

BUSINESS MODEL: AGROFORESTRY



EUCALYPTUS WITH PADDY

Published by

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Registered offices:

Bonn and Eschborn

Umbrella Programme for Natural Resource Management

A2/18, Safdarjung Enclave

New Delhi 110 029 India

T: +91 11 4949 5353

F : + 91 11 4949 5391

E: info@giz.de

I: www.giz.de

Responsible

Mohamed El-Khawad

Program Director and Cluster Coordinator

Environment, Climate Change and Biodiversity

Email: mohamed.el-khawad@giz.de

Rajeev Ahal

Director, Natural Resource Management

Email: rajeev.ahal@giz.de

Technical Partners

Intellect Consortium

Content Review

Deepak Chamola, Technical Expert, GIZ

Editor

Raj Pratim Das

Design and Layout

Rouge Communications

rougecommunications@gmail.com

Photo credits/GIZ

GIZ is responsible for the content of this publication

On behalf of the

German Federal Ministry for Economic Cooperation and Development (BMZ)

New Delhi, India

November, 2019



BUSINESS MODEL:
AGROFORESTRY

EUCALYPTUS WITH **PADDY**

CONTENTS

1. BACKGROUND	1
2. CHALLENGES IN AGROFORESTRY	3
3. PROJECT IDEA	4
3.1 Proposed agroforestry model	3
3.2 Intervention Strategies	3
3.3 Case Example: Cooperative Ltd.(IFFDC), Uttar Pradesh	5
3.4 Business model	6
3.5 Potential for up-scaling	7
4. IMPACTS AND SUSTAINABILITY	8
4.1 Impacts- Social, Economic and Environment	8
4.2 Climate change resilience	9
4.3 Sustainability	9
5. FINANCIAL DETAILS	10
5.1 Scope of financing and subsidy	10
5.2 Cost Economics	11
5.2.1 Cost benefit for farmers ⁶	11
5.2.2 Cost benefit for FPOs	14

LIST OF TABLES

Table 1: Cost-benefits for individual farmers engaged in eucalyptus-based agroforestry (1 ha landholding)	12-13
Table 2: Economic analysis of Eucalyptus agroforestry cultivation in one ha landholding	14
Table 3: Cost-benefits for FPO engaged in aggregation and marketing of Eucalyptus (375 acres)	14-15
Table 4: Working capital loan for FPO	15
Table 5: Capital expenditure loan for FPO	16

LIST OF FIGURES

Figure 1: State-wise agroforestry area (m ha) in India	1
Figure 2: Diagrammatic representation of the proposed business model	7

01

BACKGROUND

Agroforestry in its simplest sense refers to a combination of forestry and agriculture (crops or livestock) resulting in enhanced productivity of land. Agroforestry systems can provide a wide range of economic, socio-cultural, and environmental benefits and are crucial to smallholder farmers – as they have the potential to enhance food supply, income and health¹.

In Indian context agroforestry has a great significance considering the large number of smallholders in the country. 86% of the farmers in India are categorized as small and marginal farmers owing less than 2 ha land while such farmers own merely 47.34% of the total cultivated area in the country². Moreover, a majority of the smallholder farms are rainfed are lowly productive and agroforestry practices help farmers in securing food and economic security.

Agroforestry also provides a wide range of ecological benefits for the farmers as it has the potential of climate moderation, halting land degradation and increasing biomass production³. Studies also reveal that agroforestry systems have the potential to generate employment significant employment opportunities.

Agroforestry in India

As mentioned above agroforestry has tremendous significance for Indian farmers and is being widely practiced across the country. Although the calculation of exact area under agroforestry in the country is a challenging task but as per estimates by Central Agroforestry Research Institute (CAFRI), Jhansi and Bhuwan LISS III the area under agroforestry is 13.75 m ha while according to estimates by the Forest Survey of India (FSI) agroforestry covers as 11.54 m ha, which is 3.39% of the geographical area of the country⁵. These figures indicate that agroforestry is being widely practiced by Indian farmers and is emerging as a viable economic model for the farmers.

In fact, India became the first nation in the world to launch a separate agroforestry policy (National Agroforestry Policy, 2014) which aims at coordination and convergence between various elements of agroforestry, scattered across various existing missions, programme and schemes under different ministries—agriculture, rural development and environment. This opens up huge opportunities for the promotion of agroforestry in the country.

Rapid industrial development, particularly of wood-based industries (paper, plywood etc.) has meant that there is a growing demand for wood. Till a few decades ago the requirement of wood for paper and plywood industries was met from forests but due to promotion of agroforestry majority of this requirement is now being met through farm forestry and agroforestry.

Some agroforestry models have been already developed in the country however there is still a need to mainstream and replicate viable models of agroforestry and popularize their adoption.

