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Agroforestry

Extension Framework

Agroforestry
Extension Framework

This publication is part of FAO-NRAA Technical Cooperation Project (TCP) on Support Implementation of National Agroforestry Policy by Enhancing Tree Cover & Production of Wood.

National Project Implementation Team

A. Arunachalam
A.K. Handa
R.P. Dwivedi
Ashok Yadav
Priyanka Singh
Suresh Ramanan S.

Ashok Dalwai
Tomio Shichiri
Konda Chavva
R.B. Sinha
B. Rath
Divya Shah
Athira Sobhana

Consultants:
Atul
V.V. Sadamate
B. Lakshmi

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List of Photo Contributors

Institution	Location
ICAR-CAFRI	Jhansi, Uttar Pradesh
CCSHAU	Hisar, Haryana
FCRI-TNAU	Coimbatore, Tamil Nadu
CSKHPKV	Palampur, Himachal Pradesh

अशोक दलवाई, भा.प्र.से.
मुख्य कार्यकारी अधिकारी
भारत सरकार,
कृषि एवं किसान कल्याण मंत्रालय
कृषि, सहकारिता एवं किसान कल्याण विभाग
राष्ट्रीय वर्षा सिंचित क्षेत्र प्राधिकरण

सत्यमेव जयते

ASHOK DALWAI, IAS
Chief Executive Officer
Government of India,
Ministry of Agriculture and Farmers Welfare
Department of Agriculture, Cooperation & Farmers Welfare
National Rainfed Area Authority (NRAA)

Foreword

Agroforestry as a land-use system has the potential to strengthen the nation's response to the current economic & ecological challenges by producing food, fuel and fibre in an eco-friendly manner, Principally, agroforestry is the deliberate inclusion of woody perennials (including trees, shrubs and bamboo) along with agricultural crops and/ or livestock on the same piece of land. This tree- based food production system is an optimal approach to reaching maximum yields on the principles of resource use efficiency and ecological harmony. It also fits well with the important agenda of Sustainable Development Goals (SDG) 2030, one of which is efficient & sustainable "land-use". Agroforestry plays a substantial role in contributing to at least 12 out of 17 SDGs, realizing which the Government of India formulated the National Agroforestry Policy in 2014, the first of its kind anywhere in the world.

Upgrading of the agroforestry to universal scale warrants participation of various institutions & organizations and, therefore their capacity building assumes importance. Promoting participatory research and identifying drivers of change in different contexts can further accelerate the pace of scale-up. There is also a large potential for innovation in relation to extension services by using social marketing in effecting behavioural changes, and introduction of practices and products, *i.e.* creation of demand to render agroforestry as demand-led initiative.

The now available digital technology could as well be optimally blended with manpower based extension for greater efficiency in delivery of services.

Pursuant to the Union Government's comprehensive policy on agroforestry, several ministries & departments, and their agencies have stepped in with concerted efforts to promote agroforestry as an initiative for negotiating climate-change associated risk alongside reconciliation of economic needs of the farmers & ecological rejuvenation at the ecosystem level.

It is in this context, that National Rainfed Area Authority (NRAA) collaborated with the Food & Agriculture Organization (FAO-India) of the United Nations, ICAR- Central Agroforestry Research Institute (CAFRI), Jhansi, and the Indian Institute of Forest Management (IIFM), Bhopal in planning for and implementing a Technical Cooperation Project (TCP), called "Support implementation of National Agroforestry Policy (NAP) by enhancing tree cover & production of wood".

This TCP broadly addresses two critical issues, inclusive of i) designing and recommending a facilitative extension module; ii) delineation & development of tradable parameters for the selected timber & non-timber species identified in the states of Uttar Pradesh & Karnataka.

The agroforestry extension framework along with a ready reckoner including a training manual & workbook developed by ICAR-CAFRI encompasses a robust approach for adoption of appropriate agro- forestry extension strategies across the country. The extension training module developed covers all the processes involved in agroforestry form end to end – nursery (pre-planting) to planting & production to post-harvest management.

