 1% of the royalties into the Environment Sector as compensation for environmental damages. The strategy option proposes options to ensure the ploughback of royalties is effective with the possibility for increasing the level. The 15% levy from hydropower is currently off-set with common national budget and directly inserted in the National Treasury as part of the National Budget. As a result, there are inadequate financial resources available to the environment sector to restore affected areas and to develop alternative and compensation areas.

60. Substantive regulatory and policy complementarity exists in Bhutan, and this should provide the necessary enabling conditions for direct and indirect REDD+ interventions. The Forest and Natura Conservation Act 1995 covers all the aspects of environmental protection. The Act recognizes the impact of shifting cultivation on the environment and therefore provides for rules to be framed to control such activity in private land. The FNCRR 2017 provides for administrative and operational details for implementation of the Act. SRF needs Forest Management Plans approved by the Ministry of Agriculture and Forests (MoAF), which provides for conservation and protection of forests. Moreover, the government has the power to declare any land as a protected area for the protection of biological diversity, management of wildlife, conservation of soil and water, and related purposes.

61. There is a significant push for economic development based on the sustainable harnessing of natural resources with minimal ecological footprints and defining, and this is driven through the Economic Development Policy 2017 complemented by other sectoral policies. The policy provides guidance on important priority sectors for economic development namely the "five jewels"- Hydropower, Cottage and small industries, Tourism, Mining and Agriculture. Overall, the policy presents very inclusive guidance for all the priority economic sectors and linkage to the broad environmental landscape.

62. A common theme that emerges for the analytical work suggests that gaps exist in compliance enforcement and regulatory implementation as a result of a lack of human and financial capacity. For instance, in NEPA 2007, the processes of monitoring and compliance are not specific with regards to roles and responsibilities. In some instances, it is not clear which organization has the mandate for each sector. While there is a process for informing communities about the impact of certain activities on the environment, there is no mention of further actions to address the negative impacts, apart from what is mentioned in other laws on penalties and fines.

63. Bhutan's challenge over the years has been to ensure strong cross-sectoral planning and coordination to reduce policy conflicts. The underlying drivers of deforestation and forest degradation identified include governance challenges, policy and enforcement as well as sectoral policy implementation conflicts. Thus, the Land Act does not provide policy or planning guidance to help reconcile trade-offs between sector goals while the regulation for Environmental Clearance of Projects 2016 has no guidance on provisions for coordinated/collaborative monitoring of environmental standards.

64. On the other hand, the Local Government Act of 2009 promotes decentralized governance and defines the roles of Dzongkhag and Gewog level government in decisions. Local governments will benefit from having national perspectives and guidance based on national-level plans and zoning. The new Economic Development Policy (June 2016) identifies these gaps and defines that the

National Land Commission (NLC) should carry out zoning to outline optimal land use, SRFL should be allotted for strategic business activities, and indicates that a range of Acts should be reviewed and revised, including the Land Act, the National Environment Protection Act, and the Local Government Act.

65. The starting point to address these underlying issues is to develop a common reference frame in the form of the national land zoning system. A national approach to master planning and how to evaluate sectoral trade-offs is necessary in order to have a broad national perspective. Land allotment based on harmonized national zoning system will encourage institutional decision-making to be based on definitive land characterization and a better understanding of trade-offs. This could provide the necessary balance between socioeconomic development and conservation. The NLC is already emphasizing the importance of such policy/planning guidance because of the emerging trends in land use such as increased urbanization and climate change. The REDD+ Readiness process is the ideal opportunity to kick start this concept. But to support the land use policy concept, substantial analytical work is required to formulate a framework for improved land allocation based on robust spatial planning. Table 3.3 summarizes the national policies, laws and regulations that are relevant to Strategy Option 3 implementation.

Table 3.3 Strategy Option 3 Ranking of most relevant policies and laws

Policies and laws	Subject	PAM 5	PAM 6
Bhutan Gender Policy Note 2013	Other		
Bhutan Vision 2020 I & II	Overarching legislation, biodiversity		
Biosafety Act 2015	Food and Livestock		
Constitution of Bhutan 2008	Overarching legislation		
Draft Access and Benefit Sharing Policy 2014	Other		
Draft Mineral Development Policy 2011	Other		
Draft Renewable Natural Resources Marketing Policy 2016	Energy		
Economic Development Policy 2010	Land		
Economic Development Policy 2016	Land		
Economic Development Policy 2017	Land		
Electricity Act 2001	Energy		
Environmental Assessment Act 2000	Overarching legislation		
Environmental Standards 2010	Overarching legislation		
Final Draft National Land Policy 2010	Land		
Food Act 2005	Food and Livestock		
Food and Nutrition Security Policy 2012	Food and Livestock		
Forest and Nature Conservation Act 1995	Forests		
Forest and Nature Conservation Rules and Regulations 2017	Forests		
Forest Fire Rules 2012	Forests		
Land Act 2007	Land		
Livestock Act 2001	Food and Livestock		
Livestock Rules and Regulations 2008	Food and Livestock		
Local Government Act 2009	Land		
National Biodiversity Strategies and Action Plan 2014	Biodiversity		
National Environmental Protection Act 2007	Overarching legislation		
National Environmental Strategy, the Middle Path 1998	Overarching legislation		
National Forest Policy 2010	Forests		
Regulation for Environmental Clearance of Projects 2016	Overarching legislation		
Renewable Energy Policy 2011	Energy		

Waste Prevention and Management Act 2009	Waste		
Waste Prevention and Management Regulation 2012	Waste		
Water Act 2011	Water		
Water Policy 2007	Water		
Water Regulation of Bhutan 2014	Water		

Highly relevant	1
Relevant	2
Complementary	3
Contradictory	4

66. Provisions for forestry leases are outlined in the Forest and Nature Conservation Act 1995 and clearly outlines that lease of forests (SRF) is provided with the main objectives of improvement, protection and sustainable use of forest in accordance with the applicable management plan, and these objectives would include development of plantation programs as one of the components of the overall objectives. For preservation/conservation of degraded land (other purposes), the Government can declare any land as a protected area and initiate restorative activity programs. These provisions are relevant for undertaking plantation activities within the scope of community and private forestry rules. The key point here is that if REDD+ can support resource mobilization and capacity building, then it is possible and feasible to reduce deforestation and in fact increase forest cover through better land use planning and stronger regulatory implementation.

67. The Environment Assessment Act 2000 ensures projects to plant trees and implement other forms of land restoration and protection as set out in the environmental clearance's terms and conditions. Non-compliance will lead to action by the authority, and as such ensures compliance with the Environmental Clearance's terms. Regulation for Environmental Clearance of Projects 2016 provides for administrative and operational details for implementation of the Act. The major challenge is monitoring of compliance with these regulations has been weakened by a lack of resources.

68. Mines and minerals management regulations 2002 indicate that excess financial bond not used in rehabilitation will be returned to leasees, but there are no provisions for the opposite situation (i.e. extra payments if the cost of rehabilitation is greater than the bond). While there are the requirements for restoration, it is not clear how much re-vegetation is required to allow regeneration of forests and/or actual establishment of plantations. It is also not clear what is the quality of the restoration plans approved and if these will allow the re-vegetation/plantation. Detailed guidance on compliance monitoring is missing. In the National Forest Policy 2011, there is no further guidance provided on the limits and established boundaries of commercial development of timber plantations. There is also a lengthy procedural requirement for establishment of plantations, and a complex management system requirement. Subsequently, there is less incentive for the community and private forestry activities.

Option 4: Improved Rural Livelihoods

69. Some key messages from the UN-REDD and recent global discussions are that

- Clear links exist between REDD+ and green economy objectives, both of which call for a change in the business-as-usual economic development in order to slow the loss of natural capital;
- Although an aggregate value is elusive, the multiple benefits of REDD+ provide a clear rationale for the integration of REDD+ in a green economy transition. This includes the enhanced provision of ecosystem services, in addition to climate change mitigation, and the potential to deliver various social benefits;
- Although challenges remain, integrating REDD+ within a green economy transition could maximise synergies in policy and planning, as well as reduce the transaction and implementation costs of pursuing each independently.

70. The role of forests and land use in the context of natural capital is included in growing discussions of a transition to a green economy, and the RGoB has already taken a position on developing a green economy. United Nations Environment Programme (UNEP) defines a green economy as one that 'results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive' (UNEP, 2011a).

71. Strategy Option 4 is multi-sectoral and targets improving community livelihoods, broadening opportunities for income generation through sustainable management of Non-wood Forest Products (NWFPs), ecosystem services, and climate-smart agricultural practices. As with other strategy options, there is a selection of PLRs that are important in creating the enabling environment. This strategy option focuses on improving income generation through the promotion and upscaling of livestock management and agricultural practices, nature-based enterprises, and mechanisms based on the co-benefits of forest conservation, such as Payment for Ecosystem Services (PES) schemes and creating income alternatives for the use of forest areas while incentivizing conservation.

72. In general, the regulatory and policy framework for enabling proposed REDD+ strategy options exist with a broad emphasis on sustainable management of forest resources and biodiversity to produce social, economic and environmental goods and services for all citizens.

73. The National Strategy for Community Forestry 2010 outlines the technical and socio-economic approaches to CF and managing community forest to generate income with a wide range of other goods and services through the National Biodiversity Centre established by the government. It highlights the need for on-going capacity building to support income generation, poverty reduction and payment for environmental services. The Biodiversity Act of Bhutan 2003 provides the regulatory framework on NWFP trading allowing research and innovation in genetic resources, and recognition of the rights over a product developed through such research. The person with rights can trade a product or transfer rights to the product.

74. The Forest and Nature Conservation Act 1995 and Forest and Nature Conservation Rules and Regulations 2017 are central to the implementation of PAMs under Strategy Option 4. NWFPs play a big role in community livelihoods but require sustainable management which can be achieved through both regulatory, policy and broader community engagement and capacity building. There are already multiple policies and regulatory measures in place that could support the strengthening of sustainable management of NWFPs and income generation. National Forest Policy 2011 provides a measure for technical assistance to facilitate communities' capacity to harvest sustainably, process and efficiently and economically market selected NWFPs through the establishment of local enterprises for instance. There is recognition of rights and responsibilities of communities to manage NWFP with a focus of improving management skills in resource quality assessment and harvesting. Policies also recognize the need for training coordination between contemporary management and institutional arrangements with indigenous and traditional approaches to management of NWFPs. These provisions give MoAF the authority to develop guidelines and other documents to implement the policy objectives.

75. The general observation is that technical regulations that provide official guidance on NWFP management, use, trading, domestication, harvesting already exist by the capacity for effective support and implementation has remained weak due to limited financial resources. It is noted that NWFP Groups are responsible for preparing bylaws with clear management objectives, rights and responsibilities; allocation and utilization of forests resource; and fund management addressing the issues of sustainability, but they require capacity building from the government.

76. In terms of gaps, it is not very clear to what extent the technical regulations for NWFPs are providing guidance for the communities, or support to marginalized groups. These bylaws need to be reviewed to evaluate their effectiveness to provide proper guidance for domestication, management and trading of NWFP for communities. Capacity building for management of NWFP has not yet been actively facilitated in practice, and they need to be organized specifically for the benefit of NWFP management for local communities, stakeholders and authorities for improved management, which is the mandate of DoFPS. There are no designated funds to focus on the capacity building and specific guidance development for the management of NWFPs, so there is a need for a proper assessment of funds necessary to organize such training and prepare specific improved guidance documents. The application of participatory technical trials involving researchers and community groups, including marginalized groups, would be a useful innovation. Environmental education and

awareness could be strengthened through protected area management plans and recreational programs.

77. Strategy Option 4 proposes strengthening and promotion of income generation from ecosystem services. Ecosystems comprise of all the elements that could at times be taken for granted - forests, mountains, wetlands, agricultural land, freshwater – which provide a variety of services that are economically valuable: fresh water supply for human settlements (e.g. by filtering the water from contaminants); irrigation and power generation; or storm protection and pollination. Ecosystem provisioning services (i.e. the products obtained from ecosystems such as food and fresh water) are a fundamental part of Bhutan's livelihood. The regulating services (i.e. the benefits obtained from the regulation of ecosystem processes such as air quality and pollination) enable people to live in a safe and healthy environment. The cultural services (i.e. the non-material benefits that Bhutan's people obtain such as spiritual enrichment, recreation, tourism and aesthetic experiences) make the country an attractive tourist destination. There are also the supporting services needed to maintain the other services (such as photosynthesis and nutrient recycling) which further support life.