¹<http://www.fao.org/forestry/agroforestry/80338/en/>

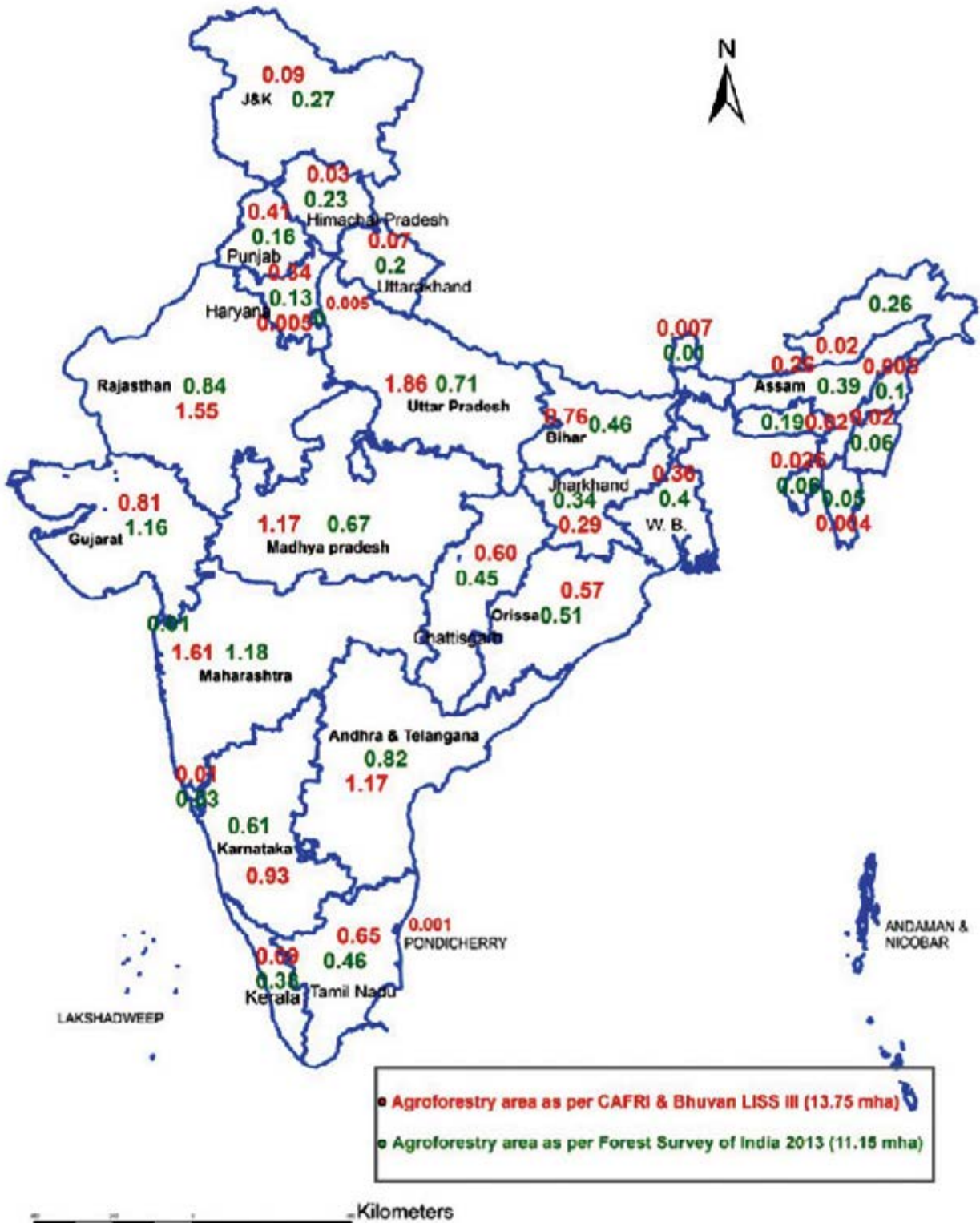
²Agriculture Census 2015-16 (Phase I) Provisional results.

³Agroforestry Annual Report 2013-14. National Research Centre for Agroforestry, Jhansi.

⁴CAFRI, Jhansi and FSI, Dehradun c.f. Ibid

⁵Chavan, S.B., Dhyani, S.K., Handa, A.K., Newaj, R., Rajarajan, K. (2015). National Agroforestry Policy in India: A low hanging fruit. *Current science*. 108. 25-2015.

Figure 1: State-wise agroforestry area (m ha) in India⁴



02

CHALLENGES IN AGROFORESTRY

Agroforestry sector in India is constrained by various factors, which are limiting wide-scale adopting of agroforestry by the small and marginal farmers in particular. The major challenges include:

- **Lack of awareness:** It has been observed that many farmers are reluctant to grow the trees on farm land as they feel that growing trees together with crops would drastically reduce crop production.
- **Lack of technical know-how:** Farmers lack technical inputs about choosing appropriate agroforestry models for their farms – including choice of tree species as well as the choice of intercrop. They also lack technical knowledge regarding post-cultivation techniques related to tree species. In fact, there is also a lack of information with the farmers related to suitable agroforestry models (combination of tree and crop species) based on diverse agro-climatic conditions.
- **Regulation on harvest of trees from farmlands:** Government regulations related to tree felling/harvesting, transportation and marketing limit the wide-scale adoption of agroforestry in the country. For example, in Uttar Pradesh the farmers are free to harvest tree species like Eucalyptus, Poplar and Subabul from farm lands while for certain other species they require permission for harvesting, transporting and marketing. However, majority of farmers do not have clear understanding of regulatory procedures related to tree felling and hence they refrain from cultivation of trees on their farmlands.
- **Poor market linkages:** Marketing linkages for sale of trees by farmers are not well developed and the farmers are exploited by middlemen. In fact, there are frequent fluctuations in the market prices of eucalyptus and poplar and farmers are often not aware of the market scenario.
- **Lack of institutional mechanism:** There is a lack of organisation of farmers and also lack of dedicated institutions such as Producers Groups (PGs), Farmer Interest Groups (FIGs), Farmer Producer Organisations (FPOs), Cooperatives and Farmer Producer Companies (FPCs) etc. in the agroforestry sector. The absence of institutional development results in lack of effective extension, value-chain development, financial support for farmers and transparent market system.
- **Lack of market support mechanism:** Unlike the agriculture sector Minimum Support Price (MSP) system is yet to be introduced in agroforestry sector by the government with the result that farmers are exposed to frequent price fluctuations of wood and also exploited by middlemen.

03

PROJECT IDEA

This business idea aims to promote agroforestry sector by creating an enabling system wherein farmers can obtain quality saplings for plantation, adopt improved Package of Practices (POPs), access financial services, engage in value-addition and leverage their collective strength to negotiate remunerative prices for their produce.

The basic approach is to promote a cluster-based approach wherein farmer groups would be federated in the form of FPO that shall link agroforestry farmers to the mainstream markets. The FPO would also support the farmers in a variety of activities viz. identification of most suitable agroforestry species, providing quality planting material, introducing improved POPs, maintenance of trees, harvesting, grading, transportation and marketing.

3.1 Proposed agroforestry model

The proposed model is based on the cultivation of eucalyptus as the tree species. Based on agro-climatic conditions and preference of farmers several intercrops can be taken up along with eucalyptus. These include wheat, paddy, sugarcane, chickpea, black gram and maize.

However, under the present model the cultivation of eucalyptus with paddy as the intercrop is being prescribed. Detailed cost estimates of this agroforestry model are being discussed in the subsequent sections of this report.

3.2 Intervention Strategies

It is being proposed that the interventions in agroforestry sector must be taken up on at least 375 ha of land spread over a period of 5 years. This would form an agroforestry cluster wherein targeted farmers would be organised into Farmer Interest Groups (FIGs) while at the cluster level FPO would be formed.

The Proposed model would operate under the premise that small farmers have limited investment capacities are they find it difficult to invest in agroforestry. It is in this light that innovative interventions by the FPO are proposed wherein the FPO would invest in tree plantations on farmers' lands also which would include providing quality planting materials as well as bearing the cost of plantation and maintenance.

The FPO would also arrange for harvest and sale of trees upon maturity. The uniqueness of this model is that the farmer would not have to make any investment on tree cultivation and hence this model is most suited for small and marginal farmers with limited investment and risk-taking capacities.

Meanwhile, for providing support to farmers the NGO/FPO would arrange finance from banks and financial institutions and also avail subsidized inputs under the different ongoing schemes through convergence.

The following would be some salient features of the proposed model:

- **Community mobilization:** Facilitating NGO would help in community mobilization in the form of FIGs and also in formation of FPO. It would also facilitate funding support for FPO to meet start-up costs as well as operational expenses for initial period.
- **Plantation at no cost to farmers:** FPO would provide quality planting materials to farmers (members of FIGs) – preferably clonal saplings procured from vendors. The model would work on the premise that the FPO would provide saplings free of cost to the farmers and also bear the main cost of plantations, including pit digging, land levelling, plantation and related labour cost.

- **Technical guidance and maintenance of plantations:** FPO would also provide technical guidance through deployment of technical experts; watch and ward through watchmen would be other additionalities that would be supported through the FPO. Technical support to the FIGs would also be provided through linkages with premier agroforestry/ forest research and technical institutions.
- **Introduction of POPs:** FPO would also support the farmers in identification of appropriate intercrops, facilitating high yielding varieties of seeds and POPs on agroforestry/ intercropping.
- **Sale of trees to contractors:** Capacities of farmers in grading of mature trees would be built while the FPO would organize the sale of standing trees (grade-wise) by inviting tenders from contractors to harvest and purchase the wood at the farm gate.
- **Coppicing of trees:** Another uniqueness of this model would be that the Eucalyptus trees would be coppiced for two consecutive harvests i.e. after the first harvest the root stock would not be removed and new shoot would be allowed to grow from the root stock. This would be followed for second harvest also and finally after the third harvest the root stock would be removed. This practice would not only reduce the costs but coppicing also ensures that coppiced shoots grow faster.
- **Sharing of revenues:**
The proposed model suggests that FPO would be sharing 40% of sales revenue with FIGs since the initially cost of plantation is to be borne by the FPO and also FPO provides all support/ facilities to the farmers. Profit sharing would be done for first two harvests while the entire revenues of the third harvest would accrue to the concerned farmers.
- **Shareholding of farmers and profit sharing:**
All the members of FIGs would also be included as shareholders of FPO and as part of benefit sharing mechanism FPO profits would be distributed to the members. This would result in additional gains for the farmers.
- **Agreement with farmers:**
The FPO would enter into an MOU between FIGs (on behalf of member farmers) wherein the terms of engagement would be specified - FPO to raise and maintain the plantation for 12-15 years with an undertaking by the FIGs that the farmers would not fell trees and market the wood directly without the consent of both FIGs and FPO. This MOU would also have an undertaking that farmers would share the revenues with FPO.
- **FPO to explore additional business opportunities:**
At a later stage the FPO could explore additional opportunities in the form of purchase of agriculture outputs of farmers and also sale of agri-inputs to the farmers. It may set up primary processing facilities as part of value addition initiative to enhance the prospects of earning higher revenue.