As regards the tradable parameters, the Report developed by IIFM, Bhopal suggests simple to adopt and easy to replicate traits, that are feasible for physical & online trade. This is facilitative of promoting the sustainable & viable use of selected timber& non-timber species in both the states. Further, there exists scope for replication of the same in other states too.

This Study is a unique attempt for promoting the agroforestry based on robust extension & appropriate post-harvest practices. This approach is expected to have a distinctive impact on the understanding and interpretation of agroforestry operations by grass root level functionaries individuals and farmers.

The effort has been cooperative & coordinated, and therefore the outcome is suitably applicable at field level. The results can be expected to generate substantive interest at government level, which envisions to scale up agroforestry as a peoples programme.

I place on record the sincere effort and innovative approach brought to bear upon this unique project.

A Dalwai

(Ashok Dalwai)

Office : NASC Complex, 2nd Floor, Dev Prakash Shastri Marg, Pusa, New Delhi-110 012 Tel.: 011-2584 2836
Office : Room No. 147, Krishi Bhawan, New Delhi-110 001 Tel.: 011-2307 0257
Website: www.nraa.gov.in Email : ashok.dalwai@gov.in Tele/Fax : 011-2338 3830

Message

India being pioneer country to have the National Agroforestry Policy that was rolled out by the Government of India in the year 2014. Ever since, agroforestry is being promoted through a Sub-Mission on Agroforestry in different states of the Indian Union under the National Mission on Sustainable Agriculture being implemented by the Ministry of Agriculture & Farmers' Welfare. The requirement of institutional arrangements for the purpose of agroforestry promotion is felt, although such arrangements in the form of ATMA and KVKs are already in place for the agricultural sector. Nonetheless, agroforestry requires special knowledge base on the woody perennials and the multipurpose tree species that make the system unique and first-of-the-kind integrated farming system in human history.

We do understand that the usefulness of this technical document as ready reckoner will be ultimately decided by the stakeholders. However, the feedback on this effort will help updating the information from an academic perspective. The information on new information, major institutional arrangements and their management practices will further be extended to other help boost agroforestry in different states on a mission mode.

The document has been prepared as a part of Letter of Agreement under the FAO Technical Cooperation Programme (TCP/IND/3710) on "Support Implementation of National Agroforestry Policy by Enhancing Tree Cover & Production of Wood".

- Director, ICAR-CAFRI

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The guidance received from Dr. Ashok Dalwai, CEO, NRAA; Shri Tomio Shichiri, FAO Representative in India; Dr. S.K. Chaudhari, Deputy Director General (NRM), Indian Council of Agricultural Research; Dr. S. Bhaskar, Assistant Director General (AA&CC) and Dr. B.P. Bhatt from NRM Division of ICAR HQ; Shri Illias Animon, Forestry Officer, FAO Regional Office of the Asia Pacific, Shri B. Rath, Technical Expert (WM), NRAA, Ministry of Agriculture & Farmers Welfare; Shri R.B. Sinha, Senior Policy Advisor (Natural Resources), FAO, Dr. Konda Reddy, Assistant FAO Representative in India and Dr. Divya Shah, NRM & Biodiversity specialist, FAO, Ms. Athira Sobhana, Project Associate, FAO, from FAO is thankfully acknowledged. The comments received from experts from FAO, NRAA and independent consulting experts - Prof. Dr. Atul, Dr. V.V. Sadamate and Dr. B. Lakshmi, ASCI, Hyderabad have helped in improving the document. The information available in the public domain of various internet sites, authors, institutions, and publications used in this strategy paper are thankfully acknowledged. In all, I thank all those who directly or indirectly contributed to the implementation of the activities under this Letter of Agreement including the State Forest Departments, State Agricultural Universities and KVKs.