78. The economic value of ecosystem services in Bhutan is estimated to range between USD 440 million to USD 1.2 billion per year. Provisioning services represent the highest values, as nature provides Bhutanese people with inputs for food, timber, water and energy in amounts that range from USD 355 million to approximate USD 1 billion per year. Ranging between USD 77 million and USD 216 million per year, cultural and recreation services also play a significant and increasing role in generating wealth in the country. Much of this is driven by the flourishing tourism sector and the flows of investments that support the efforts to conserve and protect natural habitats and biodiversity. Approximate 29% of all visitors are nature-based. This suggests that nature-based ecosystems (which includes forests, wetlands, glaciers etc.) generate an annual income of at least USD 42.6 million. These are significant values that provide a rationale for finding options to tap into PES mechanism to generate additional income for local communities and government.

79. The feasibility and justification for proposing REDD+ interventions focusing on enhancing opportunities from ecosystems services is that benefits from ecosystems for regulation of key functions, which are often unaccounted in traditional economics, range between USD 9 million to USD 46 million and are linked to a range of opportunities including the potential contribution to greenhouse gas emissions noting the net sink position. The provision of such services might require communities living in the proximity of the ecosystem to undertake or not to undertake certain activities. PES has the potential to be a cost-effective means to improve environmental management and improve livelihoods by rewarding the communities for their efforts and stewardship in providing ecosystem services, such as watershed protection, soil stabilization.

80. Bhutan already has some experience with PES schemes. A PES Feasibility Study was undertaken by the Food and Agriculture Organization of the United Nations (FAO) in 2009 and identified certain positive conditions for PES implementation. PES was piloted for three environmental services in three locations in the country leading to the development of a National Framework for PES and Field Guides, and PES is in fact by the National Forest Policy.

81. In 2009, the Watershed Management Department piloted the PES concept for sustainable land management. From this pilot, only Yukpugang CFMG PES developed into a PES scheme for water source protection, and it is a practical example that can provide lessons, but Bhutan can take this further with opportunities presented under the REDD+. The 10th FYP considered tourism as an important growth sector to support youth employment and poverty reduction in rural, and this remains the case. Ecotourism PES was proposed in Phobjikha valley, Wangdue and this another opportunity Bhutan can build on.

82. Strategy Option 4 also proposes interventions in the agriculture sector. From a feasibility point, intervention in the agriculture sector will serve a dual function – reducing pressure on forests while creating better opportunities for income generation and poverty reduction. For the agriculture sector, there are a number of key PLRs. The protection of agriculture land and the promotion of commercial agriculture are widely outlined in the Land Act (2007). Existing policy objectives include the development and implementation of adaptation and mitigation measures for long term climate and environmental changes through climate-smart agriculture and farming practices (Food and Nutrition Security Policy (2014). These form a substantive basis for income generation and increase in productivity per unit area. The Food and Nutrition Security Policy (2014) also emphasises support

for communities and particularly women's access to resources, income generation opportunities and decision-making in households.

83. Opportunities exist in improving livestock productivity, and the regulatory and policy framework has important provisions. The Livestock Act 2001 has a strong focus on animal health in terms of control and management of diseases, regulation on import and export, and promotion of better and productive breeds. The scope of the Act ensures quality and appropriate breeds of livestock, poultry and fish are introduced in the country.

84. Regarding livestock management and agricultural practices development, the Land Act 2007 addresses protection of agriculture land, support for traditional natural resource management to sustain agriculture production system, promotion of commercial agriculture, categorization of lands and among other important aspects. Conversion of land to other categories is highly restricted except in accordance with the laws, but this has largely been in the absence of substantive land zoning. The Livestock Rules and Regulations 2008 provide more detailed guidance and procedures on animal health management, control and prevention of diseases, regulation on import and export of breeds. There are provisions for technical support and feasibility assessment for private individual or agencies wishing to establish farms for different purpose including genetic improvement, commercial and dairy farming for instance. In the event of a need for construction of infrastructure on such farms, the NEC and Department of Forest issue clearances for infrastructure following vulnerability assessment of land stability, environmental degradation and pollution. The main point is that REDD+ support of any form is well in line with the objectives of the government and the enabling environment including necessary safeguard measures are in place or at least can easily be put in place.

85. With the main economic sectors being 1) energy due to large scale hydropower export to India; 2) agriculture, livestock, and forestry; and 3) construction due to road and energy system construction work, which are also the main drivers of deforestation, it is therefore logical that REDD+ interventions must address these areas. The proposals under Strategy Option 4 will contribute in general, to food security and income generation while reducing pressure on forests through what is termed climate-smart agricultural practices. There are a number of highly relevant policies that provide the enabling environment with the most direct being the Economic Development Policy 2017 which has provisions and emphasis on climate-smart and organic agriculture. Agriculture is one of the main contributors to the national GDP, and the emphasis of this policy is on improving productivity sustainably and ensuring self-sufficiency. Organic agriculture is potentially one source of income that has not been widely explored at the local level. MOAF is pointed as the agency leading this process.

86. The Food and Nutrition Security Policy 2014 strongly emphasizes the need to ensure sustainable domestic food production and productivity beyond agricultural crops. The policy also aims to promote, and support agro-based and non-farm based rural enterprises for employment and income generation. In an emerging economy such as Bhutan, it is also important to establish a business environment to promote private, domestic and foreign investment in agriculture to stabilize food prices in the longer term through sustained food production.

87. The Seeds of Bhutan Act 2000 and Seed Rules and Regulations of Bhutan 2006 both provide the necessary environment and govern the seed industry to ensure only approved and certified seeds enter the market. The proposed measures under REDD+ may well involve seed production. This is necessary for any REDD+ intervention.

88. The Livestock Act 2001 and the Livestock Rules and Regulations 2008 set provisions for a wide range of opportunities related to livestock and pasture development. However, there seem to be some gaps that could be addressed under REDD+. For instance, in practice, modern methods of rearing livestock for commercial purposes are not widely practised. In the provisions relating to pasture management, both improved pasture and rangelands are largely missing. Table 3.4 below summarizes the relevant PLRs-

Table 3.4 Strategy Option 4 Ranking of most relevant policies and laws

Policies and laws	Subject	PAM 7	PAM 8	PAM 9	PAM 10
Bhutan Gender Policy Note 2013	Other				

Bhutan Vision 2020 I & II	Overarching legislation, biodiversity				
Biosafety Act 2015	Food and Livestock				
Constitution of Bhutan 2008	Overarching legislation				
Draft Access and Benefit Sharing Policy 2014	Other				
Draft Mineral Development Policy 2011	Other				
Draft Renewable Natural Resources Marketing Policy 2016	Energy				
Economic Development Policy 2010	Land				
Economic Development Policy 2016	Land				
Economic Development Policy 2017	Land				
Environmental Assessment Act 2000	Overarching legislation				
Environmental Standards 2010	Overarching legislation				
Final Draft National Land Policy 2010	Land				
Food Act 2005	Food and Livestock				
Food and Nutrition Security Policy 2012	Food and Livestock				
Forest and Nature Conservation Act 1995	Forests				
Forest and Nature Conservation Rules and Regulations 2017	Forests				
Forest Fire Rules 2012	Forests				
Land Act 2007	Land				
Livestock Act 2001	Food and Livestock				
Livestock Rules and Regulations 2008	Food and Livestock				
Local Government Act 2009	Land				
National Biodiversity Strategies and Action Plan 2014	Biodiversity				
National Environmental Protection Act 2007	Overarching legislation				
National Environmental Strategy, the Middle Path 1998	Overarching legislation				
National Forest Policy 2010	Forests				
Regulation for Environmental Clearance of Projects 2016	Overarching legislation				
Renewable Energy Policy 2011	Energy				
Waste Prevention and Management Act 2009	Waste				
Waste Prevention and Management Regulation 2012	Waste				
Water Act 2011	Water				
Water Policy 2007	Water				
Water Regulation of Bhutan 2014	Water				

Highly relevant	1
Relevant	2
Complementary	3
Contradictory	4

3.2 Institutional Analysis

89. The institutional set up is a key enabling factor for the implementation of the REDD+ strategy options. Bhutan has defined institutional arrangements for the REDD+ readiness phase. Throughout the implementation of the strategy options, it is expected that the capacity of the organizations linked to the PAM activities will be continuously assessed as new needs will arise which may require supplementing functions or even the creation of new organizations or divisions.

90. Firstly, this analysis identifies the existing institutional arrangements and REDD+ functions as defined for the readiness phase. Then the analysis will identify the role of these organizations in the implementation of the strategy options and PAMs. The general observation is that the institutional setting in Bhutan would support REDD+ implementation without necessarily requiring the creation of new institutions if REDD+ principle can be mainstreamed into the five-year plans. Table 3.5 lists all the institutions that have been or will be involved in the REDD+ process in Bhutan. Many of them have already played a key role in REDD+ Readiness process and will continue to build on the existing institutional roles to facilitate the implementation of the NRS. This is a non-exhaustive list. Each of the institutions on the list is further briefly described below.

Table 3.5 Agencies to be involved in the REDD+ process

Agencies	Role in REDD+ Readiness
Gross National Happiness Commission	Ensure REDD+ programs are in line with government plans and policies
National Land Commission	Cadastral data, advice and guidance on land use change and land tenure
National Environment Commission	GHG reporting, National Communication, UNFCCC Focal Point with a secretariat – with sectoral technical committees.
Ministry of Agriculture and Forests	Coordinate and implement REDD+ program
Ministry of Economic Affairs	Land clearance system, represent in the Technical working group, ensure harmonization of their policies with that of REDD+ vision
Ministry of Foreign Affairs	Represent Bhutan at government level in all international negotiations
Ministry of Finance	Representation in REDD+ Task Force, facilitate for budget availability for REDD+ readiness activities
Ministry of Home and Cultural Affairs Department of Local Government, Dzongkhag Administration, Geog Administration	Represented in REDD+ Task Force, REDD+ committee at the local level facilitates disseminating information to local communities
Non-Governmental Organizations and Civil Society Organizations Royal Society for Protection of Nature Bhutan Trust Fund for Environmental Conservation National Commission for Women and Children Tarayana Foundation	Represented in REDD+ Task Force, Technical Working Groups and provide recommendations on relevant issues and assist the Government in REDD+ Readiness implementation

Natural Resources Development Corporation Ltd.	Represent in the Technical Working Groups and recommendations on relevant issues and assist the Government in REDD+ Readiness implementation
Royal University of Bhutan	Represent in Technical Working Groups and contribute to research and studies

91. **The GNH Commission** is central for coordinating and driving planning and policy formulation. Its role is to ensure that REDD+ is in line with existing plans and policies and to monitor, facilitate, and coordinate implementation of policies, plans and programs for effective delivery. The GNH Commission could also oversee overall NRS implementation.

92. The **National Land Commission** and the **National Environmental Commission** are high-level multisectoral bodies. The NLC is responsible for laying down the policies, programs, regulations and guidelines to implement the provisions of the Land Act, including the allotment of SRF land, and coordinating with stakeholders on the identification and demarcation of land. The NEC focuses on decision-making on environmentally sustainable and integrated development. It is also the national focal point agency for the UNFCCC and compiles the National Communications, Biennial Update Reports, and reports on Bhutan's REDD+ actions to the UNFCCC.

93. **Ministry of Agriculture and Forests'** mission is to ensure the sustainable social and economic well-being of the Bhutanese people through adequate access to food and natural resources. It is comprised of several agencies that make up different elements of agricultural and forest management. **The Department of Forests and Park Services** is responsible for the conservation and sustainable management of SRFs and plays a key role in developing policies and strategies. The DoFPS territorial divisions (14) and offices implement forestry plans and programs, while Dzongkhag (district) administrations contribute to the implementation of REDD+ activities. DoFPS is responsible for addressing the following programs, which also cover REDD+ related activities: sustainable management of SRF; sustainable management of forest landscapes and conservation of biodiversity; and integrated watershed management to ensure sustainable environmental service delivery.

94. **Ministry of Economic Affairs** aims to create an enabling environment, including institutions and infrastructure for the sustainable growth of the economy through public & private sector development. It would mainly oversee land and clearance system, represent in the Technical working group, and ensure harmonization of their policies with that of REDD+ vision.

95. **The Department of Renewable Energy** highly regards sustainable watershed management as it serves as a backbone for hydropower generation by maintaining sufficient water flows. Therefore, the energy supply expects to be broadened in consideration to electricity demand, climate change issues and Bhutan's reliance on hydropower.

