Kingdom of Bhutan

TECHNOLOGY NEEDS ASSESSMENT AND PROJECT IDEA REPORT

ADAPTATION

"March 2013"

National Environment Commission
Royal Government of Bhutan

Kingdom of Bhutan

TECHNOLOGY NEEDS ASSESSMENT AND TECHNOLOGY ACTION PLANS FOR CLIMATE CHANGE ADAPTATION

Disclaimer

This document is an output of the Technology Needs Assessment project, funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP) and the UNEP Risoe Centre (URC) in collaboration with the Regional Centre (from the corresponding region), for the benefit of the participating countries. The present report is the output of a fully country-led process and the views and information contained herein is a product of the National TNA team, led by the National Environment Commission, Royal Government of Bhutan.

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FOREWORD

PRIME MINISTER

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Royal Government of Bhutan

28 March, 2013.

Foreword

Bhutan, with its commitment to preserve the natural environment, has been actively participating in the fight against one of the most pressing challenges of the current times, the climate change. The country has undertaken the Technology Needs Assessment process to identify, evaluate, and prioritize technologies that fit in the overall development context of the nation while allowing the country to adapt to and mitigate climate change. At the Conference of Parties (COP) 14 in 2008, the Poznań Strategic Programme on Technology Transfer was adopted as a step towards *scaling up the level of investment in technology transfer in order to help developing countries address their needs for environmentally sound technologies.* As part of this programme, in 2010, on behalf of Global Environment Facility (GEF), the United Nations Environment Programme (UNEP) started the implementation of Technology Needs Assessment (TNA) for 36 countries.

Taking forward its commitment at the international forums, I am pleased that the National Environment Commission (NEC) Secretariat has completed the Technology Needs Assessment for Climate Change (TNA) and that it led to the formulation of a Technology Action Plan (TAP) for implementation of the prioritized technologies for adaptation and mitigation. These initiatives fit in the larger scheme of things that we are pursuing for low-carbon and climate-resilient development and will contribute to the development of the 11th Five Year Plan of the country, to be finalized soon.

As a party to the UNFCCC, Bhutan is fully committed to developing and implementing policies, programmes and projects to address the many challenges posed by climate change. We have also adopted a new Economic Development Policy in 2010, which embraces the concept and principles of green economic development. We are now formulating a national strategy for low-carbon and climate-resilient development.

Application of collective knowledge and skills is crucial in developing solutions for combating the challenges of climate change. In this regard, I am encouraged to note that various stakeholders not only from government agencies, but also from the civil society and private sector have been involved in the TNA process and have contributed extensively in selecting the prioritized technologies, identifying the key barriers to technology development and deployment, preparing the Technology Action Plans for overcoming the identified barriers and identifying the implementable project ideas for each technology. I would like to commend all the individuals and organizations that have contributed to the TNA process particularly, the TNA Taskforce members, the respective government departments and agencies and the National Environment Commission for effectively leading this exercise.

I look forward to seeing the findings and recommendations of the TNA project feed into the national strategy for combating climate change in Bhutan.

Tashi Delek !

(Jigmi Y. Thinley)
Prime Minister, and
Chairman of NEC

PREFACE

Given Bhutan's vulnerability to the impacts of climate change, the nation has accorded climate change a high priority. The nation's commitment to remain carbon neutral while ensuring overall social-economic development reflects its vision to address the challenges of climate change and move towards a sustainable future.

The challenges of addressing climate change, particularly by developing and least developed countries have been recognized at various international forums. Technology transfer as a vital instrument to overcome these challenges has been identified by the UNFCCC in Article 4.5. Subsequently, the need and importance of technology transfer has been reiterated at various Conference of Parties (COP) of the UNFCCC. At COP 14 in 2008, the Poznań Strategic Program on Technology Transfer was adopted as a step towards *scaling up the level of investment in technology transfer in order to help developing countries address their needs for environmentally sound technologies.* As part of this programme, in 2010, on behalf of Global Environment Facility (GEF), the United National Environment Programme (UNEP) started the implementation of Technology Needs Assessment (TNA) for 36 countries.

Bhutan has undertaken the TNA process to identify, evaluate, and prioritize technologies that fit in the overall development context of the nation while allowing the country to combat climate change. The National Environment Commission Secretariat is the nodal agency for the TNA project and has constituted a TNA Task Force involving representatives from various sectors to provide inputs to the TNA project and most importantly in preparing the Technology Action Plan for identified technologies.

In the Part I of the TNA report, for each prioritized sub-sector in climate change adaptation and mitigation one technology was prioritized based on a technology prioritization framework prepared through secondary research and rigorous stakeholder consultation. Part III of the TNA report, the Technology Action Plan covers each adaptation and mitigation technology, in a way to reflect the prioritized measures required to enhance technology diffusion and overcome barriers identified in Part II of the TNA report. The current Project Idea Report brings together implementable project ideas for both adaptation and mitigation, emerging out of the Technology Action Plans for each technology.