- Director, ICAR-CAFRI

Abbreviations and acronyms

AICRP	All India Coordinated Research Project
ATMA	Agricultural Technology Management Agency
CAU	Central Agricultural University
CCSHAU	Chaudhary Charan Singh Haryana Agricultural University
CIAF	Consortium of Industrial Agroforestry
CSKHPKV	Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya
CSR	Corporate Social Responsibility
DAHD&F	Department of Animal Husbandry, Dairying & Fisheries
DoAC	Department of Agriculture and Cooperation
DU	Deemed University
FAO	Food and Agriculture Organization of the United Nations
FCRI, TNAU	Forest College and Research Institute, Tamil Nadu Agricultural University
FPO	Farmer Producer Organisation
ha	hectare
ICAR	Indian Council of Agricultural Research
ICFRE	Indian Council of Forestry Research and Education
ICT	Information and Communications Technology
KVK	Krishi Vigyan Kendra
MIDH	Mission for Integrated Development of Horticulture
MNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MoEF&CC	Ministry of Environment, Forest and Climate Change
NFSM	National Food Security Mission
NGO	Non-governmental Organisation
NMOOP	National Mission on Oilseeds and Oil Palm
NMSA	National Mission for Sustainable Agriculture
NRAA	National Rainfed Area Authority
NRM	Natural Resource Management
ODOP	One District One Product
PMKSY	Pradhan Mantri Krishi Sinchai Yojana
PRA	Participatory Rural Appraisal
RKVY	Rashtriya Krishi Vikas Yojana
SAU	State Agricultural University
SDC	Skill Development Centre
SFRI	State Forest Research Institute
SMAF	Sub-Mission on Agroforestry
ToF	Trees outside Forests
TTC	Trainers Training Centre
TU	Traditional University
VVK	Van Vigyan Kendra

1. Agroforestry Concepts and Overview

1.1. Agroforestry

Agroforestry, social forestry, community forestry, village forestry and farm forestry are all terms used to describe tree growing that is undertaken mainly outside forest areas (ToF). Agroforestry is a land-use system in which trees or shrubs are grown in association with agricultural crops, pastures, and / or livestock. This integration of trees and shrubs in the land-use system can be either a spatial arrangement, e.g. trees growing in a field at the same time as the crop, or in a time sequence, e.g. shrubs, grasses grown on a fallow for restoration of soil fertility. Sometimes the phrase woody perennials is used instead of trees and shrubs. Of course, woody perennials include all trees and shrubs with a lifespan of more than a year, but they also cover bamboos and palms. The trees in an agroforestry system are not necessarily planted. Instead, natural regeneration of trees may be protected, or mature trees may be deliberately left in the fields or pastures. Hence agroforestry is a much wider concept than tree planting. Agroforestry systems often involve management of trees, crops and shrubs and utilization of their products. The trees and shrubs will have an impact on the other components in the land-use system. Hence, agroforestry systems are normally characterized by ecological and economic interactions between woody perennials and crops and / or livestock.

Most of the agriculture, forestry, and animal husbandry-livestock related service units are working in silos on increasing production and / or increasing tree number or forest cover etc. However, for many small-scale farmers including future farmers (youth), the prime concerns may actually be marketing their produce or products and increasing income. To address these concerns, they require services on farm management, organization and business development, support to reduce costs, increase revenue and link to markets. A pluralistic agroforestry service system that addresses a range of different demands (which exists in agriculture extension system) is needed for agroforestry and the same is proposed in the present agroforestry extension framework. Such a pluralistic system is more likely to be relevant to farmers if providers (agriculture, forest sector, state government, NGOs and other private sector partners) will avoid one-size-fits-all approaches as is briefly proposed under different sections.