96. **Ministry of Foreign Affairs** represents Bhutan at government level in all international negotiations, including climate change and REDD+ processes. It ensures UNFCC compliance and oversees an overall meeting of international requirements. Moreover, it has been very closely involved with hydropower projects in Bhutan from the perspective of foreign relations. Hydropower in Bhutan is primarily exported to India, as it remains the biggest buyer and as a result has the most impact on the Bhutanese economy.

97. **Ministry of Finance** is represented in the REDD+ Task Force, and its role is to facilitate budget availability for REDD+ readiness activities. It is the national agency responsible for managing and allocating budgets for all other ministries. The guiding principles for the financial management arrangements for the project are to use the current RGoB financial management systems feasibly. The budget for implementing the activities is routed through the Ministry of Finance as per the RGoB rules, and both financial and procurement management is done by the Administrative and Finance Division in MoAF. As a result, it has also been very closely involved with hydropower development in Bhutan.

98. **Ministry of Home and Cultural Affairs** maintains its role in representing in REDD+ Task Force, REDD+ committee at the local level, facilitates disseminating information to local communities. It is able to reach the communities and enable facilitation of capacity building and information sharing, as well as the implementation of REDD+ at local levels.

99. **NGOs and CSOs** play an essential role in facilitating REDD+ processes and offering recommendations from social and environmental perspectives related, for instance, to rural forest-dependent communities. They also assist in the overall implementation of REDD+ processes and are also part of the Technical Working Group. NGOs and CSOs will continue to contribute to the REDD+ processes throughout the NRS implementation.

100. **Natural Resources Development Corporation Ltd.** offers recommendations on relevant issues and assists the Government in REDD+ Readiness implementation. It is also the only entity allowed to produce timber for commercial purposes from Forest Management Units and Working Schemes managed through forest management plans approved by the government, in which DoFPS carries out monitoring procedures. It also carries out reforestation activities in harvested and degraded areas.

101. **The Royal University of Bhutan** can develop research and small studies on climate change in Bhutan relevant for decision making, capacity development and awareness creation. It is also represented in the Technical Working Group and maintains its academic representation towards REDD+ processes in Bhutan.

102. In general, the institutional setting necessary for the implementation of REDD+ is in place, but further clarity or roles and responsibilities, and improved coordination is necessary to improved policy implementation across sectors.

3.3 Cost Benefit Analysis

103. Each of the PAMs are evaluated based on costs and benefits they generate over a period of 20 years. The results of this high-level exercise will support and guide the prioritization of the strategy options and PAMs for implementation from the point of view of the most effective and efficient use of funds. The process of developing the NRS has also included the development of a fund mobilization strategy (FMS) and Benefit Sharing Mechanism. The FMS entails assessing both domestic and external sources of funding to support relevant thematic areas of REDD+ as defined under Bhutan´s R-PP. It is also acknowledged that determining what counts as REDD+ related finance is sometimes not so clear as donor institutions often report funding against broad categories such as “environment” or “forests”, instead of reporting against activities that are country-driven, promote co-benefits and biodiversity, actions that are consistent with conservation of natural forests, involvement of indigenous peoples and local communities as well as transparent forest governance (definition by UNFCCC). For this feasibility, funding is treated as an inherent gap, but the basic assumption is that some funding will be available under general national fiscal planning and regulatory and policy reform, improvement can still be achieved under annual institutional work plans.

104. In the process of developing the national REDD+ framework, it is important to understand cost-related information of REDD+ as a basis for developing strategies, allocate budgets, and assess the effectiveness of REDD+ investments and expenditures and prepare for results-based payments where it makes business sense. As defined by the World Bank, REDD+ implementation costs[5] are defined as the costs and investments required to implement REDD+ and avoid or minimize displacement of emissions to other regions or sectors (leakage). For instance, these costs can include:
    - the cost of forest protection to prevent illegal logging;
    - sustainable forest management activities;
    - agriculture or pasture intensification;
    - improving energy efficiency in household cooking methods.

105. Depending on the scale of the cost assessment, the implementation costs may also include national level costs such as program implementation, extension support services, investment in interventions and inputs directly related to reducing emissions from deforestation and forest degradation.

106. At the project level, implementation costs of REDD+ are closely related to the respective project designs, which should explicitly address the drivers of deforestation and forest degradation as identified in the opportunity cost analysis, leakage prevention and overall project management as well as technical training and capacity building. A major characteristic of implementation costs is

[5] World Bank – Estimation of REDD+ Cost Elements 2016

their recurrent nature after initial investments have taken place, that are related to addressing the drivers of deforestation and forest degradation.

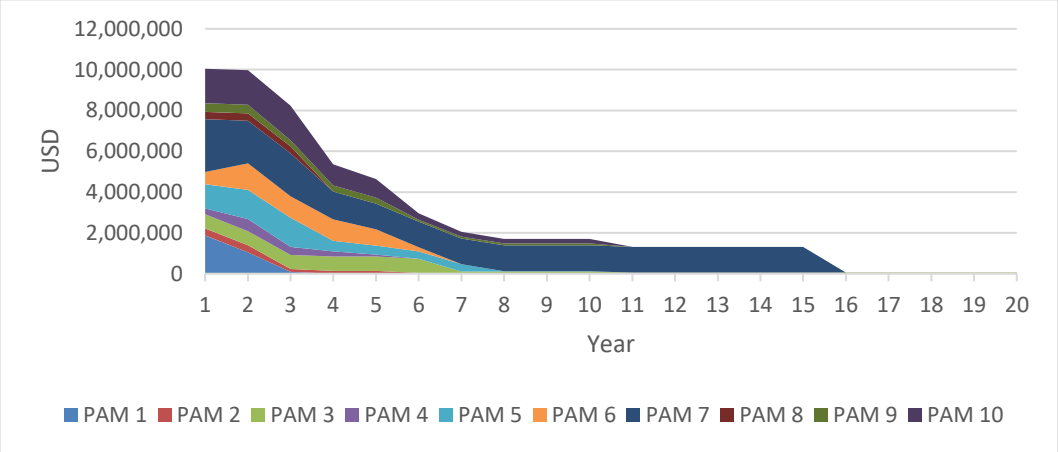
3.3.1 General Approach

107. The CBA gives an indication regarding the financial profitability of the various PAMs. The results should be interpreted as indicative only as the analysis relies on multiple assumptions that generally attempt to predict the future. Nevertheless, the results can still be used while deciding which PAMs to pursue, but only as one part of a more holistic assessment. Also, most of the PAMs generate direct and indirect benefits that are not valued as part of this analysis.

108. The CBA calculates financial indicators to show the profitability of the PAMs proposed by this strategy. The indicators used in the CBA are a net present value (NPV), and internal rate of return (IRR). The NPV is calculated with both social and commercial discount rates. Furthermore, the financial indicators are calculated for various benefits of the PAMs since they have differences in liquidity. Some generate direct monetary benefits and some less tangible ecosystem services that have limited markets. Namely, the financial indicators are calculated for monetary, non-monetary and carbon benefits, and all combinations of these. It should be noted that there are interventions that will have a negative NPV. A negative NPV does not necessarily suggest that such an intervention should be abandoned, but the qualitative analysis must justify the adoption. From a policy perspective, REDD+ requires the enabling environment to succeed and often the interventions that create the enabling environment are intangible and difficult to quantify in financial terms. Hence, there are multiple analytical streams associated with the NRS including DD analysis, SESA, ESMF, FREL, benefit sharing and stakeholder consultations.

109. The budget values for the CBA are derived directly from the NRS Action Plan which has a detailed implementation outlined for each PAM. Figure 3.1 illustrates how the budgets are divided for all project years according to the Action Plan. Each Action Plan budget line is divided for project years evenly.

Figure 3.1 Budget allocations for the PAMs over 20 years



110. Each PAM is assigned a baseline value of relevant ecosystem services that it is assumed to be impacted. These values are derived from literature, and appropriate assumptions are made where high-quality data is not available. The impact of the PAMs over time are assumed to take place during the 20-year period following a linear function between the current state to the assumed future state at year 20. The projects are assumed to have an impact on annual area deforested, annual forest area degraded, and the annual area lost for fires. Conversely, the plantation project is assumed only to have an impact on the area planted, although it has indirect impacts on releasing pressure on forest degradation.

111. The impact on the baseline by the PAMs are valued using various values generated by avoided damage to the forests or by increased forest cover due to the PAMs. These benefits are modelled over a 20-year period. Deducting the costs of the PAMs during the same period results in a net value flow for each year which is then used to calculate the financial indicators. The formulas for the financial indicators are presented in Table 3.6.

112. Finally, a sensitivity analysis of the key assumptions is carried out to show how the PAMs' profitability behaves if these key assumptions are changed. The key assumptions generally deal with the project targets, i.e. the impact of the PAM on the baseline situation in the Bhutanese forests.

Table 3.6 Financial indicator definitions and formulas

Method	Definition	Formula
Net Present Value (NPV)	The sum that results when the expected financial costs of the investment are deducted from the discounted value of the expected revenues.	NPV (i,N) = $\sum_{t=0}^{N} \frac{R_t - C_t}{(1+i)^t}$ i = discount rate, t = time of the activity, R_t = revenues and C_t costs during time t, N = the number of periods.
Internal Rate of Return (IRR)	The discount rate that zeros out the NPV is the IRR. It is compared with a benchmark discount rate to evaluate project performance.	IRR (i,N) = $\sum_{t=0}^{N} \frac{R_t - C_t}{(1+i)^t} = 0$ Same as above.

3.3.2 Discount Rates

113. In addition to a normal time preference discount rate used by private companies and individuals that is assumed here at 15%, the analysis uses a social discount rate (SDR) calculated according to Valentim & Prado (2008). The equation for calculating the SDR is adjusted to Bhutan with 1.3% population growth[6] and 6.6% annual per capita GDP growth[7]. The social discount rate is set at 8.36%. The justification for using an SDR is that an impact investor or the government generally has a lower time preference and perhaps a lower expectation for profits than a commercial investor.

114. Time preference is included in the assessment while calculating net present values to account for the general depreciation of future cash flows as opposed to a cash flow received today. A practical example of the discount rate in the NPV calculations is that an investor investing in a project needs to earn at least at the rate of its cost of capital. For example, an investor uses only borrowed money to fund a project at an interest rate of 10%. This would mean that the investor would at least have to earn that 10% from the project. Otherwise, they would end up losing money. Thus, by using this 10% as the discount rate in the NPV calculations, a positive NPV would suggest a profitable investment while a negative NPV would indicate an unprofitable project.

3.3.3 Baselines for Ecosystem Service Values

115. The baseline values considered here for the main ecosystem services are discussed in the next sub-sections. These are considered to be impacted by forest degradation, deforestation, forest fires and forest establishment as the PAMs are modelled.

116. The baseline scenarios for forest degradation, deforestation, and forest fires are assumed to be stable over the 20-year period, i.e. without a specific PAM; the situation will not change. The baseline data are compiled in the table below.

[6] World Bank. 2016. Population growth (annual %). https://data.worldbank.org/indicator/SP.POP.GROW?locations=IR
[7] World Bank. 2016. GDP per capita growth (annual %). https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG

Table 3.7 Baseline data for current forest disturbances

Baseline	Definition	Source
Annual area deforested	5,798.00 ha/year	Drivers of deforestation and forest degradation -study
Annual forest area degraded	14,059.00 ha/year	Drivers of deforestation and forest degradation -study
The annual area lost to forest fires	7,301.73 ha/year	RNR statistics 2016. Mean forest fires for 2015-2016.

117. Further, we assume that an occurrence of a forest disturbance decreases the ecosystem services of a hectare of the forest by a certain per cent. We assume that forest degradation decreases the value of forest ecosystems services by 70% from current to perpetuity, deforestation by 100% from current to perpetuity, and forest fires by 90% the year of fire. Areas lost to forest fires are assumed to recover in 80 years, thus affecting the ecosystem services of these proportionally. For example, a hectare of forest produces an ecosystem service worth 10 USD/ha. The area is lost to forest fire and after the fire; the area only produces 90% of the value, i.e. 1 USD/ha. As the forest recovers, the value of ecosystem services will increase. In the case of planting forests, the ecosystem services follow a similar logic to the recovering forest fire areas.

118. The following values for ecosystem services represent their values before the forest disturbances.

119. **Non-Wood Forest Products (NWFPs):** The current value of NWFPs per hectare was estimated based on the total value of NWFPs in Bhutan for the 8 most valuable products[8] divided by the forested area of Bhutan according to the National Forest Inventory (NFI) data of 2017[9]. These produce an average value of Nu. 159 per hectare which is equivalent to USD 2.4 per hectare.