Various agro-forestry practices

1. Eucalyptus and wheat-mustard plus beekeeping
2. Eucalyptus and paddy
3. Eucalyptus and papaya plus beekeeping
4. Eucalyptus and lentils - black gram
5. Popular and wheat-mustard plus beekeeping
6. Popular and paddy
7. Popular and papaya plus beekeeping
8. Popular and lentils-Black gram

3.3 Case Example: IFFDC, Uttar Pradesh

This project idea is based on the model developed by **Indian Farm Forestry Development Cooperative Ltd. (IFFDC)** in several states in India viz. U.P. M.P. Chhattisgarh, Jharkhand, Bihar, Orissa, Haryana, Punjab, Jharkhand, West Bengal, Telangana, Andhra Pradesh, Tamil Nadu, Karnataka and Uttarakhand. IFFDC had initially focussed on land reclamation in eastern UP through plantation and watershed- based approach however, later farm forestry and agroforestry interventions were taken up. This model has been quite successful in terms of increasing the

land productivity and engaging the farmers in agroforestry. The key highlights of the model are as follows:

- (i) IFFDC has successfully established a structured process and institutionalized model in agroforestry sector through farmer managed cooperatives i.e. PFFCs which are conduit of economic and environmental developmental programs in the program areas of IFFDC.
- (ii) The interventions of IFFDC have enhanced green cover in the degraded lands in more than 500 villages. The degraded lands have been improved through the forestry programs in these villages.
- (iii) The integrated approach of IFFDC have successfully addressed issues like illegal tree felling, encroachment, low productivity and market accessibility for the farmers.
- (iv) Possibility created for carbon-credit trading through developing farm forestry and defining the usufruct land rights.
- (v) More than 152 Primary Farm Forestry Cooperative Societies (PFFCS) have been developed and engaged in community forestry. Forestry activities have been carried out in more than 29420 ha land by planting more than 140.86 lakh trees of different species alone in U.P.
- (vi) An area of more than 16974 hectare treated through watershed and forestry in several states.
- (vii) A total of 52.61 lakh plants have been planted in approximately agroforestry in 12435 ha with the engagement of 1702 households.
- (viii) Equal participation of women has been ensured in all PFFCS and allied activities such as training, capacity building, knowledge management, exposures, research and development, varietal trail etc. have been streamlined through PFFCS.
- (ix) PFFCS are instrumental in ensuring the sustainability of all interventions that have been and or are being made by IFFDC. Most of the PFFCs are by and large independent in terms of governance, management and finance however IFFDC provides handholding to PFFCS to a certain extent on need basis only.

3.4 Business model with flow chart representation

Under this model, it is proposed that an established NGO could initially take up community mobilization and organization of farmers in the form of Farmer Interest Groups (FIGs) and later federate/collectivize the FIGs in the form of an FPO.

This model is most suited for small and marginalized farmers who have limited capacities to make investments in tree plantations. As discussed earlier the FPO would bear the cost of plantations and their maintenance on farmers' fields in lieu of 40% of the revenues from sale of trees after 5 years.

This model is based on the premise (already being practiced by IFFC in their project areas) that Eucalyptus is a good coppicer and that it could be coppiced twice i.e. three harvests from the same planting stock. The FPO would share revenues for the first two harvests while the entire revenues from the third harvest would accrue to the farmers.

The FPO would also provide technical backstopping for the farmers for tree cultivation as well as in intercropping. However, intercropping would be done by the farmers themselves and the FPO would neither bear the cost of intercrops nor share any revenues therefrom.