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1.2. Potential benefits of agroforestry

The potential benefits of agroforestry include adding to the national supply of timber, essential oils and other tree-based products; diversification and increase of farm incomes; synergistic effects on crop, pasture and animal production; amelioration and containment of land degradation; conservation of biodiversity; and sequestration of greenhouse gases. Such outcomes are likely to be beneficial not only to individual farmers but also to the wider community; for example, by reducing India's reliance on imports and potentially contributing to exports, thus improving our trade balance

Agroforestry supports farmers' livelihoods while reducing pressure on forests. Agroforestry can provide many tree-related ecosystem services such as biodiversity and increased soil fertility and can contribute to water management. It also contributes to reduced erosion, a common environmental problem in various regions, and carbon sequestration thus reducing the net global emissions of greenhouse gases. Agroforestry has a potential to support large parts of the rural population with fuelwood. However, most of these positive effects are dependent on a proper management and use of suitable tree species for the purpose and context ('the right tree for the right place'). If done correctly, agroforestry increases agricultural yields and improves the food and nutrition security of farmers living in poverty, while helping them adapt to more variable and extreme weather. Climate adaptation is particularly important for female farmers as they often have less access to resources compared to their male counterparts. Female farmers produce a major part of the food in many regions but generally do not have the same possibilities as men do to improve their livelihoods. Agroforestry can be a suitable land management system to reduce gender inequalities related to natural resource access, while contributing to increased control of their benefits.

1.3. Multifunctional Agroforestry Systems in India – an overview

Agroforestry systems in India include trees in farms and a variety of local forest management and ethno-forestry practices. India is estimated to have between 14,224 million (Ravindranath and Hall, 1995) and 24,602 million trees outside forests, spread over an equivalent area of 17 million ha supplying 49% of the 201 million tonnes of fuelwood and 48% of the 64 million m3 of timber consumed annually by the country (Chakravarty et al., 2019; Rai and Chakrabarti, 2001). Forest Survey of India earlier has estimated that 2.68 billion trees outside forests exist over an equivalent area of 9.99 million ha. More recent estimates suggest that an equivalent area of 92,769 km2 (i.e., 2.82% of the geographical area) is under tree cover in India (Pandey, 2007; Sahoo and Wani, 2019). The current growing stock has been estimated to be about 1.616 billion cubic metres. For these calculations the tree cover has been defined as tree patches less than 1 ha with the canopy density >10%

In some states where good analyses are now available, the Haryana and Kerala are a case in point. With merely 3.5 percent of Haryana's area under forests, the state has become self-sufficient in small wood, fuelwood, and industrial timber by establishing large-scale plantations on farmlands. Trees in agroecosystems have increased the extent of area under forest and tree cover to 6.63 percent. These plantations sustain about 670 wood-based veneer, plywood and board, manufacturing units, one large paper mill and about 4 300 sawmills that depend on agroforestry produce. Similarly, the case of Kerala suggests that the state has a surplus of 0.027 million m3 of wood in terms of consumption. While the total wood production in the state is 11.714 million m3 , the forests provide only about 10 percent and trees in home gardens and mixed cropping multi-tier agroforestry system contribute to the remaining 90 percent (Sahoo and Wani, 2019, Chakarvarty et. al., 2019).

In India, average sequestration potential in agroforestry has been estimated to be 25tC per ha over 96 million ha24 but there is substantial variation in different regions depending upon the biomass production. However, compared to degraded areas agroforestry may hold more carbon. The role of trees outside forests in carbon balance has been considered only recently, reporting that trees outside forests in India store about 934 Tg C or 4 Mg C ha^{-1}, in addition, to the forests (Murthy et al., 2013).

1.4. Impediments to the Adoption of Agroforestry

The potential benefits from the adoption of agroforestry are both economic and environmental. Nevertheless, the adoption of agroforestry into Indian farming systems has been constrained. In addition to technical impediments, there are impediments associated with economic uncertainties, distorted markets, particular public policies (especially transit) and lack of an agroforestry culture in most rural communities and among some agricultural advisers and forestry professionals. Major socioeconomic factors affecting regional agroforestry development include uncertainty about the economic and environmental viability of agroforestry; uncertainty about the respective roles of growers, industry and government; inadequate understanding of the likely socioeconomic impact of agroforestry upon each region; and lifestyle, life-cycle and socio-demographic factors affecting decision-making at farm level.Complexity of agroforestry; its trialability; degree of congruence with farm and personal objectives; effects on farmers' flexibility; likely economic benefits; implementation cost – capital outlay; implementation cost – intellectual outlay; risk and uncertainty; conflicting information;

perceptions of the environment; physical infrastructure; social infrastructure; farming subcultures and styles of farming are some of the other important factors affecting the adoption of agroforestry at a larger scale.