120. **Carbon**: Total carbon dioxide in Bhutan's forests is estimated at 622 million tons of CO_2e while above-ground carbon was in 2010 some 245 million tons of CO_2e[10]. Divided by the NFI forest area the average above-ground biomass carbon per forest hectare is some 89,7 tons of CO_2e per hectare of forested land on average. Impacts of forest degradation and deforestation in this cost benefit analysis consider changes to the above-ground biomass carbon only.

121. The carbon price used in the estimations is USD 5.1 per ton of CO_2e. This is according to Forest Trends' State of the Voluntary Carbon Markets 2017 report's average forest and land use carbon price in voluntary schemes. In each case, where carbon benefits are valued at voluntary carbon market prices, a fixed budget of USD 50 000 for project formulation and USD 25 000 for the subsequent years for reporting, verification and marketing is reserved. Bhutan has also prepared a Forest Reference Emission Level (FREL) summarized in Table 3.8 covering periods 2005-2009 and 2010-2014 illustrating the country´s net sink position.

Table 3.8 Bhutan FREL

Activity	Emission (million tonnes CO_2e/year)		Removal (million tonnes CO2e/year)		NET Removal (million tonnes CO2e/year)		FRL (million tonnes CO2e/year)
	2005-2009	2010-2014	2005-2009	2010-2014	2005-2009	2010-2014	
SMF	0.660	0.605	-6.408	-6.408	-5.748	-5.803	-5.776
Conservation	0.041	0.036	-2.957	-2.957	-2.916	-2.921	-2.918
Enhancement	0.000	0.000	-0.011	-0.034	-0.011	-0.034	-0.023
Total	0.702	0.641	-9.376	-9.400	-8.674	-8.758	-8.716

[8] Personal communications with Social Forestry Division in December 2017
[9] National Forest Inventory 2017
[10] Forest$ in Bhutan. 2017. Economic Value of Forest Ecosystem Services in Bhutan. Draft.

122. **Water:** A study calculating the total economic value of forests in Bhutan[10] stated that the water users total value derived from forests with medium estimates was USD 0.4 million for rural users and USD 1.4 million for urban users. This attributed to hectares of forests as in NFI 2017 is USD 0.66 per hectare of forest.

123. **Sediment removal (soil stability):** The current value of sediment removal provided by forests at hydropower plants in Bhutan is estimated at USD 7.8 million[10]. On average this value per hectare of forested land is USD 2.86 hectare of forested land.

124. **Fuelwood:** The implicit value that considers the time and effort used for collecting fuelwood in Bhutan is some USD 5.6 million per year[10]. Per hectare, this value is USD 2.05 per hectare per year. Based on economic statistics the value would be the only USD 1.4 million.

4. ESTIMATED COSTS AND BENEFITS

4.1 PAM 1: Strengthen institutional and sectoral capacity to achieve sustainable forest management

125. The objective of PAM 1 is to build national capacity for sustainable forest management across institutional, organizational, and community levels. This includes strengthening capacity for the development and implementation of forest management plans, monitoring, and silvicultural practices. Training will be conducted for government staff, particularly at sub-national levels. By developing government capacity, PAM 1 will, in turn, strengthen stakeholder and community participation in forest management.

126. Both technical and functional capacity are required and will be defined through a comprehensive capacity needs assessment across relevant institutions that will have roles and responsibilities for REDD+ implementation. This assessment will identify the required capacity across all sectors, highlight existing gaps, and prepare a capacity-building strategy. The costs of PAM 1 per target action are listed in the table below.

Table 4.1 Target actions and costs of PAM 1

	Target activity	Start year	End year	Budget, USD
1.1	Undertake a capacity needs assessment for REDD+ implementation and develop a Capacity Development Strategy and Plan	1	1	75 000
1.2	Institutional capacity building and support in developing and implementation of management plans for Forest Management Unit (FMUs), Protected Areas, Community Forests, areas outside FMUs, watershed areas and private forests	1	1	750 000
1.3	Capacity building and strengthening National Forest Monitoring Systems (National Forest Inventory, Land and Land Cover Monitoring, MRV for REDD+)	1	2	1 925 000
1.4	Capacity building in silvicultural practices, pest and disease management to improve forest productivity through technical training	1	3	250 000
	Total			**3 000 000**

127. As one of four enabling measures (indirect) hence it is a cost incurring option but will result in exponential benefits in other PAMs. This means that the project has only costs attached to it resulting in a negative NPV. Financial analysis on zero and negative NPV investments helps in evaluating alternatives to find the least negative NPV solution. Without the enabling policy environment, REDD+ would fail. The negative NPV in PAM 1 reflects the fact that the intangible and long-term economic, social and environmental benefits are hard to quantify but can be monitored through milestones that can be used to track performance after the investment. The proposed interventions have a negative NPV because the investment does not generate immediate profit or financial gains but prevents further erosion of critical social, environmental, and economic values that contribute to national economic development – for instance through GDP growth. PAM 1 is the only PAM in the analysis that does not have any proposed benefits, but only costs.

Table 4.2 Financial indicators of PAM 1

Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	-2 682 679	-2 472 405	N/A	0
Monetary and non-monetary	-2 682 679	-2 472 405	N/A	
Monetary and carbon	-2 682 679	-2 472 405	N/A	
All	-2 682 679	-2 472 405	N/A	

4.2 PAM 2: Strengthen the effectiveness of existing policies and approaches across all forestry jurisdictions and areas

128. The key assumption in PAM 2 that can also be seen as the target for the project is that the project activities will result in a 30% reduction in forest degradation of the current level by year 20. This key assumption is also tested in a sensitivity analysis where the assumption's effect on the overall viability of the PAM are assessed (Figure 4.1). The budget estimates represent a starting point and can be adjusted with the availability of more resources.

Table 4.3 Target actions and costs of PAM 2

	Target activity	Start year	End year	Budget, USD
2.1	Develop and implement effective forest management plans in all SFRL	1	5	500 000
2.2	Develop and provide tools for efficient management plan writing (templates, software and applications).	1	2	100 000
2.3	Carry out functional zonation within the forest areas, demarcating forest production areas, watershed areas, wildlife habitats, and recreational areas	1	2	150 000
2.4	Implementation of the already established Protected Areas Zonation Guidelines	1	2	150 000
2.5	Strengthening the national forest monitoring system to monitor forest cover changes and carbon stock	1	20	500 000
2.6	Pest and disease management and monitoring incorporated into all forest management planning	1	3	20 000
2.7	Establish reliable information and monitoring systems on demand and supply for rural and commercial timber requests	1	20	250 000
	Total			**1 670 000**

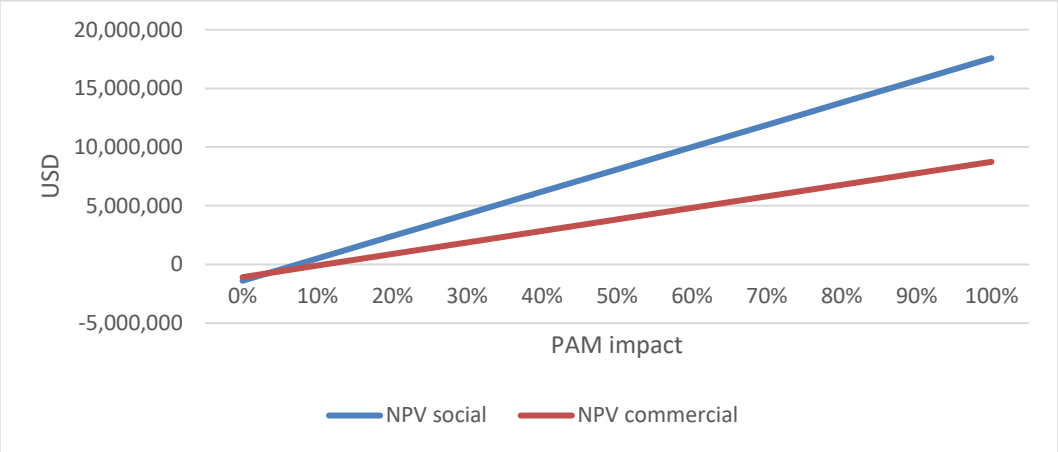
129. The financial indicators for PAM 2 shown in Table 4.4 below show the positive carbon benefit, i.e. the emission reductions potential which can be monetized. This CBA calculation includes no direct monetary benefits for PAM 2 and the inclusion of non-monetary benefits, i.e. the increased value of intangible ecosystem services (NWFPs, soil stability, fuelwood, and water).

Table 4.4 Financial indicators of PAM 2

Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	-1 126 004	-910 304	N/A	2 780 709
Monetary and non-monetary	-561 796	-651 572	1	
Monetary and carbon	3 737 516	1 602 030	37	
All	4 301 723	1 860 762	39	

130. The sensitivity analysis with respect to the key assumption of project impact reducing forest degradation is presented in Figure 4.1. The viability and relevance of this PAM largely depend on implementation effectiveness and financing. An 8% degradation impact would make the PAM return on investment worthwhile.

Figure 4.1 Sensitivity between PAM 2 impact and NPVs



4.3 PAM 3: Strengthen cross-sectoral land use planning and coordination

131. Noting that the projected allotment of State Reserve Forest Land (SRFL) for development of hydropower, road construction, agricultural expansion, and power lines may result in significant deforestation and forest degradation, it is necessary to invest both time and money to strengthen land use planning and sectoral coordination. Effective land use planning requires investment in long-term spatial planning to reduce piecemeal decision making, and this should be accompanied by adequate guidance, decision criteria, accessible data and information, in order to align or mitigate regulatory and sectoral policy conflicts. Since the criteria for evaluating allotments or leases of SRFL sits with each individual sector the Land Act, 2007 does not provide policy or planning guidance to help reconcile trade-offs across conflicting land use interests or by different sectors.

132. Therefore, the objective of PAM 3 is well in line with addressing these gaps and can lead to the achievement of significant non-carbon benefits. But to result in value for money, a 30% reduction in deforestation from the current level by year 20 must be achieved. This depends on how well the PAM is implemented. Based on the sensitivity analysis, the proposed combined budget of USD 4.6 million should be adequate and can achieve a reasonable return on investment (from a financial perspective). Like PAM 2, the financial indicators for PAM 3 shown in Table 4.6 illustrate that the project will generate financial benefits assuming emission reduction potential can be monetized. But more importantly, over the 20-year period, in the order of magnitude, the total emission reductions to be generated from all PAMs have limited commercial attractiveness, therefore, non-tangible social benefits such as increased value of intangible ecosystem services (NWFPs, soil stability, fuelwood, and water) justify the relevance of these PAMs.

133. The associated target actions in Table 4.5 adequately cover the gaps and weakness identified in the overall analysis of drivers and underlying causes of deforestation.

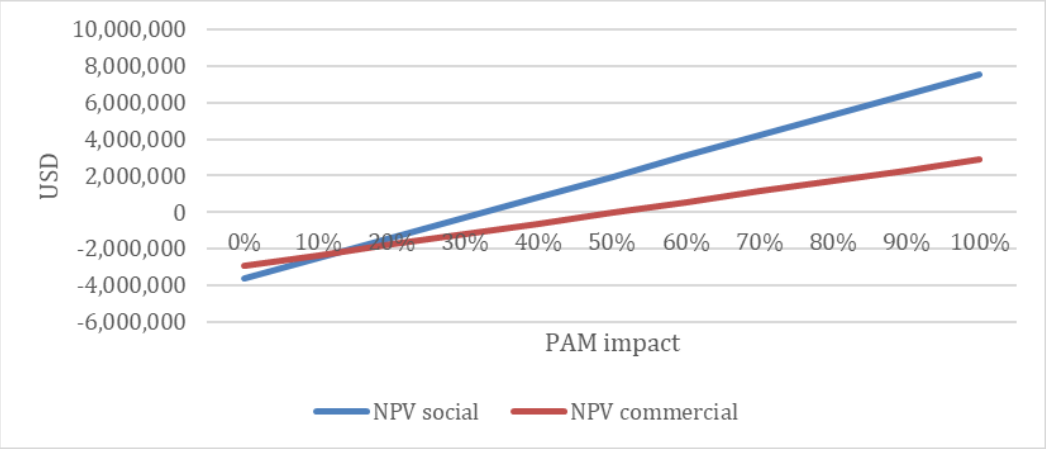
Table 4.5 Target actions and costs of PAM 3

	Target activity	Start year	End year	Budget, USD
3.1	Review of policies related to land use, such as Land Act 2007, FNCA, EDP 2017, PSMP 2040, Road Master Plan 2027, Transmission Master Plan	1	6	400 000
3.2	Establishing a monitoring and evaluation system on land zoning and regulatory implementation	1	20	300 000
3.3	Development of a harmonized national land use strategy, through broad stakeholder consultation	1	6	400 000
3.4	Development and enforcement of Zoning Ordinances and Land Use Strategy through awareness raising, capacity building and stakeholder engagement	1	10	500 000
3.5	Strengthened National Spatial Information System for land use zoning and improved data collection, processing, and validation	1	6	3 000 000
	Total			**4 600 000**

Table 4.6 Financial indicators of PAM 3

Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	-3 369 654	-2 741 667	N/A	2 730 423
Monetary and non-monetary	-2 815 650	-2 487 615	-8	
Monetary and carbon	1 401 176	-277 989	13	
All	1 955 180	-23 936	15	

Figure 4.2 Sensitivity between PAM 3 impact and NPVs



4.4 PAM 4: Strengthen EIA processes for infrastructure proposals

134. Recognizing that according the Environmental Assessment Act 2000, assessments must be conducted prior to undertaking environmental clearances, such as those required in new infrastructure projects. The analysis of the effectiveness of the process shows that broader impacts affecting forest environmental services are adequately addressed and that the different stages of Environmental Impact Assessment (EIA) process are disaggregated (e.g. roads, transmission lines

and power plant facilities in hydropower). The approach to environmental clearances often requires input from a range of departments. The National Environmental Protection Act 2007 (NEPA) is the umbrella legislation that sets out requirements for the protection of the physical and ecological environment. But there is a noted lack of clarity over government roles and responsibilities with regards to coordination across the monitoring and compliance processes. Furthermore, specific guidance on how to reconcile the interests of different sectors is weak.