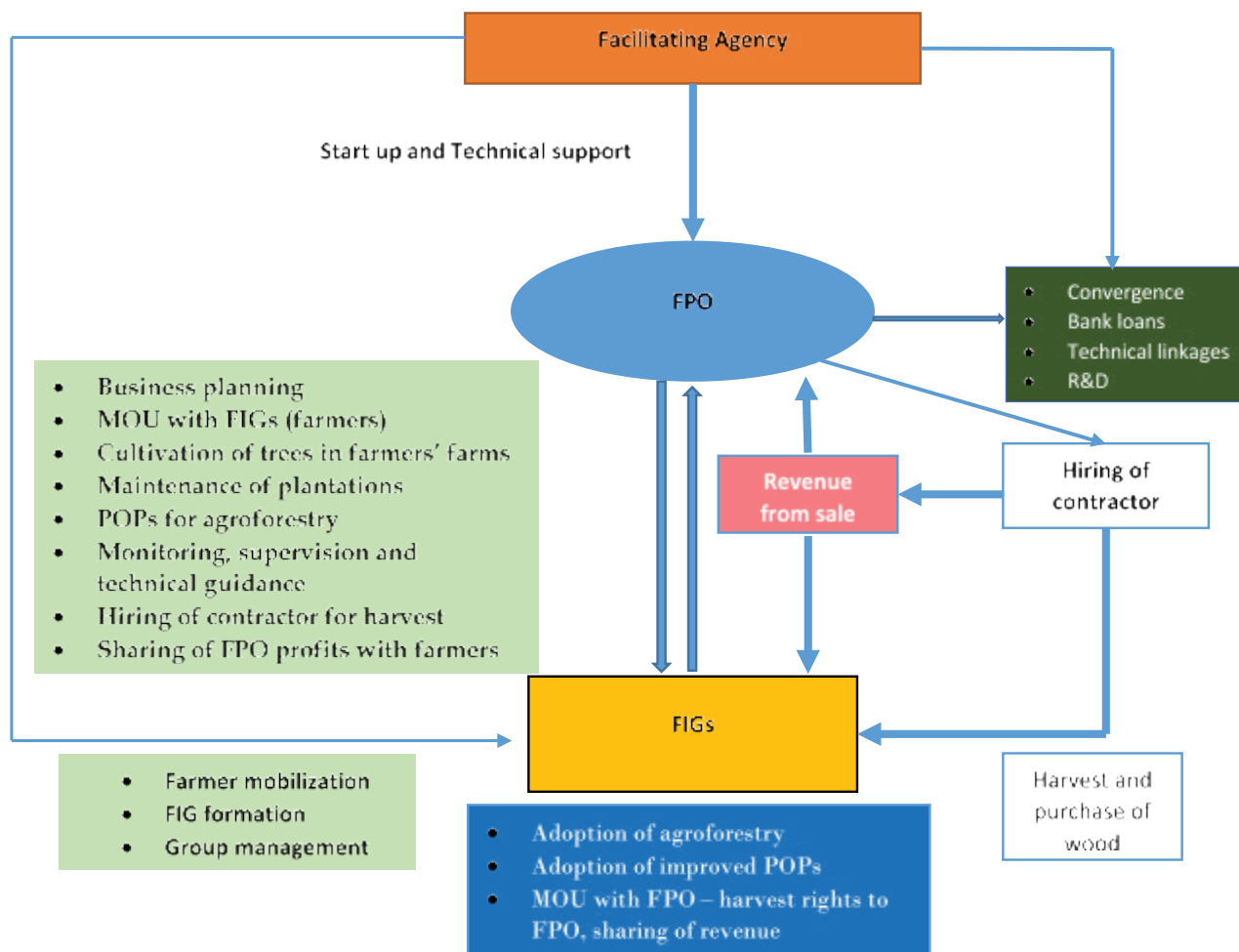
From economic perspective, this model assumes that the FPO would assist in Eucalyptus plantations on 75 ha each year for the first 5 years and from the fifth year onwards the FPO would start generating revenues from sale of trees. The trees would be sold to contractors – selected after following due diligence – who would harvest and transport the trees from farmers' fields with no extra cost of harvesting/transportation to either the farmers or the FPO.

However, in order to meet the costs of plantations and operation for the first 4 to 5 years the FPO would require working capital. It is recommended that the FPO could obtain loan (along with grant/subsidy - if applicable) - from NABARD or commercial banks –for establishing enabling infrastructure and meeting its operational cost.

Under this model, the farmers are not expected to require any loan as it is assumed that they would be able to meet the cost of cultivation of paddy through their own means.

The following flow chart represents the role of various institutions within the business model and also depicts the flow of inputs and outputs:

Figure 2: Diagrammatic representation of the proposed business model



04

IMPACTS AND SUSTAINABILITY

4.1 Impacts – Social, Economic and Environment

It is expected that this model of agroforestry will bring significant social, economic and ecological impacts which are explained below:

Social Impacts

- Vibrant economic institutions developed in the form of FIGs in the villages to address issues that relate to the economic, social and environmental well-being of the habitants.
- Awareness, education and skill development of the farmers in agroforestry.
- Enhanced leadership among the small and marginalized farmers due to their role in business decision making, management of production, infrastructure and supply chain.
- Agroforestry is expected to generate additional employment opportunities (nurseries raising, sale of plants, harvesting, and transportation of wood and managing procurement depots) at the local level.

Economic Impacts

- Agroforestry is expected to enhance the income levels of farmers while also increasing employment opportunities for marginal and small farmers and landless.
- Reducing economic exploitation of farmers by middlemen and integrating them with the markets through FPO. This will make them free from the exploitative intermediary-based marketing system.
- Linking farmers to financial institutions for improving their access to credit while also increasing their propensity to engage in savings.
- Increase in productivity of soil thereby resulting in higher yields from intercroops.