1.4.1. Agroforestry not promoted as a viable sustainable agricultural system

Though traditional agroforestry is an age-old concept yet the population engaged in agriculture have not included scientific agroforestry in land management strategies, development plans or extension services. The paradigm is instead to separate agriculture for food production, while forestry if focused on timber production and for providing ecosystem services. This paradigm has created numerous barriers preventing a scaling-up of agroforestry.

1.4.2. Few value chains for products and inputs

Barriers are found in the whole value chain, limiting the possibility for farmers to reach markets with their products and preventing companies to engage. Except for a few products, e.g. coffee, cocoa, rubber etc., value chains for nontimber agroforestry products are poorly developed. This is especially true for products from indigenous trees, even if there are exceptions locally. The same goes for inputs used in agroforestry systems such as certified seeds and high-quality seedlings. High quality germplasm for tree species suitable for agroforestry is difficult to get hold of, especially for indigenous tree species, and infrastructure such as nurseries, for large-scale implementation is poorly developed

1.4.3. Disproportionate investments and support

Agroforestry requires an upfront investment in terms of money and time but the return on the investment is longer than for annual crops. Many farmers living in poverty, who could benefit from adopting agroforestry practices, lack buffers and capital to do long-term investments, financial support and their access to credit is in general low. When loans are granted to farmers, they usually have a short payback time and high interest rates making long-term investments less profitable.

1.4.4. Limited incentives to invest in ecosystem services

Some of the positive effects from agroforestry directly benefit the farmer, but some are only seen at a landscape level. This means that the farmer is not provided with incentives for all the goods and services that she or he produces. Some practices could therefore fall victim for the “tragedy of the commons”, i.e. when a common resource is overused because each individual lacks incentives to take part in a collective action to conserve it. Monetary valuation of ecosystem services is one of many ways to address the “tragedy of the commons” for example implementing payment schemes for ecosystem services. However, transaction costs are significant for such schemes and the whole process of its implementation together with small and marginal farmers is very complex.

1.4.5. Poor extension services, knowledge, and linkage

Barriers are also commonly preventing dissemination of knowledge for example limiting extension services and knowledge exchange between farmers. There are barriers that are preventing research from serving the scale-up processes and barriers in institutional environments and policies.

2. Scaling up Agroforestry

For upscaling agroforestry, various concepts of theory need to be transformed into actions that would improve farmers' access to knowledge, services, and infrastructure to increase their production followed by market interventions that would provide better economic incentives, and research frameworks that would improve the scale-up process.

2.1. Agroforestry and Allied Sectors Initiatives

In order to strengthen agroforestry program as a successful joint venture of farmers, following initiatives have already been taken by government, NGOs, industries, financial institutions, social entrepreneurs, societies, community and farmer organizations which will act as a base for scaling up activities:

- National Agroforestry Policy 2014 (GOI, 2014)
- Farm-based production enterprises
- Business incubation ecosystem for Farmers -SEWA Model
- Consortium mode for up scaling agroforestry
- Consortium Mode of Industrial Agroforestry
- Contract farming-Design and Deployment of value chain-based agroforestry
- Small-scale Industry enterprises
- Small and medium forest enterprises
- Social Entrepreneurship in India
- Agroforestry an option for Farmer producer organisations (FPOs)
- FPOs with One District, One Product (ODOP) Partnership
- Sub-Mission on Agroforestry (SMAF)
- Convergence of Government Schemes

For brief of the above given initiatives please refer Annexures. Despite all these initiatives, the potential of agroforestry land use technology has not been harnessed to the maximum for sustainable development goals. Thus, there is an urgent need to investigate the following aspects for upscaling agroforestry in its true perspective.