The project ideas have been identified based on inputs received from a number of stakeholders from various agencies in the government, civil society and private sector.

Ugyen Tshewang, PhD
Secretary
National Environment Commission

ACKNOWLEDGMENT

The National Environment Commission Secretariat (NECS) sincerely acknowledges the Global Environment Facility (GEF) for the financial support provided for the Technology Needs Assessment (TNA) project in Bhutan. We would also like to thank UNEP Risø Centre (URC) and Asian Institute of Technology (AIT) for their technical guidance during the course of the TNA. The NECS is particularly grateful to Mr. Gordon Mackenzie, TNA country coordinator for Bhutan, for coordinating all the activities between the NECS, AIT and URC.

We would like to thank all the TNA taskforce members for their valuable contribution in prioritization of sectors and technologies, and for their comments on the draft report.

Further, we express our sincere appreciation to Emergent Ventures India and Norbu Samyul Consulting for facilitating the TNA process and putting together the TNA report.

ABBREVIATIONS

BAFRA	Bhutan Agriculture and Food Regulatory Authority
DOA	Department of Agriculture
EVI	Emergent Ventures India
FYP	Five-year plan
GHG	Green house gas
IPCC	Intergovernmental Panel on Climate Change
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
JICA	Japan International Cooperation Agency
MOAF	Ministry of Agriculture and Forests
MCDA	Multi-criteria Decision Analysis
NABARD	National Bank for Agriculture and Rural Development
NAPA	National Adaptation Programme of Actions
NBC	National Biodiversity Centre
NEC	National Environment Commission
NECS	National Environment Commission Secretariat
NSC	National Seeds Centre
PGR	Plant Genetic Resources
RDC	Research and Development Centre
RNR	Renewable Natural Resources
SALT	Sloping Agriculture Land Technology
TAP	Technology Action Plan
TNA	Technology Needs Assessment
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	U.S. Agency for International Development

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1.1 Brief Summary

Transfer and diffusion of drought and pest resistant crop varieties has been seen as an important way of combating some of the critical impacts of climate change such as crop yield instability, increased incidence of pests attacks and diseases, etc. Bhutan has initiated work on development of these kinds of varieties of crops particularly for rice and maize. The country has also initiated a Food Availability Program which has evaluation and adoption of genetic resources resistant to biotic and a-biotic stresses including drought, pests and diseases as one of the key strategies.

While efforts have been initiated in the country towards development and diffusion of such varieties, some efforts at market and institutional aspects are required to complement the on-going efforts. The current proposed project idea consists of set of activities aimed at improving market, institutional, information and awareness aspects associated with diffusion of these varieties. The project idea also consists of setting up a seed development fund which will be aimed at improving the financial support required for providing financial incentives, strengthening institutional structure etc. It also includes training and capacity building workshops for sales representatives to enable proper diffusion of drought and pest resistant varieties of crops, by improving extensions services of RDCs.

1.2 Specific Project Ideas

1.2.1 Introduction

Project title: *Diffusion of drought and pest resistant varieties of crops in Bhutan by strengthening the domestic institutional structure, undertaking pilots and establishing a national seed development fund.*

Background and rationale

Agriculture is the mainstay of the Bhutanese economy, with the sector contributing 16.8 percent to Bhutan's GDP in 2010 (National Statistics Bureau, 2011). More than 60 percent of the Bhutanese population still depends on the agriculture sector which is mostly subsistence in nature (Labour Force Survey, 2011). The agriculture sector in Bhutan is particularly sensitive to the impacts of changing climate, with vulnerabilities such as crop yield instability, decreased water availability, loss of soil fertility, delayed sowing etc. A country road map paper prepared by the Ministry of Agriculture and Forests ahead of the Bhutan Climate Summit 2011 identifies climate change as one of the major threats of food security in the country.

In addition, several reports have suggested increased occurrence of pests and diseases in various parts of the country, and climate change is suspected to be a major factor in this regard. Further, studies have shown that 65% of the total rice growing areas and 51% of the maize growing areas in the country is still planted with traditional varieties of crops and that there are low adoption rates of improved varieties.

With this background, development of drought and pest resistant varieties of crops was the technology finalized by the TNA Taskforce. The current report, building on the work undertaken in the other parts of the TNA exercise, proposes a project idea with a view of initiating a process towards implementing the needed measures for overcoming the barriers associated with diffusion of drought and pest resistant varieties of crops. The project idea aims to create an enabling environment for diffusion of drought and pest resistant varieties by facilitating technology development and addressing the financing and capacity building requirements for this technology in Bhutan.