Environmental Impacts

- Raising of trees in farmlands would lead to increase in green cover and thereby contributing in carbon sequestration and climate change mitigation.
- Increasing availability of fuelwood at the farms and thereby reducing pressure on forests
- Improving soil health at the farms through nutrient cycling and reducing soil erosion.
- Fulfilling industrial demand (paper mills, match stick manufacturing units etc.) through trees grown on farm lands and thereby conserving natural forests.

4.2 Climate change resilience

Agroforestry has the potential to become an important tool to build resilience of farmers against threats of climate change and natural calamities. Agroforestry also has the potential to enhance ecosystem services through carbon storage, prevention of deforestation, biodiversity conservation, and soil and water conservation. In addition, when strategically applied on a large scale, with appropriate mix of species, agroforestry enables agricultural land to withstand extreme weather events, such as floods and droughts, and climate change.

4.3 Sustainability

The proposed model is based on the experience gained in Eastern Uttar Pradesh in the program areas of IFFDC. This model has been designed in a manner that it should suit small and marginal farmers and would ensure higher economic gains for them.

The major factors that are expected to contribute towards sustaining this model are:

- Facilitating agency would provide initial facilitation, startup and handholding support - helping in mobilization of farmers and in the institutionalization of FPO.
- Adequate capacities of FIGs and FPOs would be built related to governance, business planning and financial management including DRR in agro-forestry sector.
- Linkage development with technical institutions, research and development institutions, private agencies and banks, financial institutions.
- Convergence with government schemes and extension of insurance services.
- FPO would bear the entire cost of tree plantation and its management with farmer not being burdened to make any investment of the same.
- The farmer would be able to generate a regular income for 4 years through cultivation of paddy and subsequently would get revenues through sale of trees.
- After first harvest of trees the farmers of the FPO do not need to make any additional investments in tree plantation as coppicing techniques would be used for two consecutive harvests and existing root stock would be used to raise the plantations.
- Farmers or FPO do not need to make any investment for harvest or transportation of trees as the FPO would hire a contractor who would be responsible for harvesting and transportation of trees.
- The economics of this model indicate moderate to high returns for the farmers and FPO.

FINANCIAL DETAILS

5.1 Scope of financing and subsidy

Under this model the FPO would require loan for meeting cost of plantations in farmers' fields (75 ha per year for 5 years) as well as to meet its operational costs. It is estimated that the FPO would require working capital assistance to the tune of INR 403 lakhs spread over a period of 5 years. Working capital requirement would be met primarily through loan from NABARD and other banks.

The facilitating agency/ FPOs may also look at the following schemes in order to meet part of the cost of cultivation of trees on farmers fields:

- **Sub-Mission on Agroforestry (SMAF):** After the launch of Agroforestry Policy 2014 Govt. of India has formulated a sub-mission to promote agroforestry in the country. Under this sub-mission the following provision have been made:
- **Nursery Development for quality planting material (NDQPM):** Small nursery (minimum capacity 25,000 plants per annum), big nursery (minimum capacity of 50,000 plants per annum) and high-tech nursery (minimum capacity of 100,000 plants per annum) assistance would be available up to 50% of the total cost of the project subject to a ceiling of INR 10 lakhs, INR 16 lakhs and INR 40 lakhs respectively.
- **Peripheral and Boundary Plantation (PBP) and low-density Plantations on farmlands-** Financial assistance will be provided upto a maximum of Rs. 70 per plant and will be distributed over a period of four years in a proportion of 40:20:20:20.
- **High Density Block Plantation (HDBP):** Assistance would be based on the number of trees planted per ha. For 500 to 1000 trees it would be a maximum of INR 30000; for 1000 to 1200 trees INR 35000; 1200 to 1500 trees INR 4500 and for more than 1500 trees INR 50000. For sustaining the plantation activities, the assistance would be spread across four years in the proportion of 40:20:20:20.
- **Capacity Building & Trainings:** States can utilize up to 5% of the allocated funds for capacity building and training activities.

Note:

- (i) It is to be noted that at least 50% of the allocated budget is to be utilized for small, marginal farmers of which 30% should be women farmers. Further 16% & 8% of the total allocation or in proportion of SC/ ST population in the district will be utilized for Special Component Plan (SCP) and Tribal Sub Plan (TSP) respectively.
- (ii) The SMAF is underway nationwide except in 8 states of NE and Himalayan States. Farmers would be given a financial assistance up to 50% of the actual cost (limited to 50% of the estimated cost as indicated in the Cost norms) for the respective interventions.
- (iii) Farmers groups/ Cooperatives/Farmer Producers Organization (FPO) can also avail the benefit of the programme but the assistance can be accessed as per norms and provisions applicable to the individual farmers.

- **PM Kishan Samman Nidhi Yojana:** This scheme is underway nationwide since its announcement on 1st February 2019. Farmers can avail upto Rs. 6000 in 3 equal tranches to meet out the cost of planting material, inputs and any other cost.
- **Pradhan Mantri Krishi Sinchai Yojana (PMKSY):** Under PMKSY, Financial Assistance of 55% for Small and marginal farmers and 45% for other farmers for adoption of Micro Irrigation system is available. This scheme is available for all crops including horticulture plantation.
- **NABARD Refinance:** In tune with the National priorities, NABARD extends refinance support for promoting wasteland development/ agro-forestry through Eucalyptus cultivation at a concessional rate of interest.
- **MNREGA:** Farmers can meet the plantation cost from MNREGA. The activities such as land leveling, pond digging, nurseries raising can be included under MNREGA.