2.2. Quantification of Ecosystem Services from trees

Increasingly, organisations and institutions are recognising the value of ecosystem services from trees on farms and in agricultural landscapes for food security and to sustain productivity. For smallholder farmers these services can be important for securing livelihood strategies, especially for farmers living in poverty, as trees provide fodder, food, fuelwood, finance and soil fertility. Smallholder farmers with less than 5 ha of land, produce around half of the world's food, but many of them are living in poverty and suffer from food insecurity and malnutrition. Unsustainable land management and climate change is degrading the environments these farmers live in and depend on. As the remaining forests in the world are threatened by a growing demand for food, feed, fibre and fuel, these farmers will face additional challenges, especially in a changing climate.

2.3. Promoting Value Chains for Agroforestry

By linking trees, agriculture and livestock, agroforestry enables farmers to generate a diversified income from the production of a variety of products. These products can be produced from trees, and from countless combinations of trees or shrubs, agricultural crops and often livestock products as part of the agroforestry system. One agroforestry farm can for example produce mango, coffee, timber, honey, grains, vegetables along with fodder for dairy cattle. An important benefit for agroforestry farmers is strengthened economic resilience, as agroforestry offers multiple income streams at different times.

As agroforestry involves various stakeholders and value chains (certified seeds and high-quality germplasm, value addition to various products of different kinds, processing, marketing etc) across both agriculture and forestry sectors, institutional mandates are often unclear and divided between agriculture, forestry, industry and allied ministries. This can lead to poor ownership for support to agroforestry systems. If these barriers are resolved, agroforestry can offer various economic, environmental and social benefits, and empower women and marginalised groups. This calls for more financing to organisations and projects focusing on developing sustainable, equitable and inclusive agroforestry market systems. Supporting farmer organisations can strengthen farmers' economic resilience in various ways; e.g. it strengthens their position in negotiating prices, and enables them to access finance and training, input services and market information. An inclusive market systems approach focuses on connecting farmers to local and regional markets, which have shown to have the highest positive impact. Once the producers/cooperatives can ensure a steady stream of a certain volume of products to for example supermarkets or farmers markets, it can increase the price.

2.4. Innovation in Agroforestry Extension Services

Increasing the agroforestry capacity of different institutions working with extension services should be prioritized to enable further implementation of agroforestry. Promoting participatory research and identifying drivers of change in different contexts can further serve the purpose of a scaling-up process. Exchange and cross-fertilisation between local knowledge and agroforestry research can generate innovations to be disseminated widely, with potential to increase yields and support adaptation of agriculture to a changing climate while preserving the environment and mitigating greenhouse gas emissions.

There is also a large potential for innovation in relation to extension services by using social marketing to change behaviours and to introduce new practices and products, i.e. create demands. New technology could as well partially replace physical extension service delivery. However, it is important that extension services keep working with extension officers, good examples and ambassadors showing the inherent possibilities of agroforestry. This enables horizontal knowledge dissemination between farmers and from farmers to extension programmes. Furthermore, by engaging with stakeholders, programmes can be kept relevant and applicable. Another important aspect of extension services is to acknowledge the role women have in food production and their rights to services. Extension programmes should address and work to erase current gender roles and provide services that are available and apply to women.

3. Developing Agroforestry Extension Advisory Services

In general, models of extension i.e., transfer of technology fall under four main headings: linear 'top-down' transfer of technology; participatory 'bottom-up' approaches (also termed 'group empowerment'); one-to-one advice or information exchange; and formal or structured education and training is an important approach. Attention is required to be given to the effectiveness of various media and methods, including the present and potential use of new information technology, particularly the Internet, as a medium for extension. This is to be followed by an examination of criteria to be used in evaluating extension and advisory strategies for agroforestry. It is found that no one model of extension is adequate by itself and that the strengths and limitations of various approaches should be borne in mind in planning and evaluating extension and advisory programs.