1.2.2 Objectives

The project aims to achieve the following:

- Strengthening the current institutions with human resources and required facilities for accelerating research and development and extension services
- Building the needed financial support for development and deployment of new varieties of seeds
- Testing the new varieties through pilots across the country for diffusion

1.2.3 Project Outputs

Following measurable outputs would be attained after the end of the program

- A detailed plan of implementation on increasing the human resources and required facilities for accelerating research and development of BAFRA, National Seed Centre, Technology Release Committee and RDCs for improved varieties of crops
- Establishment of a seed development fund for building the financial support required for providing financial incentives, strengthening institutional structure etc.
- Undertake pilots and field testing of new drought and pest resistant varieties of horticultural crops

1.2.4 Relationship to the country's sustainable development priorities

The importance of agriculture as well as the growing realization of climate change impacts on the agriculture sector is driving several actions within the country aimed at coping with the likely impacts. The current project focussed on development and diffusion of drought and pest resistant varieties of crops is in line with country's Second National Communication to UNFCCC, which identifies the likely areas of action for adaptation in the agriculture sector. In addition, a country road map paper prepared by the Ministry of Agriculture and Forests ahead of the Bhutan Climate Summit 2011 includes a National Food Security Program with an overall goal of ensuring availability of safe and quality food at affordable prices. Under this program, a Food Availability Program has been prepared with the goal of increasing crop production through development of improved varieties, breeds, and management technologies. One of the key strategies to achieve this goal is through evaluation and adoption of genetic resources resistant to biotic and a-biotic stresses including drought, pests and diseases. Some work on climate resilient technologies (drought tolerant varieties, disease resistant varieties) particularly on rice and maize have already been carried out in the country.

Development of new varieties of crops is also the focus in the draft 11th Five Year Plan (FYP) of the Government. The project will be a support to the on-going Food Availability Program and help in achieving the targets as identified in the 11th FYP.

1.2.5 Project Benefits

The project by developing an implementable plan for enhancing the institutional capacity will help in building the institutional strength in terms of human resources, R&D facilities, and extension services of the institutions such as the BAFRA, National Seed Centre, Technology Release Committee and RDCs. By undertaking training of the current and new extension agents, will help in diffusion of these varieties to farmers, especially those located in remote areas. Enhancing the extension services of the RDCs has been the focus of the government in the recent years and this project will greatly benefit that endeavour. By introducing a seed development fund, the project can go a long way in tiding over the financial crunch associated with building research facilities or undertaking extension activities. It'll help build the confidence of farmers in adopting and cultivating new varieties of seeds and overall help the country in tiding over the adverse impacts of climate change particularly on its agriculture sector and issue of food security.

1.2.6 Project Scope and Possible Implementation

The project covers the entire country by developing strategies of strengthening of institutions both at central and regional level. The proposed seed development fund to be established under this project would also cover the entire country. The pilot projects would be implemented at each Dzonkhags in Bhutan as each of them have very different features. The implementation possibility of the project idea is very high as it very well aligned with the National Food Availability Program of the Ministry of Agriculture and Forests and the 11th Five Year Plan of the country. The Ministry has also endorsed this project idea and there is a possibility of linking this project with ongoing programs of the Ministry such as the shuttle breeding program to develop new varieties. The Ministry is also keen to develop a Comprehensive Agriculture Policy of Bhutan for which the outputs of the proposed project idea would be very useful.

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1.2.7 Project activities and timelines

The key project activities and timelines are shown in Table 1 below

Table 1: Proposed project activities- Agriculture sector

S No.	Activity	Sub-activity	Duration	Budget (000 USD)	Budget heads	Responsibility/Coordination agency	Measurement/Evaluation parameter
1	Prepare a detailed plan of implementation for increasing the human resources and required facilities for accelerating R&D and extension services of the domestic institutions	1.1 Review existing institutional arrangements and assess areas of improvement. As part of the review, conduct stakeholder consultations *inter alia* through key informant and focused group interviews. 1.2 Assess and identify the specific technical expertise required in key institutes including BAFRA, National Seed Centre, Technology Release Committee and RDCs 1.3 Identifying equipments/lab requirements, of the institutions for development of technology. Identify domestic and international technology suppliers along with scope of tie ups 1.4 Identify and collaborate with regional and international research institutes with the RDCs under DoA by - Establishing tie-ups - Defining scope of tie-ups - Promoting exchange of experts on exchange programmes 1.5 Design a training program	6 months (activities 1.1 to 1.4) 6-8 months (activities 1.5 to 1.8) would be required for designing the program and actually conducting the first training. However this should be an on-going	100 100	· Staff costs/ consulting fees; · Workshop costs;cost of training materials, venue and other logistics · Travel, accommodation and other related logistical expenses · Website creation and maintenance	Department of Agriculture under the Ministry of Agriculture and Forests – will provide dedicated staff and procure services from consultants for the study. For activities 1.5 to 1.8 DoA along with RDCs and Royal University of Bhutan (RUB) will be involved.	Integration of the plan of strengthening the institutional capacity in the national strategy. Establishing tie ups with international research institutes. About 20-30 extension agents trained under the first phase of training across all RDCs.