135. The proposed interventions are in line with the issues and gaps identified. The cumulative impact of PAM 4 with the proposed budget would need to contribute to a 15% reduction in deforestation from the current level by year 20 (an average of less than 1% per annum). This is also tested in a sensitivity analysis where the assumption's effect on the overall viability of the PAM is assessed. To turn financially viable for a commercial investor, the project should have an impact of some 20% on the current deforestation level as the social investor is already satisfied at around 10% reduction in deforestation (Figure 4.3).

Table 4.7 Target actions and costs of PAM 4

	Target activity	Start year	End year	Budget, USD
4.1	Reviewing and revision of budget allocation practices, including procurement processes in order to mitigate environmental damages from infrastructure development	3	5	300 000
4.2	Evaluation of EIA guidelines and services from stakeholders' perspective to effectively implement the environmental rules and regulation by the third party	2	2	300 000
4.3	Strengthening institutional capacity for EIA and compliance monitoring system	1	4	600 000
4.4	The packaging of EIA for hydropower projects including power plant facilities, transmission lines and towers, and roads,	1	3	400 000
	Total			**1 600 000**

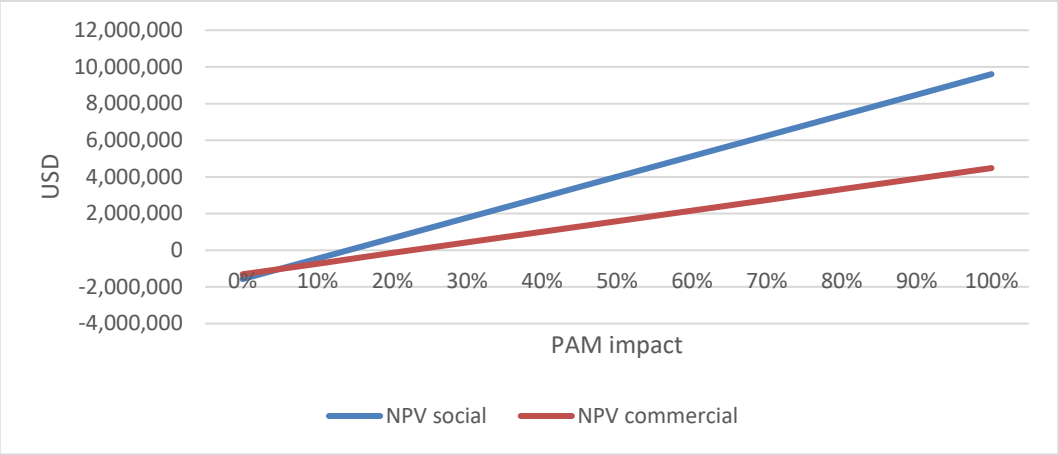
136. PAM 4 has largely negative NPVs because of the nature of the proposed interventions. However, without implementing such policy measures, it is unlikely that the direct interventions would have an impact. The negative NPVs mean that financial viability is not an appropriate measure of value for money because even with all benefits accounted for, PAM 4 would be barely viable. But again, the PAM contributes to the cumulative impact of the entire REDD+ strategy, and if it can achieve an impact of some 20% on the current deforestation level it makes strategic business sense.

137. The emission reduction potential of PAM over the 20-year period is low, but this also reflects the results of the FREL which generally shows low emissions (Table 4.8).

Table 4.8 Financial indicators of PAM 4

Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	-1 307 813	-1 132 164	N/A	819 127
Monetary and non-monetary	-1 141 612	-1 055 949	-8	
Monetary and carbon	-60 025	-517 817	8	
All	106 176	-441 601	9	

Figure 4.3 Sensitivity between PAM 4 impact and NPVs



4.5 PAM 5: Achieving a highly diversified and technology-based timber supply chain

138. Analytical work during the REDD+ readiness process shows that there are performance inefficiencies across the timber supply chain (harvesting, transportation, storage, sawing, seasoning, manufacturing into finished products), particularly in downstream processes where there has been the limited introduction of new technology. The value chain is characterized by antiquated equipment with poor recovery and wastage, producing rough-cut sawn timber with limited grading and with average recovery rates of 60-70 per cent depending on species and class of timber (Dhital 2009). It is also reported that some guidance already exists on efficient harvesting and wood processing, but these guidelines are not necessarily followed. The basic tenet in improving supply chain performance lies in investment in innovation and knowledge. However, private sector investment is generally market driven with adequate data and information on current and future demand as well as access to low-cost finance to enable higher return on investment.

139. Stakeholder feedback throughout the REDD+ Readiness process has pointed out the lack of data and a coherent understanding of the current situation with regards to market supply and demand of timber throughout different parts of Bhutan. Discussions with NRDCL suggested that the combination of inefficiencies in the timber value chain, distribution, and narrow focus on softwoods, could lead to uneven wood availability leading to some form of artificial deficit. While the current forest supply chain focus is on softwood species, the dominant type is broadleaf, constituting approximately 62% of all Bhutan's forests (NEC 2016). Bhutan's wood processing industry has limited knowledge and infrastructure to the season and process hardwood. The assumption, therefore, is that building knowledge capacity, market understanding and reducing barriers to utilization of the more readily available hardwoods should lead to a greater appetite for private sector investment.

140. The main objective of PAM 5 is to increase net income from timber from the current USD 9.63 million per year. But in addition, it must contribute to reducing forest degradation. An assessment of the proposed budget (Table 4.9) and a sensitive analysis (Figure 4.4) leads to two key assumptions - one for the project impact on forest degradation of 25% reduction, and another for increased timber net income[11] which is assumed (or targeted) to increase by 20% due to the PAM.

[11] Calculated based on Forest$ in Bhutan. 2017. Economic Value of Forest Ecosystem Services in Bhutan. Draft which states that annual timber revenues are some USD 32 million per year. We assume that from this the net income for the companies is some 30%. Thus, the current annual net income from timber are USD 9.63 million per year.

Table 4.9 Target actions and costs of PAM 5

	Target activity	Start year	End year	Budget, USD
5.1	Establish a Forestry and Wood Innovation Hub of integrated wood-based industries	1	3	2 750 000
5.2	Develop and increase the capacity of DoFPS, NRDCL and SMEs to operationalize improved approaches to timber harvesting and processing and value addition	1	1	200 000
5.3	Promoting the utilization of alternative lesser known tree species to reduce pressure on high-value timber supplies	1	10	225 000
5.4	Promote and diversify timber products and value addition through the provision of low-interest finance for small to medium enterprises	2	5	150 000
5.5	Improvement and dissemination of efficient wood technologies (harvesting, processing and recovery)	2	7	2 000 000
5.6	Set up pilot projects to improve value at different levels of the timber supply chain	2	4	250 000
5.7	Piloting of new technologies and tools in wood-based industries, wood seasoning and treatment	1	5	200 000
5.8	Updating government procurement policies and schedule of rates to show leadership in the use of lesser-known tree species and alternative timber products	1	5	25 000
	Total			**5 800 000**

141. In addition to significant increased monetary income from more efficient wood use by the industries, the project aims to have a significant impact on forest degradation. The financial indicators in Table 4.10 show the positive NPVs and emission reductions potential.

Table 4.10 Financial indicators of PAM 5

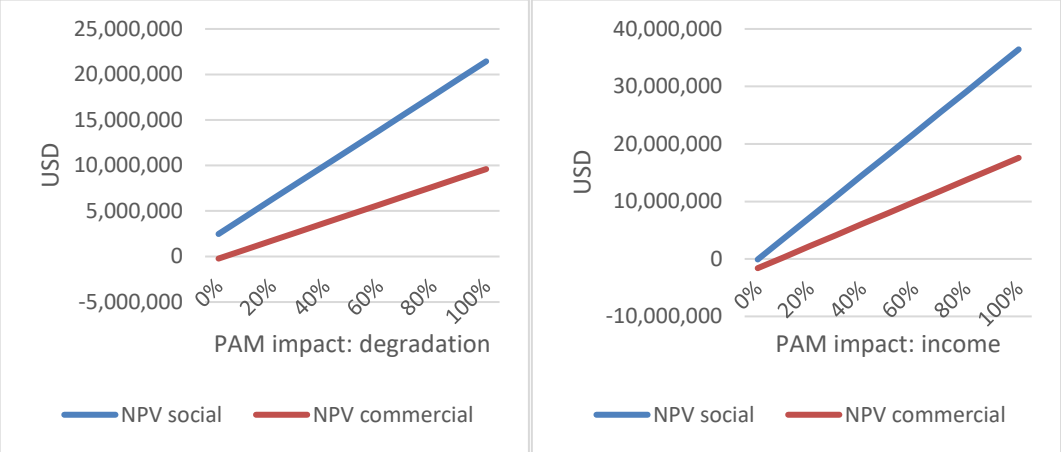
Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	2 733 643	-49 402	15	2 317 257
Monetary and non-monetary	3 203 815	166 208	16	
Monetary and carbon	6 742 894	2 014 506	22	
All	7 213 067	2 230 116	23	

142. As shown by the sensitivities (Figure 4.4), PAM will demonstrate value for money with relatively high IRRs and this is because it is a direct intervention. With these assumptions, business incomes are expected to increase and efficiency in wood use also expected to improve hence the PAM is justifiable.

143. The proposed Forestry and Wood Innovation Hub is a significant long-term undertaking that requires a financial commitment from both industry and government to ensure it achieves value for money. Innovation is an essential driver of economic progress, benefitting consumers, businesses, the government and the economy. If the Forestry and Wood Innovation Hub can achieve the necessary consolidation of existing initiatives throughout Bhutan's forestry and wood-based industries, it would provide an important mechanism for the development of the supply chain and adoption of new technologies. The various options considered such using hardwoods to manufacture glued laminated timber (glulam) could offer incentives for broader market adoption. It is noted that the

government could influence the market by changing its own procurement process and promote new products – this could be the necessary catalyst for the success of new technologies.

Figure 4.4 Sensitivity between PAM 5 impact on forest degradation (left), impact on forest business net income (right) and NPVs



4.6 PAM 6: Adopting fire management approaches that limit impacts on the environment and communities

144. Fire is recognized as a key driver in forest degradation hence it is covered in the Forestry Law. Literature and stakeholder consultations indicate that fire outbreaks are a result of burning agricultural residues as well as other natural causes. Western and eastern regions have historically experienced more fires than the southern and central regions, and this is partially attributed the tree types in these areas, with pine and oak forests being associated with high fuel loads during the dry season. The DoFPS is responsible for forest fire management, although local communities are often the first responders. The country's rugged terrain makes fire control difficult. With the Himalayas becoming warmer due to climate change, there is an increased risk of fires.

145. Based on the proposed budget, the key assumption of PAM 6 is that it can result in a 30% reduction in forest fires of the current level by year 20. This assumption is tested in a sensitivity analysis where the assumption's effect on the overall viability of the PAM are assessed (Figure 4.5).