Measuring the success of agroforestry extension programs is problematic because of the long rotation involved in tree growing. For various reasons, the rate of tree planting is, by itself, not an adequate measure of the success of these programs. First, rates of planting are influenced by various factors such as economic incentives, government regulations and infrastructural development, as well as by extension programs. Secondly, unless appropriate location specific and need based species of trees are planted and scientifically managed, the mere planting of trees is of doubtful benefit. Thirdly, unless landholders are aware of the risks as well as the potential benefits of agroforestry, they cannot be said to have made adequately informed decisions. Fourthly, in some particular cases, reliable information may indicate that agroforestry is not the best farm management option. Fifthly, successful management is an on-going process with different sets of decisions to be taken at different stages of the production cycle. Sixthly, agroforesters should take account of emerging scientific findings, technological developments and market trends.

3.1. Strategic objective

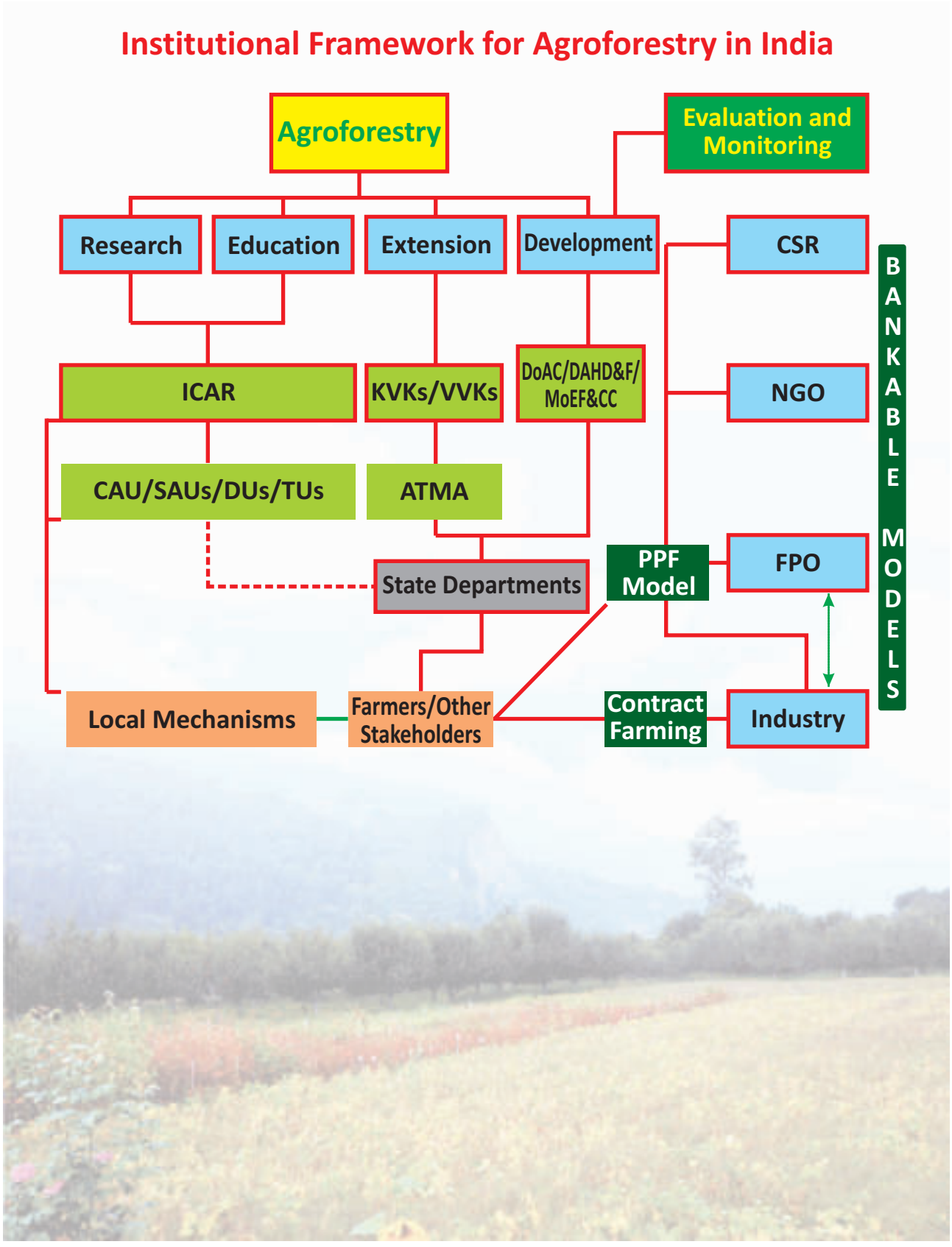
The strategic objective of extension and advisory programs should be to promote the growth of a culture of continuous learning about agroforestry and related issues, so as to facilitate informed decision-making and successful adoption of agroforestry.