		(certification based) in collaboration with the research arm of RDCs to train extension agents on selling of new varieties to farmers. In collaboration with College of Natural Resources under the Royal University of Bhutan (RUB) 1.6 Develop extension and communication materials for the training programmes, handouts for farmers for their ready reference. This could be done by hiring consultants. 1.7 Create a website/webpage within Department of Agriculture for knowledge creation on new varieties of seeds and for easy reference for extension agents. 1.8 Assign responsibility to a particular team/individual at DOA, to act as a contact point for RDCs or extension agencies to coordinate with. Also, responsible for coordinating and planning these training programmes periodically.	exercise, conducted at regular intervals.				
2	Establishing a seed development fund for building the financial support required for strengthening institutional structure, conducting trainings etc.	2.1 Conduct a review of similar funds in other countries 2.2 Design and develop a possible institutional structure of such a fund. Estimate the fund corpus based on targets set 2.3 Set procedures and protocols and institutional structure for operationalizing the fund. Organize a workshop to discuss the structure of such a fund with different stakeholders within the Government. 2.4 Identifying potential international	12-18 months	50	-Staff cost/consulting costs - Workshop costs; - Documentation and printing costs	Department of Agriculture	Creation of a fund by end of the tenure of the activity

	The fund could consist of domestic and international funds, provided either in form of grant and debt for identified activities	agencies/funds to be approached 2.5 Develop tie-ups with selected agencies. Formalizing the scope of financing and particular financing mechanism to be introduced through such tie-ups					
3	Undertake pilots and field testing of new varieties of horticultural crops	3.1 Identifying sites for pilots and field testing 3.2 Identify institutions for conducting the pilots 3.3 Prepare techno-economic feasibility reports and detailed project reports highlighting technology, application and financial details, taking into account soil erosion aspects of the selected pilot sites. 3.4 Seek source of funding these pilots 3.5 Prepare implementation plan including ownership models and project management models, technical skill development plans, etc. 3.6 Implement the pilot and monitor the pilots to draw lessons from pilot applications of the drought and pest resistant varieties	3 years	1000	-Staff cost for planning, implementation and management of the pilots - Technical reports including detailed project reports - Documentation and printing costs	RDCs and Dzongkhags	No. of pilotsimplemented by 2015

1.7.1 Possible Complications/Challenges

The key challenges in the project are:

- Limited human resources in DOA and RDCs may slow down the process and thereby increase lag time
- Delay in getting access to fund from domestic and international sources
- Delay in implementation of pilot projects due to low level of supportive infrastructure

Chapter 2 Project Idea for Water Sector

2.1 Brief summary of the Project Ideas for Water Resources

With its aggressive food self-sufficiency goals and with increased food demand due to population growth, Bhutan aims to intensify agriculture production on the available land. The challenge of achieving food sufficiency together with the challenge of climate change is thereby necessitating an important role for advanced irrigation facilities in the country. The development of these facilities would play a critical role in increasing yield and food production. With this background, transfer and diffusion of drip and sprinkler irrigation system was finalized as the technology under the TNA exercise for the water resources sector.

The proposed project idea based on other parts of the TNA report suggests a set of activities focussing on financial and training and capacity building aspects for effective diffusion of these systems.The project will focus on building capacity by providing training to RDC engineers, extension agents and farmers regionally, covering the jurisdiction of the four RDCs. the project will also come with a financial incentive scheme most suitable for improving the financing viability of these systems to the farmer, to be implemented at the national level.

2.2Specific Project Ideas

2.2.1 Introduction

Project title:*Diffusion of drip and sprinkler irrigation systems in Bhutan by designing innovative financing mechanisms and capacity building of implementing entities in Bhutan.*

Background and rationale

The agriculture sector in Bhutan has the highest consumption of water in the country. Thereby, the sector is also highly vulnerable to impacts of climate change on water bodies. By utilizing water in the most efficient way will not only reduce the vulnerability of the sector but also will result in overall water conservation in the country. As the country aims to commercialize its agriculture sector, the use of water is set to increase multi-fold. In this context, drip and sprinkler irrigation systems will play an important role. Some initiatives have been taken by the Department of Agriculture in promoting these micro irrigation systems in the country in terms of pilot projects as part of the Decentralized Rural Development Project in Bhutan (funded by The World Bank).

However, it was felt by the department and the TNA task force that large scale deployment of these systems in the country would require addressing key barriers which are related to knowledge of these systems by local level implementing entities and financing of these systems. The project idea therefore includes conducting training programs for relevant agencies and community groups as well as identifying innovative financing mechanisms which can address the high capital and operational cost requirements of the systems.

2.2.2 Objectives

The project aims to achieve the following:

- Improve capacity of implementing agencies and communities by conducting training programmes on drip and sprinkler irrigation techniques
- Identify innovative financing mechanisms for encouraging the uptake of these systems by farmers and recommend the most suitable scheme for the country.