5.2 Cost Economics

The proposed business model provides estimates of cost-benefits at two levels i.e. at the level of individual farmer and at the level of the FPO engaged in agro-forestry sector-wood sales and marketing.

5.2.1. Cost-benefit for farmers⁶

The following tables provide details of the expected cost of cultivation and the expected revenue for individual farmers engaged in eucalyptus and paddy cultivation on one-ha land.

⁶*It must be mentioned that the costing and yield taken under this model are based on experiences from Raebareilly, U.P. Therefore, the cost-benefit estimates would be valid under similar geographic conditions. However, costing and yield may show slight variations from region to region.*

Table 1: Cost-benefits for individual farmers engaged in eucalyptus-based agroforestry (1 ha landholding)

S.No	Particulars	Unit	Quantity	Unit cost (INR)	Cost to farmer						Cost to FPO	
					Year 1	Year 2	Year 3	Year 4	Year 5	Total Cost	Total	
A.1	Sowing practices											
1	Land preparation (including pit digging)											
1.1	Eucalyptus (pit digging, manure and pesticides etc.)	L/S										12000
1.2	Paddy field preparation cost	L/S	L/S	L/S	5000	5000	5000	5000		20000		
2	Cost of planting material											
2.1	Eucalyptus seedlings (3X2 mts spacing)	Nos.	1600	12								19200
2.2	Cost of raising paddy nursery for 1 Ha.	1										
2.1.1	Paddy seed	Kg	30	25	750	750	750	750		3000		
2.1.2	Fertilizers	Kg	15	30	450	450	450	450		1800		
2.1.3	Bed preparation		Nos.	4	1000	1000	1000	1000	1000			4000
3	Labour cost for plantation											
3.1	Eucalyptus	L/S										5000
	Total (A.1)				13200	12600	10980	9090		45870		36200
A.2	Main field cultivation-Paddy											
4	Cost of Manure, irrigation, fertilizers etc.											
4.1	Manure (Trolley)	Nos	1	3000	3000	2700	2100	1500		9300		
4.2	Irrigation	Nos	12	6000	6000	5400	3780	1890		17070		
4.3	DAP	Kg	100	29	2900	2900	2900	2900		11600		
4.4	Urea	Kg	200	6	1200	1200	1200	1200		4800		
4.5	Herbicides	Pkt	L/S	L/S	500	500	500	500		2000		
5	Weeding and maintenance of crop field	Person Days	5	200	1000	1000	1000	1000		4000		
6	Plant Protection	L/S			2000	1800	1400	980		6180		
7	Watch and ward (Eucalyptus)	L/S										6000
8	Harvesting cost	Ha.										

8.1	Eucalyptus	L/S									
8.2	Paddy (by combine harvesting machine)	Person Days	1	15000	15000	13500	10500	7500		46500	
	Total (A.2)				31600	29000	23380	17470	0	101450	6000
A.3	Post-harvest expenses										
9	Transportation cost										
9.1	Eucalyptus	L/S									
9.2	Paddy	L/S	L/S	L/S	1000	900	700	600		3200	
9.3	Primary processing/ drying										
	Eucalyptus	Ha									
	Paddy	Person Days	7	200	1400	1260	882	441		3983	
	Total A.3				2400	2160	1582	1041	0	7183	0
	Cost of cultivation (A.1+A.2+A.3)				47200	43760	35942	27601	0	154503	42200

Assumptions:

- The cost of plantation and maintenance of Eucalyptus plantations would be borne by the FPO. The estimated costs accruing to the FPO have been indicated in the last column.
- It is assumed that the farmers would not require any capital assistance for meeting the cost of cultivation of paddy.
- The labour costs are included while calculating the above costs but in-case farmer engages in performing various agricultural operations then the cost of labour may be a saving for the farmer.
- Working Capital includes cost of planation of Eucalyptus and its maintenance for 5 years (excluding labour costs) and cost of cultivation of sugarcane for one year.
- Farmers would be able to get four crops of paddy (during the first four years). However, the yield from paddy would decline progressively by around 10% to 20% each year – as the trees gain height and this has been factored in the above calculations.
- It is assumed that a spacing of 3m x 2m would be taken for tree plantations.

Economic analysis

Under the proposed model, farmers are able to get total net returns of around INR 4.20 lakhs over a period of 5 years. Although the returns from Eucalyptus are realized only after 5 years but farmers also get annual returns (for the first 4 years) though sale of Paddy. Benefit Cost ratio (over a 5-year period) for an individual farmer is calculated to be 2.99 which indicates the financial viability of this model.