Table 4.11 Target actions and costs of PAM 6

	Target activity	Start year	End year	Budget, USD
6.1	Establish fire early warning systems, including communication tools and approaches to ensure that threats to communities are reduced and responses to fires are prompt	1	4	1 000 000
6.2	Development of forest fire management planning guidelines, including post forest fire management and replanting	1	2	250 000
6.3	Survey and mapping of forest fire prone areas (fire hazard map)	1	2	250 000
6.4	Instituting, upscaling and operationalizing of forest fire management groups at all levels (village/gewog/dzongkhag/national)	1	5	500 000
6.5	Institutionalization of improved firefighting equipment and high-tech forest fire early-warning system	2	5	2 000 000
6.6	Enhanced knowledge and capacity building on forest fire prevention techniques at institutional and community levels	2	6	1 000 000
	Total			**5 000 000**

146. The PAM has no direct monetary benefits. The benefits of the PAM come through non-monetary benefits and carbon benefits through avoided loss of forests in forest fires. The negative NPVs are an indicator that this PAM is primarily a cost but a necessary one. Quantifying the long-term impact quantitatively is difficult because they can only be quantified based on resulting losses which include human life. But of course, there primary quantifiable benefit is the avoided emission reductions (Table 4.12).

Table 4.12 Financial indicators of PAM 6

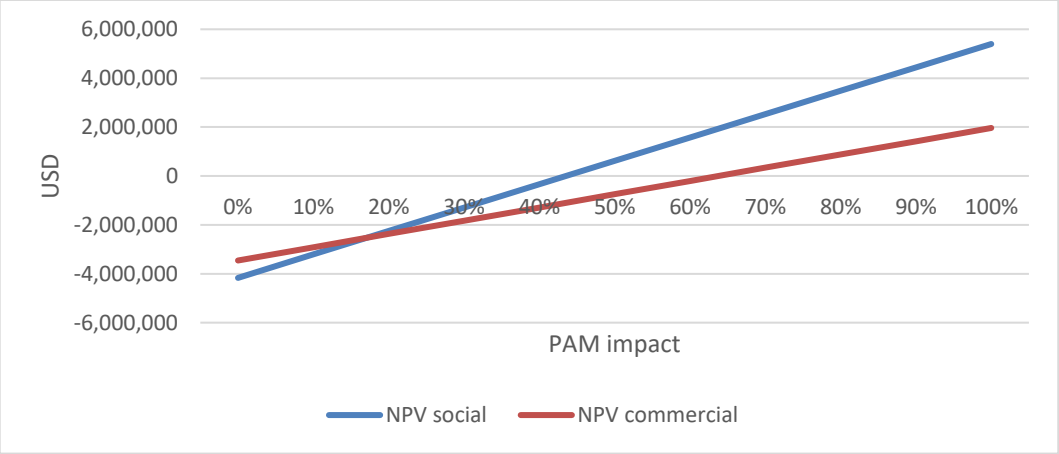
Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	-3 906 702	-3 279 666	N/A	1 139 025
Monetary and non-monetary	-3 515 566	-3 099 252	-10	
Monetary and carbon	-1 690 162	-2 011 925	1	
All	-1 299 026	-1 831 511	3	

147. PAM 6, therefore, aims to reduce the risk of forest fires, thereby avoiding degradation of forests and GHG emissions, as well as limiting risks to human settlements by preventing the destruction of property, injuries and deaths. This PAM supports existing regulatory measures, such as those in the Forest and Nature Conservation Rules and Regulations of Bhutan 2017 and Forest Fire Management Strategy 2013. The proposed actions are appropriate taking into considerations exiting financial limitations. The development of fire management planning guidelines, monitoring, and fire hazard maps will be of strategic importance in planning for more effective fire responses. Enhanced knowledge and capacity building, at both government and community levels, will be required for fire prevention and control. This may include silvicultural manipulation of forest stands, controlled burning, and other management practices.

148. These actions do not necessarily demonstrate financial viability from an economic sense. The sensitivity analysis shows that the social investor would require some 40% reduction in forest fires and commercial investor some 60% reduction. These could be switched to targets to show viable project plans, or the PAM could be further justified by co-benefits and other non-tangible benefits that are not valued here. Also, the value of the lost trees may be rather significant. The proper valuation of this lost asset is not included in this calculation as it would likely lead to significant over

estimation, and proper valuation would require detailed information of the age classes of the forests lost.

Figure 4.5 Sensitivity between PAM 6 impact and NPVs



4.7 PAM 7: Establish plantations to provide sustainable wood products supply, increase carbon-stock, and enhance biodiversity

149. PAM 7 has one of the largest investment actions with an estimated cost of USD 18.9 million. This is designed to respond to infrastructure development and the continuing demand for timber from increasing construction and wood-based industries which are creating increasing pressure on forests and watersheds. There is a logistical and cost challenge in some parts of the country in matching supply and demand in timber, exacerbated by the narrow market preference for softwood tree species. Due to the terrain and accessibility limitations, only 17% of the total forest in Bhutan is economically harvestable (WMD 2015).

150. PAM 7 is also expected to contribute to alleviating the increasing human-wildlife conflict which has become a major problem in some rural parts of Bhutan. Studies show that conflicts are likely to be higher in settlement areas where there has been deforestation, habitat loss and degradation (Distefano 2005). These conflicts can have social and economic impacts, as well as threaten the population viability of wildlife. Records show that 55% of crop damage can be attributed to damage from wildlife (NEC 2016).

151. The demand for firewood is variable, with some regions experiencing a surplus of fuelwood, while others have a deficit. Despite many people using stoves for heating and cooking, the use of energy efficient stoves is not widespread. The widespread availability of electricity may mean a reduction in the demand for firewood in future although this will depend on cultural requirements and costs to households.

152. The detailed plan for the plantation program will be elaborated at a future stage, therefore, there are some assumptions taken for the feasibility analysis. The plantation project aims to plant 5 000 hectares of forests within a period of some 15 years. The planting program is therefore assumed to take place gradually until 5 000 hectares is reached. The specific species selection is to be defined by local experts of the project, and it is understood the program will involve enrichment planting, reforestation and afforestation targeting degraded areas. Recognizing the lack of data, it is assumed that the planting area will be planted with slow growth species on degraded lands. Thus the assessment uses mean annual increment of 2 m^3/ha/year to represent the growth of the forest. As the forests are slow growing, they will not be harvested during the assessment period. Further, the assessment uses a factor of 1.65 to transform[12] wood volume to CO_2e. The target of 5 000 hectares is considered here as the key assumption (or target) for the project. The sensitivity of the project viability regarding this is presented in Figure 4.6.

[12] Using a factor of 0.45 to convert wood volume to carbon and 3.67 to carbon dioxide equivalents.

Table 4.13 Target actions and costs of PAM 7

	Target activity	Start year	End year	Budget, USD
7.1	Establish a Government-Private Sector Joint Plantation and Nursery Development Program	1	1	500 000
7.2	Establish 5 000 hectares of new plantations across a range of different ecological regimes, for climate mitigation, wildlife habitat enrichment, watershed and soil conservation, and recreation	1	15	18 900 000
7.3	Capacity building, guidelines, tools, and support for the private sector for plantation development and management	1	3	1 000 000
7.4	Strengthening plantation development norms and standards to promote multi-purpose plantations and species in different ecological and climatic zones	1	4	450 000
7.5	Implementation monitoring and evaluation guidelines and tools, capacity building, and conducting ongoing monitoring and evaluation Management and control of invasive species and grazing	1	3	1 150 000
	Total			**21 600 000**

153. In the absence of harvests, the benefits of the project rely on non-monetary ecosystem services (NWFPs, soil stability, fuelwood, and water) and carbon to generate the benefits for the assessment. As the forests grow, they start to generate more and more ecosystem services and their value grows over time. With long enough assessment period, the project would start producing roundwood. Thus, the upfront investment makes PAM 7 a high-cost investment hence the constant negative NPVs until a future point that some of the planted areas can be harvested for timber production. The nature of plantations and types of species will determine the emission reduction potential, but this is limited based on this analysis.

Table 4.14 Financial indicators of PAM 7

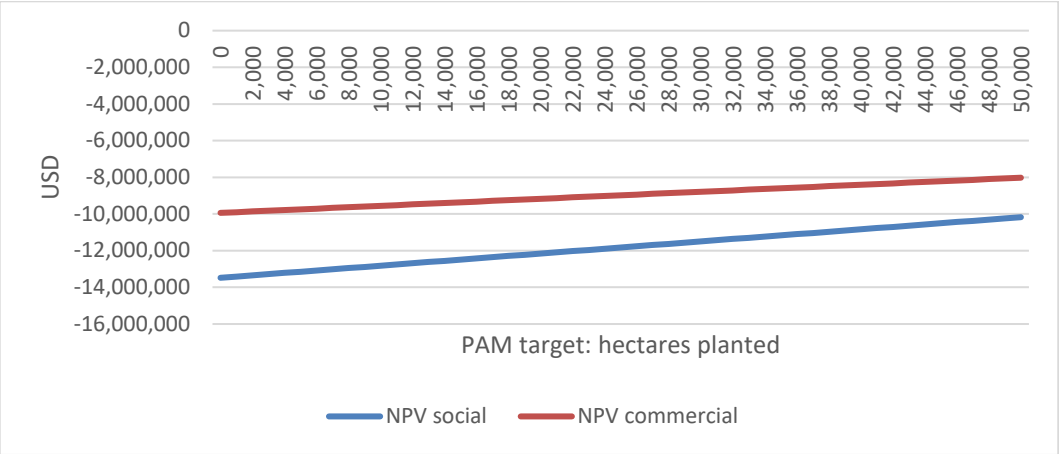
Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	-13 217 926	-9 759 965	N/A	123 750
Monetary and non-monetary	-13 162 758	-9 734 278	N/A	
Monetary and carbon	-13 204 705	-9 772 250	N/A	
All	-13 149 537	-9 746 562	N/A	

154. The sensitivity analysis (Figure 4.6) regarding the plantation area shows that the financial viability of the PAM increases slightly as the area increases. However, the project will remain unprofitable at all plantation areas between 0 and 50 000 hectares.

155. From the cross-analysis of the PAMs, it is noted that the establishment of the Forestry and Wood Innovation Hub and promotion of lesser-known species in PAM 5 will be a key complementary measure to the establishment of a plantation programme. There is currently a limited understanding of current and future market requirements for timber in different parts of the country. Therefore, a wood flow and market analysis are proposed and are necessary to adequately establish a better understanding of resource availability and domestic biomass flows. The wood flow analysis should represent a total resource assessment, including all wood products in all process steps from forest to final disposal. A market analysis is also essential to understand domestic biomass flows, competition between material and energy uses, leading to informed decisions on the type and location of plantations that are required. The basic premise is that plantation development locations

should be prioritized in line with the land zoning proposed under PAM 3. Establishing plantations in degraded areas would be a productive and beneficial use from ecological, social, and economic points of view. As Bhutan has different ecological regimes and local conditions vary from place to place, the type and purpose of each plantation will need to be carefully assessed.

Figure 4.6 Sensitivity between PAM 7 impact and NPVs



4.8 PAM 8: Promote the development of enterprises that sustainably manage Non-Wood Forest Products

156. The impact (or target) of the project is the increased revenue from NWFPs through enterprise development. The target is to increase the revenues by 20% from the current level. The current annual revenues are calculated based on the total revenue of the eight most valuable NWFPs per year. Based on data obtained from Social Forestry, this current value is USD 6.5 million. We further assume that increasing income from NWFPs has an impact on forest degradation in Bhutan. The assumed ratio states that an additional USD 5 000 per year could result in one hectare of avoided forest degradation. Both assumptions are analyzed in the sensitivity analysis in Figure 4.7.