2.2.3 Project Outputs

Following measurable outputs would be attained after the end of the project

- Conduct at least four training programme covering the four RDCs on drip and sprinkler irrigation system installations, operation and maintenance.
- A report on feasibility analysis of different financial incentives and improving access to finance for increasing uptake of drip and sprinkler irrigation systems

2.2.4 Relationship to the country's sustainable development priorities

The importance of agriculture as well as the growing realization of climate change impacts on the agriculture and water resources sector is driving several actions within the country aimed at coping with the likely impacts of climate change. The current project focussed on diffusion of drip and sprinkler irrigation systems is in line with country's Second National Communication to UNFCCC, which identifies the likely areas of action for adaptation in the water sector. In addition, a country road map paper prepared by the Ministry of Agriculture and Forests ahead of the Bhutan Climate Summit 2011 includes brings to focus the issues with the current irrigation systems, possible adaptation measures and a 10 year roadmap for the sector. The current proposed program is in line with what has been proposed in the country paper. Like the paper, the program suggests, improving awareness levels on new irrigation technologies and its applicability in Bhutan as well as undertaking demonstrations and pilots.

Deployment of new irrigation systems for horticultural crops is also the focus in the upcoming 11th Five Year Plan of the Government. The current project will be a support to the on-going efforts and help in achieving the targets as identified in the 11th FYP.

2.2.5 Project Benefits

The project by undertaking training of the district engineers, RDC engineers, farmers and extension agents will help in creating support staff for installation, operation and management of these systems, which is currently lacking. An assessment of likely options of providing financial incentives for promoting these systems will help in bring to light the most suitable financial scheme supporting the uptake of these systems by farmers which is at the same time sustainable for the Government.

2.2.6 Project Scope and Possible Implementation

The project covers the entire nation targeting both central level planning as well as local level implementation. The capacity building and training programs would be conducted for RDC engineers, extension agents and farmers regionally, covering the jurisdiction of the four RDCs. The project will also come with a financial incentive scheme most suitable for improving the financing viability of these systems to the farmer, to be implemented at the national level.

The implementation possibility is very high, as some pilot projects have already been set up and targeted beneficiaries for the capacity building and training programs have been tentatively identified. The Department of Agriculture has also been proactive in initiating partnerships with technology suppliers and research institutions for introducing drip and sprinkler systems in their agriculture sector. The proposed project idea would also assist the department in achieving the target set under their draft 11th five year plan of covering 300 hectares of land under new irrigation systems.

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2.2.7 Project activities and timelines

The key project activities and timelines are shown in Table 2 below

Table 2: Proposed Project Activities- Water Sector

S No.	Activity	Sub-activity	Duration	Budget (000 USD)	Budget heads	Responsibility/Coordination agency	Measurement/Evaluation parameter
1	Conduct training programme covering the four RDCs on drip and sprinkler irrigation system installations, operation and maintenance	1.1 Design two training program (certification based) curricula in collaboration with the research arm of RDCs to train district engineers and farmers respectively, on installation and maintenance of these systems 1.2 Develop extension and communication materials for the training programmes, handouts for farmers/engineers for their ready reference. This could be done by hiring consultants. 1.3 Create a website/webpage within Department of Agriculture, Engineering Division for knowledge creation on new technology for micro irrigation 1.4 Assign responsibility to a particular team/individual at DOA, to act as a contact point for RDCs to coordinate with. Also, responsible for coordinating and planning these training programmes periodically.	6-8 months would be required for designing the program and actually conducting the first training. However this should be an on-going exercise, conducted at regular intervals.	100	· Staff/consultant cost for designing and delivering training programs · Cost of training materials, venue and other logistics · Cost for website creation and maintenance	Department of Agriculture, Engineering Division and Research and Development Centres	4 trainings conducted in coordination with 4 RDCs.
2	A report on	2.1 Appoint an agency for conducting	6 months	25	· Staff	Department of Agriculture	Submission of the final

	feasibility analysis of different financial incentives and improving access to finance for increasing uptake of drip and sprinkler irrigation systems	such a study, domestic or international consultants 2.2 Analyse and prepare a list of possible financial incentives that can be introduced such as a capital subsidy, low interest debts etc. 2.3 Conduct review of similar schemes in other countries such as India, Israeletc. 2.4 Undertake a cost benefit analysis of the scheme and assign budget for micro irrigation scheme 2.5 Explore funding options from domestic and international sources 2.6 Recommend the most suitable scheme 2.7 Develop institutional structure to implement the scheme	cost/consulting costs · Workshop costs; · Documentation and printing costs	and Ministry of Finance	report to concerned authorities

2.2.8 Possible Complications/Challenges

The key challenges in the project are:

- High costs of these systems in absence of any financial incentives may result in limited adoption of these systems by the farmers
- Limited human resources in Engineering Division, DOA and RDCs may slow down the process and thereby increase lag time
- Delay in finding the relevant consultants for carrying out the feasibility study for example
- Lower participation in the training programmers by farmers, due to less confidence in new technology and mindset issues towards traditional practices

Chapter 3 Project Ideas for Natural Disaster and Infrastructure

3.1 Brief summary of the Project Ideas

The Technology Needs Assessment and Technology Action Plan reports have identified climate-resilient farm road development as the most preferred technology option for climate change adaptation in the natural disaster and infrastructure sector.