Table 2: Economic analysis of Eucalyptus agroforestry cultivation in one ha landholding

Particulars	Amount in INR					
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Capital cost		0	0	0		
Recurring cost	47200	43760	35942	27601		
Total cost	47200	43760	35942	27601	0	154503
Total benefits	70000	63000	49000	42000	351000	575000
Net benefits	22800	19240	13058	14399	351000	420497
Net present worth of cost @15%	113584					
Net present worth of benefits @15%	339241					
Benefit Cost Ratio	2.99					

5.2.2 Cost-benefit for FPOs

Details of cost-benefit of FPO engaged in aggregation and marketing of Eucalyptus is provided under the following table:

Table 3: Cost-benefits for FPO engaged in aggregation and marketing of Eucalyptus (375 acres)

S.No	Particulars	Unit	Quantity	Cost (Rs.)	Amount in INR lakhs				
					Year 1	Year 2	Year 3	Year 4	Year 5
A.1	Capital Cost								
1.1	Office	Sq. ft.	200	700	1.40				
1.2	Office equipment (Chairs, table, computer, printer etc.)	Lumpsum	1	75000	0.75	0	0	0	0
	Total capital cost				2.15	0.00	0.00	0.00	0.00
A.2	Recurring cost				0.00	0.00	0.00	0.00	0.00
2.1	Procurement and plantation of Eucalyptus clonal seedlings in farmers' fields (75 ha per year)	Nos	75	36200	27.15	28.51	29.93	31.43	33.00
2.2	Mobilisation of farmers, capacity building in POPs and technical guidance on Eucalyptus and intercropping (per year for 3 years)	Ha.	75	3000	2.25	4.73	7.44	7.81	8.21
2.3	Watch and ward of plantations (5 years)	Ha	75	1200	0.90	1.89	2.98	3.13	3.28

2.4	Staff, administration, travel, coordination, marketing etc.	Month	12	100000	12.00	12.60	13.23	13.89	14.59
2.5	Interest on loan for working capital (12%)	Per annum			5.80	13.93	25.08	39.64	58.49
2.6	Interest on loan for capital cost (12%)	Per annum			0.26	0.29	0.32	0.36	0.00
Total recurring cost					48.36	61.94	78.99	96.26	117.56
Total cost - capital and recurring (A1+A2)					50.51	61.94	78.99	96.26	117.56
B	Income/ Benefits								
B.1	Production								
1.2	Share of sale of eucalyptus trees at farm gate (40%)	MT	9750	1800					176
Net returns					0.00	0.00	0.00	0.00	57.94

Assumptions:

In the above analysis the following assumptions have been made:

- The above analysis assumes that the FPO is promoting agroforestry plantations of Eucalyptus with about 500 to 1000 farmers cultivating an aggregated area of 375 ha over a 5-year period.
- The FPO would engage in mobilisation of farmers and engage in capacity building in POPs, technical guidance and intercropping for Eucalyptus farmers.
- Loan will be obtained for INR 4.03 crores (spread over a period of 5 years) as working capital for meeting plantation and maintenance cost for Eucalyptus plantations as well as for meeting the operational cost of FPO.
- This model assumed that the FPO would get 40% share of revenues from the sale of Eucalyptus trees for the first two harvests.
- A loan of INR 0.02 crores would be obtained for meeting the capital costs.
- An increment of 5% each year for price escalation in costs has been factored in each year.
- The staff of FPO will coordinate the entire business operation while services of experts would be obtained for capacity building.

LOANS

It is envisaged that for this business model the FPO would require a loan of INR 403 lakhs as working capital and a loan of INR 2.15 lakhs for meeting the capital costs.

Working capital loan would be spread across a period of 5 years and repayment is expected to start from the end of 5th year onwards. The working capital loan is expected to be paid over a period of 10 years.

Table 4: Working capital loan for FPO

Working capital loan	INR in Lakhs									
	Y 1	Y 2	Y 3	Y 4	Y 5	Y 6	Y 7	Y 8	Y 9	Y 10
Yearly Working Capital Requirement	48.36	61.94	79.00	96.20	117.45					
Repayment					120.00	120.00	120.00	120.00	120.00	93.85
Interest on net working capital Loan (Diminishing) @ 12% per annum	5.80	13.93	25.08	39.64	58.49	51.11	42.84	33.58	23.21	0.00
Loan outstanding	54.16	130.03	234.11	369.95	425.89	357.00	279.84	193.42	96.63	0.00

The repayment of loan for capital expenditure would be initiated in the fifth year and considering the small amount of loan it would be repaid in a single installment.

Table 5: Capital expenditure loan for FPO

Particulars	Capital expenditure loan					
	Y 1	Y 2	Y 3	Y 4	Y 5	Total
Capital expenditure	2.15					
Repayment					3.38	
Interest on capital loan (Diminishing) @ 12% per annum	0.26	0.29	0.32	0.36	0.00	4962
Total loan outstanding	2.41	2.70	3.02	3.38	0.00	5059



NOTES



A series of horizontal dotted lines spanning the width of the page, intended for writing notes.

Deutsche Gesellschaft für Internationale
Zusammenarbeit (GIZ) GmbH

A2/18 Safdarjung Enclave
New Delhi-110029 India

T: +91-11-494953535
E: nrm@giz.de
www.giz.de/India