Table 4.15 Target actions and costs of PAM 8

	Target activity	Start year	End year	Budget, USD
8.1	Development of small and medium scale rural NWFP enterprises for domestic and international markets	1	3	500 000
8.2	Community capacity building and development of product guidelines to create a broader understanding of sustainable management, harvesting, and the supply chain of NWFP	1	3	500 000
8.3	Incorporation of the objectives and actions for the sustainable management of NWFPs in management plans (Community Forest, watershed, protected areas and FMU management plans)	1	3	75 000
				1 075 000

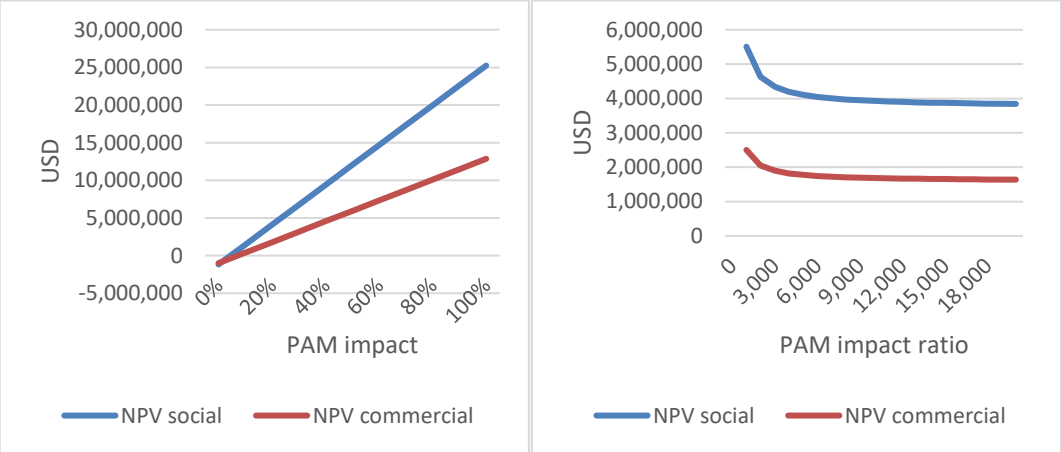
157. The additional income from NWFPs creates monetary benefits, and the avoided forest degradation enhances ecosystem service values. It is worth noting that the emission reductions potential of the PAM is low because of the financial viability hinges on the impact of additional income from NWFPs.

Table 4.16 Financial indicators of PAM 8

Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	4 015 973	1 771 542	40	171 417
Monetary and non-monetary	4 050 753	1 787 492	40	
Monetary and carbon	4 069 854	1 759 179	37	
All	4 104 635	1 775 128	37	

158. The increasing revenue from NWFPs in naturally directly linked with the overall viability of the PAM as can be seen from Figure 4.7 on the left. The more the project generates new revenues, the more profitable it is. For instance, a 10% increase in the NWFPs revenue, increases the financial viability of the PAM.

Figure 4.7 Sensitivity between PAM 8 impact on NWFP revenue (left), the amount of additional revenue needed for decreased forest degradation (right) and NPVs



4.9 PAM 9: Broaden opportunities for income generation from ecosystem services

159. The impact (or target) of the project is the increased revenue from ecotourism/PES through enterprise development. The target is to increase the revenues by 100% of the current level, i.e. double the existing small projects. It is worth highlighting that the project does not consider that the entire national ecotourism/PES would be doubled. However, we use an artificial baseline here USD 500 000 per year and assume that would be doubled due to the project. Another way of explaining the target would be to say that we expect the project to generate USD 500 000 per year through new ecotourism/PES by year 20. We further assume that increasing income from ecotourism/PES has an impact on forest degradation in Bhutan. The assumed ratio states that an additional USD 5 000 per year results in one hectare of avoided forest degradation. Both assumptions are analyzed in the sensitivity analysis in Figure 4.8.

Table 4.17 Target actions and costs of PAM 9

	Target activity	Start year	End year	Budget, USD
9.1	Encouragement and promotion of eco-tourism/ community-based ecotourism (eco-trails, bird watching, fishing, hot springs, rafting)	1	10	1 000 000
9.2	Training of communities on craft manufacturing and product diversification	1	2	250 000
9.3	Scoping and operationalizing potential Payment for Ecosystem Services (PES) schemes	1	5	1 000 000
	Total			**2 250 000**

160. The PAM has low financial profitability with all levels of benefits included (Table 4.18). This is indicated by the fact that the project is viable with all social discount rates and unviable with all commercial rates. The project has very small emissions reduction potential which is also seen in the negative impact of including carbon benefits in the assessment. The carbon crediting project would be so small scale that it would not make financial sense to sell the carbon credits.

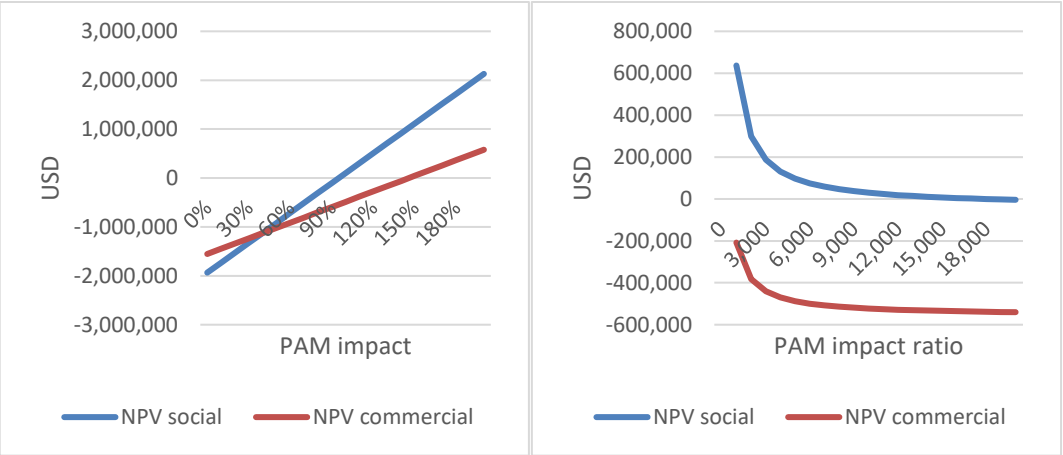
161. While considering PES and the financial indicators, it is worth noting that implementation of PES schemes can result in rural communities benefiting from increased knowledge of sustainable resource use practices that are usually connected to PES through the provision of training and technical assistance. These are aspects not necessarily captured in the CBA NPV.

Table 4.18 Financial indicators of PAM 9

Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	224 405	-379 484	10	65 930
Monetary and non-monetary	237 782	-373 349	10	
Monetary and carbon	83 844	-493 914	9	
All	97 222	-487 780	9	

162. The sensitivity analysis in Figure 4.8 below shows that from a social investment perspective, a breakeven can be achieved with a 90% increase revenue from ecotourism/PES whereas to achieve positive commercial NPV, a 150% increase, i.e. some USD 750 000 increased income should be generated.

Figure 4.8 Sensitivity between PAM 9 impact on ecotourism/PES revenue (left), amount of additional revenue needed for decreased forest degradation (right) and NPVs



4.10 PAM 10: Develop climate smart approaches in agriculture

163. Following a similar logic as in PAM 8 and PAM 9, this assessment of agriculture and livestock assumes that this additional revenue has an impact on agriculture driver deforestation. We assume that the project could aim at having a 2% increase in the value added of the sector. Increasing the value added from the current USD 86.5 million per year[13] to some USD 88.3 million per year at year 20. We further assume that increasing value added from agriculture and livestock has an impact on the deforestation in Bhutan. The assumed ratio states that an additional USD 8 000 per year avoid one hectare of forest being degraded. Both assumptions are analyzed in the sensitivity analysis in. The social investor would be satisfied already with an increased value added of below 2% as the commercial investor would need additional value added of almost 4%. Further, the ratio between the additional income required to avoid deforestation shows again similar form than for PAM 8 and PAM 9.

Table 4.19 Target actions and costs of PAM 10

	Target activity	Start year	End year	Budget, USD
10.1	Encouraging agroforestry practices for promoting fodder trees and pasture development	1	10	2 250 000
10.2	Promotion of high yielding cattle and stall feeding	1	3	2 000 000
10.3	Promotion and upscaling of traditional dairy farming practices into commercial dairy farming (site specific)	1	5	2 200 000
10.4	Integrated fishponds and piggery development	1	6	500 000
10.5	Encouragement of organic agriculture production, integration of pest management and support for the development of trading strategies	1	5	500 000
10.6	Promotion of cultivation of high value crops	1	4	500 000
10.7	Support to Community Groups for solar and electrical interface use for drying high-value crops	1	5	250 000
	Total			**8 000 000**

164. The financial viability of the project with the given assumptions is low and would only satisfy a social investor. This viability is based on the additional value added to the sector. Benefits from ecosystem services have a negligible role in the NPVs. With the social perspective the carbon revenues are just enough to break even, but with the commercial discount rate, the carbon revenues would not make for a profitable project.

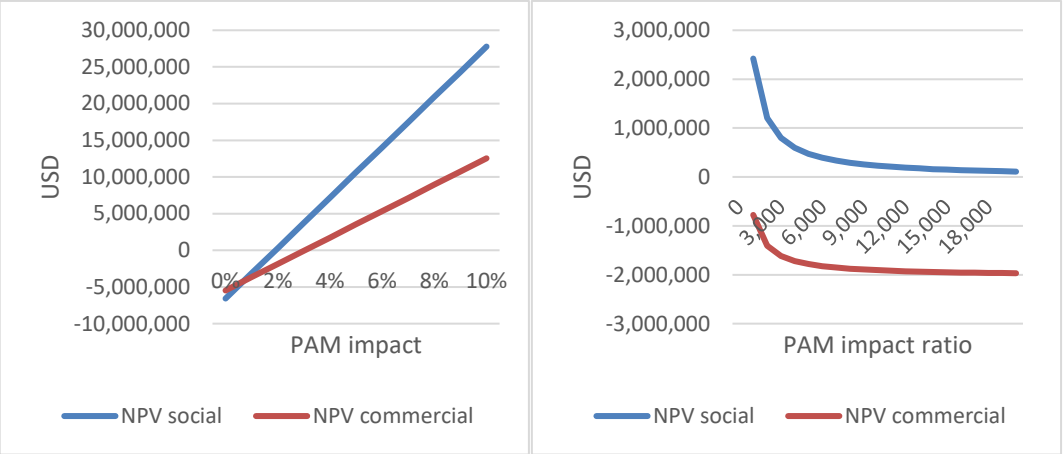
Table 4.20 Financial indicators of PAM 10

Benefits included	NPV social, USD	NPV commercial, USD	IRR, %	Emissions reduction, tCO_2e
Monetary	249 301	-1 854 144	9	142 612
Monetary and non-monetary	290 638	-1 835 188	9	
Monetary and carbon	250 088	-1 894 378	9	
All	291 425	-1 875 422	9	

165. The social investor would be satisfied already with an increased value added of below 2% as the commercial investor would need additional value added of almost 4%. Further, the ratio between the additional income required to avoid deforestation shows again similar form than for PAM 8 and PAM 9.

[13] National Agriculture Statistics 2016

Figure 4.9 **Sensitivity between PAM 10 impact on agriculture and livestock value added (left), the amount of additional revenue needed for decreased deforestation (right) and NPVs**



5. PRIORITIZATION OF STRATEGY OPTIONS

166. A key methodological step in evaluating PAM options is to consider what counter-measures to address the drivers that are already in place, those that are in place but could be improved, and those that might have been identified already but not yet implemented. The extensive analysis from the assessment of drivers and agents of deforestation and degradation provides important relational metrics on the strengths, weaknesses and opportunities within economic development trajectory, regulatory and policy framework, and some future scenarios.

167. In the order of magnitude deforestation is relatively low. Hence, Bhutan is a net sink. But degradation poses the biggest threat to the objective of maintaining a high level of forest cover and the overall integrity of environmental services. This simply implies that PAMs must inherently reduce the current and future drivers of deforestation and forest degradation. The broad strategies and PAMs presented in this document in part focus on creating the enabling environment for effective implementation of interventions, and in part provide some direct intervention measures to create sectoral and sub-sector transformation.

168. This strategy places significant importance to support the NLC to undertake and complete national land zoning. Bhutan's challenge over the years has been to ensure strong cross-sectoral planning and coordination to reduce policy conflicts. Currently, decision-making on urban development and infrastructure expansion is occurring in an ad hoc, the piecemeal manner in the absence of a long-term national spatial planning policy. Many decisions are made on developments at the project level, but there is a lack of policy, decision criteria, and spatially-explicit master plans to guide decisions. There are no clear mechanisms for harmonizing the many sector plans of different line Ministries. As a result, completing and implementing national land zoning will be of most benefit to Bhutan.

169. Hydropower development and associated infrastructure development will have a large impact on forests. Interventions that address the trade-offs between sectors are important and should address current weaknesses in governance. A more robust national land use policy and spatial land use planning or zoning will provide a clearer framework for land allocation and investment. Simply addressing needs from the forest sector perspective will not reconcile the conflicting priorities between sectors.

170. The relative impact of the Subsidized Rural Timber Allotment Policy on the amount of timber harvested each year, and the inconsistency with principles of sustainable forest management, deserve a re-think that goes beyond amending the Forest and Nature Conservation Rules. It is also appropriate to acknowledge in the policy planning and revision of existing strategies towards forest management that future deforestation will happen, so it is advisable to prioritize the suitability of the loss of some forest areas under different scenarios, which safeguard high conservation value and high carbon stock forests.