With 69 percent of the country's population living in the rural areas and subsisting on farm-based livelihoods, and with much of the country's terrain being highly mountainous, geologically fragile, and extremely sensitive to erratic and intense rains, development of farm roads using approaches, techniques and practices for climate-resilience is hugely crucial. The proposed project idea is being presented with the aim to implement a set of key enabling measures for the transfer and diffusion of climate-resilient farm road development technology.

3.2Specific Project Ideas

3.2.1 Introduction

Project Title: Promoting and Implementing Climate-Resilient Farm Road Development

Background and rationale

While the general policy and principle in Bhutan is to adhere to environment-friendly road construction concept and practices, there are certain institutional, financial and policy constraints as explained in the Barrier Analysis and Enabling Framework and Technology Action Plan reports that need to be addressed. For a quick recapitulation, some of the key constraints are listed below:

- Limited focus on climate-resilience in existing policy and guidelines for farm road development;
- Lack of inter-institutional coordination mechanism between Dzongkhag Administrations and the Department of Agriculture, Ministry of Agriculture and Forests;
- Mismatch between physical targets and institutional capacity at the Dzongkhag and Gewog levels;
- Mismatch between budget allocation and recommended technical standards;
- Dearth of well-researched information, e.g. cost-benefit analysis, to sensitize stakeholders and inform public policies and investment decisions on climate-resilient farm road development.

Furthermore, there is currently a dearth of examples in the field that demonstrate the full range of climate-resilient farm road development technology and provide the basis for adaptation, replication and scaling-up of the technology.

This project idea is based on the need to address the aforesaid constraints and provide a practical basis for promoting and implementing climate-resilient farm road development.

3.2.2 Objectives

The project idea is proposed with the following main objectives:

- Strengthening institutional, policy and fiscal framework for climate-resilient farm road development;
- Demonstrating and promoting the full-range of climate-resilient farm road development technology on a pilot scale and provide a practical basis for adaptation, replication and scaling-up of the technology.

3.2.3 Project Outputs

The following outputs are expected from the implementation of the project:

- National strategy and technical guidelines for farm road development with emphasis on climate-resilience;
- Institutional framework and mechanism for better coordination and development of farm roads in a climate-resilient manner, clearly defining the roles and responsibilities and functional linkages between various agencies with a role in climate-resilient farm road development;
- Budget allocation/ fiscal framework that is in harmony with the technical standards recommended for development of farm roads in a climate-resilient manner;
- Cost-benefit analysis through a set of case studies of climate-resilient farm road development to sensitize stakeholders and to inform public policies and investment decisions;
- A pilot set of farm roads that demonstrate the full range of climate-resilient approaches, techniques and practices in the field.

3.2.4 Relationship to the country's sustainable development priorities

The proposed project idea will contribute to poverty reduction, which is an overarching development objective of the Royal Government of Bhutan for the past two Five-Year Plans (9th and 10th Five-Year Plans) as well as for the oncoming 11th Five-Year Plan (July 2013-June 2018). It also fits in very well within context of the country's Gross National Happiness (GNH) development philosophy and specifically corresponds with the GNH development objectives of equitable socio-economic development and environmental sustainability

A primary development strategy of the country is to improve and expand road connectivity for poverty reduction and socio-economic development of the rural communities but in a manner that is environmentally sustainable. The project will contribute to implementation of this strategy.

3.2.5 Project Benefits

The direct benefits will include creation of conducive policy, institutional, and fiscal environments for promotion and implementation of climate-resilient farm road development technology and greater visibility of the technology through development of climate-resilient farm roads on a pilot/ demonstrational scale. In addition, the implementation of the project will have spin-off benefits in terms of hands-on knowledge and implementation experience in the field of climate-resilient farm road development among the people and agencies involved during the project.

3.2.6 Project Scope and Possible Implementation

The project scope will be comprehensive in that it will focus on policy and institutional aspects as well as on operational aspect. The policy and institutional aspects will largely look at the macro-level framework while the operational aspect will focus on implementation and demonstration of the technology at the local level by developing climate-resilient farm roads (this would include both construction of new roads as well as improvement of existing roads) on a pilot scale at the rate of 15-20 km in each Dzongkhag.

3.2.7 Project activities and timelines

The key project activities and timelines are shown in Table 3 below

Table 3: Proposed Project Activities- Infrastructure Sector

S. No	Activity	Sub-activity	Duration	Budget (USD)	Budget heads	Responsibility/Coordination agency	Measurement/Evaluation parameter
1.	Develop and disseminate national strategy and technical guidelines for farm road development with emphasis on climate resilience	1.1 Review existing policies, plans and guidelines related to development of farm roads with the lens of mainstreaming climate-resilience. As part of the review, conduct stakeholder consultations through *inter alia* key informant and focused group interviews. 1.2 Conduct a technical workshop to discuss the findings and recommendations of the aforesaid review and elicit feedback. 1.3 Based on the outcome of the aforesaid workshop and, if necessary, with additional literature review and stakeholder consultations, formulate a draft national strategy and technical guidelines for farm road development with emphasis on climate resilience. Incorporate the draft institutional framework and mechanism resulting from activity 2	10-12 months	100,000	· Staff costs/ consultancy fees · Workshop/ meeting costs · Documentation and printing cost · Travel, accommodation and other related logistical expenses	Department of Agriculture, Ministry of Agriculture and Forests	Existence of national strategy and technical guidelines for climate-resilient farm road development and the level of awareness about it among the agencies that have a role in farm road development.

		(see sub-activities 2.1 – 2.3) into the national strategy and technical guidelines. 1.4 Conduct a high-level national consultation to present the draft national strategy and technical guidelines for climate-resilient farm road development and elicit feedback. 1.5 Based on the outcome of the high-level national consultation, finalize the national strategy and technical guidelines for climate-resilient farm road development. 1.6 Conduct a series of four regional workshops (east, central-east, central-west, and west) to disseminate the national strategy and technical guidelines for climate-resilient farm road development.				
2	Develop institutional framework and mechanism for improved coordination in the development of climate-resilient farm roads.	2.1 Review existing institutional arrangements and assess areas of improvement for institutional coordination for climate-resilient farm road development. As part of the review, conduct stakeholder consultations *inter alia* through key informant and focused group interviews. 2.2 Conduct a workshop to discuss the	2-3 months	15,000	- Staff costs/ consulting fees; - Workshop costs; - Travel, accommodation and other related logistical expenses	Department of Agriculture, Ministry of Agriculture and Forests	Integration of the institutional framework and mechanism in the national strategy and technical guidelines for climate-resilient farm road development.

		findings and recommendations of the review and elicit feedback. 2.3 Based on the outcome of the aforesaid workshop formulate a draft institutional framework and mechanism for improved coordination in the development of climate-resilient farm roads. Feed this framework and mechanism into the national draft strategy and technical guidelines (see sub-activities 1.1 – 1.3).					
3	Harmonize budget allocation/ fiscal framework with technical standards recommended for climate-resilient farm road development	3.1 Review existing fiscal policies/ standards for farm roads and develop draft budget allocation norms and codes, corresponding with the technical standards set in the national strategy and technical guidelines for climate-resilient farm road development. 3.2 Conduct a workshop to present the draft budget allocation norms and codes and elicit feedback. 3.3 Based on the outcome of the workshop, finalize the budget allocation norms and codes.	3-4 months	30,000	- Staff costs/ consulting fees; - Workshop costs; - Travel, accommodation and other related logistical expenses; - Documentation and printing costs	Ministry of Agriculture and Forests/ Ministry of Finance	Adequacy of budgetary allocation for climate-resilient farm road development
4	Cost-benefit analysis of climate-resilient farm road	4.1 Design case study approach including research parameters and selection of study sites. 4.2 Conduct field work in the selected	12 -18 months	60,000	- Staff/ consulting costs; - Fieldwork and	Ministry of Agriculture and Forests/ Gross National Happiness Commission	Existence of case studies on cost-benefit analysis of climate-resilient farm

	development to sensitize stakeholders and inform public policies and investment decisions	sites. 4.3 Analyze data secured from field work and prepare case study reports. 4.4 Prepare and disseminate policy briefs summarizing the information and insights presented by the case study reports.			other study related logistical expenses; - Printing cost		road development and their reference in policies and plans.
5a	Implement pilot project to demonstrate the full range of climate-resilient farm road development in the field in all the dzongkhags (full-scale option)	5a.1. Select pilot sites in each dzongkhag for implementation of the full range of standards outlined in the national strategy and technical guidelines for climate-resilient farm road development. 5a.2. Develop climate-resilient farm roads in the selected sites using the full range of standards outlined in the national strategy and technical guidelines for climate-resilient farm road development. 5a.3 Evaluate the results of the pilot field project	54 months	18,000,000	· Engineering service expenses; · Construction costs (labour and materials); · Staff costs for supervision and monitoring.	Dzongkhag Administrations with support and backstopping from the Department of Agriculture, Ministry of Agriculture and Forests	Existence of ground examples of farm roads that demonstrate the full range of technical standards outlined in the national strategy and technical guidelines for climate-resilient farm road development, and the level of their adaptation/ replication in other areas in the future.
5b	Implement pilot project to demonstrate the full range of climate-resilient farm road development in the field in 10 selected	5b.1. Select 10 dzongkhags for pilot project and, in each selected dzongkhags, select pilot sites for implementation of the full range of standards outlined in the national strategy and technical guidelines for climate-resilient farm road development.	54 months	9,000,000	· Engineering service expenses; · Construction costs (labour and materials); · Staff costs for supervision and monitoring.	Dzongkhag Administrations with support and backstopping from the Department of Agriculture, Ministry of Agriculture and Forests	Existence of ground examples of farm roads that demonstrate the full range of technical standards outlined in the national strategy and technical guidelines for climate-resilient farm

dzongkhags (down-scaled option)		road development, and the level of their adaptation/ replication in other areas in the future.
	5a.2. Develop climate-resilient farm roads in the selected sites using the full range of standards outlined in the national strategy and technical guidelines for climate-resilient farm road development. 5b.3. Evaluate the results of the pilot field project.	