171. The cultural significance of forests in Bhutan must not be overlooked, and the NWFPs and traditional uses of the forest are an important part of culture and livelihoods. The adaptation benefits and values of forests are crucial, and yet integration of climate considerations into current forest management and planning is not clear. This presents a large opportunity. The economic value of ecosystem services in Bhutan is estimated to range between USD 440 million to USD 1.2 billion per year. Provisioning services represent the highest values, as nature provides Bhutanese people with inputs for food, timber, water and energy in amounts that range from USD 355 million to approximate USD 1 billion per year. Ranging between USD 77 million and USD 216 million per year, cultural and recreation services also play a significant and increasing role in generating wealth in the country. Much of this is driven by the flourishing tourism sector and the flows of investments that support the efforts to conserve and protect natural habitats and biodiversity. Approximate 29% of all visitors are nature-based. This suggests that nature-based ecosystems (which includes forests, wetlands, glaciers etc.) generate an annual income of at least USD 42.6 million. These are significant values that provide a rationale for finding options to tap into PES mechanism to generate additional income for local communities and government.

172. The feasibility and justification for proposing REDD+ interventions focusing on enhancing opportunities from ecosystems services is that benefits from ecosystems for regulation of key functions, which are often unaccounted in traditional economics, range between USD 9 million to USD 46 million and are linked to a range of opportunities including the potential contribution to greenhouse gas emissions noting the net sink position. The provision of such services might require communities living in the proximity of the ecosystem to undertake or not to undertake certain

activities. This means that PES has the potential to be a cost-effective means to improve environmental management and improve livelihoods by rewarding the communities for their efforts and stewardship in providing ecosystem services, such as watershed protection, soil stabilization.

173. **Error! Reference source not found.** is a high-level representation of the relationship between strategy options and contribution to the national policy framework, institutional setting, national planning, and climate change mitigation potential. The uncertainty in funding mobilization inherently requires taking a pragmatic approach of using the strategy options as the broader basis of interventions (PAMs) and select those that can be implemented with domestic funding in the short-term as outlined in Annex to this document (Action Plan). This illustrates that efforts to improve forest management practices and land use planning will have a long-term positive impact and this is re-enforced by ecosystem valuation. The analysis of the value of ecosystem services has provided additional clarity on the social and economic role of ecosystem thus creating a renewed impetus for relitigating discussions about the financing modalities and fiscal allocation for sustainable natural resource management.

174. For the purpose of analysis and carbon benefit response testing, with a USD 1 million budget allocation for each PAM, the estimated carbon impact and income from carbon revenues that Bhutan might be able to receive is limited, but this is still significant for a relatively small country like Bhutan. An increase in budget would also not necessarily result in a linear increase in carbon revenue. However, an increase in the budget towards interventions that improve the effectiveness of PAMs would result in greater socio-economic benefits. These models assume that the projects carried out would reduce forest degradation and deforestation against a baseline, in which they would remain as they are as identified in Bhutan's Drivers of Deforestation study. The results of this analysis are based on simplified models that consider the main features of the PAMs. Therefore, they should be treated as indicators only supporting the notion that Bhutan´s emission reductions potential is limited in order of magnitude, but the investment is necessary to realize the socio-economic benefits that contribute to the GNH principle.

175. In general, the four strategy options and proposed intervention actions are highly relevant and respond to the identified drivers and underlying causes of deforestation. The limitation of the CBA approach has been the availability of adequate data for some components. However, both quantitative and qualitative analysis clearly suggests that a combination of regulatory and institutional strengthening would have a greater impact on reducing deforestation and forest degradation. As noted, Bhutan has a wide range of suitable policies and opportunities, but enforcement and financial capacity have been significant barriers to effectiveness.

6. RISKS AND MITIGATION MEASURES: SESA AND ESMF

176. The Readiness Fund has two procedural safeguard requirements, namely the:

- Strategic Environmental and Social Assessment, or SESA, and
- Environmental and Social Management Framework, or ESMF.

177. The SESA stems from environmental assessment requirements of the World Bank.[14] It is intended to be an inclusive process whereby the REDD+ country, with the participation of all potentially affected stakeholders, seeks to "identify likely impacts and risks, as well as opportunities," among different strategic REDD+ options. During the SESA process these impacts, risks and opportunities are assessed and weighed by the various stakeholders. Activities that form part of the SESA include:[15]

- Identifying and prioritising the drivers of deforestation. This assessment also includes looking at how issues such as land tenure and access to forest resources are dealt with in Bhutan;
- Analysing the legal, policy and institutional "aspects" of REDD+ readiness;
- Assessing the environmental and social issues linked to the strategic options or PAMs contained in the National REDD+ Strategy; and
- Establishing outreach, communication and consultative mechanisms with relevant stakeholders throughout the process.

178. All REDD+ countries must produce an ESMF as a direct output of the SESA process.[16] The ESMF lays out principles, rules, guidelines and procedures for assessing issues and impacts associated with planned REDD+ activities that may occur in the future but are not presently known or are uncertain.[17] It largely provides a framework for REDD+ countries to address environmental and social issues in their REDD+ Strategy as it is implemented.

179. As such the risks assessment and mitigation against potential negative impacts is thoroughly analyzed on the SESA/ ESMF process which are separate documents made publicly available under the REDD+ Readiness Process.

[14] See OP 4.01 – Environmental Assessment, para. 7; and Annex A, para. 10.
[15] Ibid
[16] R-PP Template, Component 2d, p. 44.
[17] Common Approach, p. 47, para. 23.

REFERENCES

Ministry of Agriculture and Forests of Bhutan. 2017. *Drivers of deforestation and forest degradation in Bhutan.*

Valentim, J. & Prado, M. 2008. *Social discount rates.* Accessed at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1113323

World Bank. 2016. *Estimation of REDD+ Cost Elements 2016*

World Bank. 2016. *GDP per capita growth (annual %).* Accessed at: https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG

World Bank. 2016. *Population growth (annual %).* Accessed at: https://data.worldbank.org/indicator/SP.POP.GROW?locations=IR

ADB [Asian Development Bank], 2013. Bhutan Transport 2040: Integrated Strategic Vision.

Costanza, R., Cumberland, J.H., Daly, H., Goodland, R. and Norgaard, R.B., 1997. An introduction to ecological economics. CRC Press.

Distefano, E., 2005. Human-Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices. Food and Agricultural Organization of the United Nations (FAO), Sustainable Agriculture and Rural Development Initiative (SARDI), Rome, Italy. Available from: FAO Corporate Document repository http://www. fao. org/documents.

Dhital, D. B., 2009. Bhutan Forestry Outlook Study. FAO Asia-Pacific Forestry Sector Outlook Study II Working Paper Series.

DoFPS [Department of Forests and Park Services], 2015. Corruption risk assessment for REDD+ in Bhutan.

DoFPS [Department of Forests and Park Services], 2016a. National forest inventory of Bhutan.

DoFPS [Department of Forests and Park Services], 2016b. Land Use and Land Cover of Bhutan.

DoFPS [Department of Forests and Park Services], 2018. Benefit Sharing Framework– draft report. Indufor: Helsinki, Finland.

DRC [Department of Revenue & Customs], 2017. National Revenue Report 2016-17.

Farina, A., 2000. The cultural landscape as a model for the integration of ecology and economics. BioScience, 50(4): 313-320.

GNHC [Gross National Happiness Commission), 2013. Eleventh Five Year Plan Document.

Gyeltshen, 2015. Over of Energy Sector in Bhutan &Sustainable Rural Biomass Energy Project. International Symposium on Renewable Energy and Energy Efficiency Initiatives: Policies, Technologies, and Sustainability 3rd–5thJune 2015. Hotel LeMeridian, Thimphu.

Kubiszewski, I., R. Costanza, L. Dorji, P. Thoennes, K. Tshering, 2013. An initial estimate of the value of ecosystem services in Bhutan, Ecosystem Services, Volume 3, March 2013.

Lean, H. and R. Smyth, 2014. Electricity Consumption, Output, and Trade in Bhutan. Asian Development Bank. ADB South Asia Working Paper Series No. 34.

MoAF [Ministry of Agriculture and Forests], 2011. National Forest Policy.

MoAF [Ministry of Agriculture and Forests], 2012. RNR Agricultural Census Data.MoAF [Ministry of Agriculture and Forests], 2015. Bhutan RNR Statistics 2015.

MoAF [Ministry of Agriculture and Forestry], 2017. Drivers of deforestation and forest degradation in Bhutan: Final Report. Department of Forest and Park Services, Ministry of Agriculture and Forests, Royal Government of Bhutan.

MoEA [Ministry of Economic Affairs], 2017. National Energy Efficiency & Conservation Policy. Department of Renewable Energy.

NEC [National Environment Commission], 2006. National Adaptation Plan of Action.

NEC [National Environment Commission], 2011. Second National Communication to the UNFCCC Kingdom of Bhutan).

NEC [National Environment Commission], 2012. National Strategy and Action Plan for Low Carbon Development, 2012.

NEC [National Environment Commission], 2016. Bhutan State of the Environment Report 2016.

NEC [National Environment Commission], 2018. Climate Change Policy [Draft].

Norbu, L., Dhital, D.B. and Wangda, P., 2008. Reforestation in Bhutan - Accomplishments and Prospects. Keep Asia Green. 3: 67-109.

NSB [National Statistics Bureau], 2017b. Bhutan Poverty Analysis Report 2017.NSB [National Statistics Bureau], 2018. 2017 Population & Housing Census of Bhutan.

NSSC [National Soil Services Centre], 2014. The National Action Program to Combat Land Degradation. Ministry of Agriculture and Forests.

RGoB [Royal Government of Bhutan], 2015. Intended Nationally Determined Contribution.

RGoB [Royal Government of Bhutan], 2016a. Economic Development Policy.

RGoB [Royal Government of Bhutan], 2017a. FCPF Grant Mid-term Review and Request for Additional Funding.

RGoB [Royal Government of Bhutan], 2017b. Forest and nature conservation rules of Bhutan 2017.

RMA [Royal Monetary Authority of Bhutan], 2017. Annual Report 2016/17.

Sampdup, T., H. Udo, C. Eilers, M. Ibrahim, and A.j. van der Zijpp, 2010. Cross-breeding and intensification of smallholder crop-cattle farming systems in Bhutan. Livestock Science 132.

Tempa, K., 2011. Analysis of people's participation in subsidized rural timber allotment policy towards sustainable forest management at Sarpang, Dzongkhag, Bhutan. Thesis; Kasetsart University.

TCB [Tourism Council of Bhutan], 2016. Bhutan Tourism Monitor, 2016.

Valentim, J. and Prado, M., 2008. Social discount rates. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1113323

WMD [Watershed Management Division], 2015. Corruption risk assessment for REDD+ in Bhutan. Thimphu: Watershed Management Division, UNDP, UN-REDD Programme.

WMD [Watershed Management Division], 2018. Forests in Bhutan: Economic Value of Forest Ecosystem Services in Bhutan [Draft].

World Bank, 2016a. Estimation of REDD+ Cost Elements.

World Bank, 2016b. Population growth (annual %). Available at https://data.worldbank.org/indicator/SP.POP.GROW?locations=IR

World Bank, 2016b. GDP per capita growth (annual %). Available at https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZGThe World Bank, 2017. Employment in agriculture (% of total employment). Available at https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS

World Bank, 2018. GDP per capita (Bhutan). Available at https://data.worldbank.org/country/bhutan

Yangchen, U., Thinley, U. and Wallentin, G., 2015. Land Use Land Cover Changes in Bhutan: 2000-2013. Occasional Publication No.

Indufor Oy

Esterinportti 2
FI-00240 Helsinki
FINLAND
Tel. +358 50 331 8217
Fax +358 9 135 2552
indufor@induforgroup.com
www.induforgroup.com

Indufor Asia Pacific Ltd

7th Floor, 55 Shortland St
PO Box 105 039
Auckland City 1143
NEW ZEALAND
Tel. +64 9 281 4750
Fax +64 9 281 4789
www.induforgroup.com

Indufor Asia Pacific (Australia) Pty Ltd

Flinders Lane
PO Box 425
Melbourne VIC 8009
AUSTRALIA
Tel. + 61 3 9639 1472
www.induforgroup.com

Indufor North America LLC

10th Floor
1875 Connecticut Avenue, NW
Washington, DC 20009
USA
www.induforgroup.com