Note: Two options have been presented for activity 5, as 5a (full-scale option) and 5b (down-scaled option) based on the recommendation of the Final TAP/PIR Workshop held at Paro, 11-13 Feb 2013.

3.2.8 Possible Complications/Challenges

The key challenges in the project are:

- There may be public and political impatience, which may not allow a meticulous process of strengthening the institutional, policy and fiscal frameworks for climate-resilient farm road development;
- Delay in getting access to fund from domestic and international sources;
- Delay in implementation of pilot projects due to low level of supportive infrastructure;
- In-country expertise to implement proposed project activities

Annex II

Kingdom of Bhutan

List of References

Bhutan National Adaptation Programme of Action (NAPA), 2006, National Environment Commission, Royal Government of Bhutan

Labour Force Survey 2011, Labour Force Survey (LFS) Report, 2011, Royal Government of Bhutan

National Environment Commission, 2011, Second National Communication to the UNFCCC, National Environment Commission, Royal Government of Bhutan, Bhutan

National Statistics Bureau, 2011, Statistical Yearbook of Bhutan 2011, National Statistics Bureau, Royal Government of Bhutan

Annex I. List of Stakeholders consulted

Several stakeholders were consulted in the process of preparation of the current Technology Action Plan Report. The list of stakeholders consulted along with their contacts is provided below.

S. No.	Name	Organization	Type of Consultation	Topics consulted for
1.	Birkha B. Chhetri, General Secretary	Association of Bhutanese Industries	Roundtable discussions and one on one interview	Industries
2.	Chhimi Dorji, Deputy Executive Engineer	Department of Hydro Meteorology Services	Roundtable discussions and one on one interview	Water, Agriculture
3.	Chhimi Rinzin, Chief Agriculture Officer	Department of Agriculture	Roundtable discussions	Agriculture
4.	Dawa Chogyel, Deputy Chief Environment Officer (EU-DOI),	Ministry of Economic Affairs	Roundtable discussions	
5.	G K Chhopel, Chief, Water Resources Division	National Environment Commission Secretariat	Roundtable discussions and one to one interview	Water
6.	Tek Nath Kararia, Civil Engineer	Thimphu Thromde	Roundtable discussions	Waste
7.	Gyembo Tenzin, Deputy Executive Engineer	Department of Agriculture	Roundtable discussions	Agriculture
8.	Jigme Nidup, Senior Environment Officer	National Environment Commission Secretariat	Roundtable discussions	Farmroads
9.	K. P Bhandari, DGM (plant)	SKW Tashi Metals	Roundtable discussions	Industries
10.	Karma Pemba, Chief Transport Officer	Road Surface and Transport Authority	Roundtable discussions and one to one interview	Transport
11.	Karma Tshethar	Department of Agriculture	Roundtable discussions	Agriculture
12.	Kunzang Choden, Senior Research Officer	Council of RNR Research in Bhutan	Roundtable discussions and one to one interactions	Water, Agriculture
13.	Nima Dorji, Engineer	Department of Agriculture	Roundtable discussion	Water, Agriculture
14.	Namgay Thinley, Deputy Chief Horticulture Officer	Department of Agriculture	Roundtable discussion	Agriculture
15.	Prem P. Adhikari, Senior Transport Officer	Road Safety and Transport Authority	Roundtable discussion	Transport

16.	Sherab Jamtsho, Deputy Executive Engineer	Department of Renewable Energy	Roundtable discussion	Industries
17.	Subarna Sharma, General Manager	Ugen Ferro Alloy Pvt Ltd	Roundtable discussion	Industries
18.	Tashi Dorji, Head of Administration	SKW Tashi Metals	Roundtable discussion	Industries
19.	Tashi Wangdi, Senior Manager	Bhutan Ferro Alloys Ltd	Roundtable discussion	Industries
20.	Tenzin Khorlo, Chief Environment Officer	National Environment Commission Secretariat	Roundtable discussion	Waste
21.	Thinley Dorji, Chief, Compliance Monitoring Division	National Environment Commission Secretariat	Roundtable discussion	
22.	Trashi Namgyel, Hydromet Officer	Department of Hydro Meteorology Services	Roundtable discussion	Water
23.	Tshering Yangchen, Assitant Environment Officer	Thimphu Thromde	Roundtable discussion	Waste
24.	Yeshey Penjor	Independent consultant	Roundtable discussion and one to one interview	Waste
25.	Tshering Wangchuk, Program Officer		Roundtable discussion	
26.	Tshewang Lhamo, Environment Officer		Roundtable discussion	