3.2. Inbuilt evaluative components

From the outset, extension programs for agroforestry should have in-built evaluative components relating to processes, outputs and outcomes, so as to facilitate on-going improvement. These evaluative components should take into account the various levels of analysis.

3.3. Collaboration between Researchers, Extension agents and Landholders

To facilitate both research and extension, there should be close collaboration between researchers, extension agents and landholders in the design, conduct and application of research on agroforestry. Public sector institutions such as Central and State Government line departments of Agriculture, Forestry, Horticulture, Animal Husbandry, Fisheries, Central and State Agricultural Universities, network of Krishi Vigyan Kendras (KVKs) and Agricultural Technology Management Agencies (ATMAs) are empowering farmers in different sectors and by adding agroforestry mandate, they can be facilitated for acting as ambassadors for upscaling of agroforestry extension initiatives.



3.4. A whole-of-Government Approach

To achieve maximum efficiency and effectiveness, a whole-of government approach should be developed in each State for the design and implementation of publicly funded extension programs. This approach should also take account of the capacity of the private sector and non-government organisations such as “Greening India” to provide extension and advisory services.

3.5. Dealing with Diversity

Extension and advisory strategies should take account of the diverse capacities, experiences, resources and needs of landholders and other people who are, or who could become, involved in agroforestry. Extension program planners should specify the categories of people being targeted in each program, and why.

3.6. Factors Influencing Success

Extension strategies for agroforestry should aim to strengthen the capacity of landholders to:

- deal appropriately with risks.
- play an active part in research and development.
- engage in regular exchange of information with fellow tree-growers and experimenters.
- recognise the link between farm forestry and farm viability.
- know the potential of their property thoroughly.
- develop appropriate links with government and/or industry.
- contribute to long-term community benefits.

3.7. Identifying Economic and other Benefits

Case studies providing objective analysis of the economic, environmental and social impact of agroforestry at whole farm level should be used to inform landholders and other stakeholders of its potential benefits. These case studies should include information on outcomes under various scenarios, and on ways of managing risks.

3.8. Best bet' versus 'Diagnosis and Design'

Although a 'best bet' approach can provide one source of information relevant to agroforestry, a 'diagnosis and design' approach is likely to consider a wider array of options. The 'diagnosis and design' approach encourages landholder ownership of decisions and also contributes more effectively to the development of a culture of continuous learning about agroforestry.

3.9. Targeting additional Audiences

Some agroforestry extension programs should be specifically targeted at:

- potential investors, whether institutions, corporations, or individuals.
- agricultural consultants, forestry consultants, and extension agents dealing with other farm enterprises.
- accountants and other financial advisers.
- local governments and other land use planning agencies.
- stock and station or real estate agents.
- tree nursery operators.
- equipment operators and contractors.
- suppliers of other inputs.
- other members of the rural community.

3.10. The Extension and Advisory Spectrum

Extension and advisory strategies should include provision for each of the following, though these may not necessarily all emanate from the one agency:

- information access and technology transfer.
- one-to-one advice or information exchange.
- formal or structured education and training.
- group facilitation and empowerment

3.10.1. Information access and Technology Transfer

Although information relevant to agroforestry is held by various agencies and individuals, this information is not always readily accessible. There are significant gaps in available information and these gaps need to be addressed in research. An 'information rich' environment is preferable to one that is 'information poor', even though the former can sometimes involve problems of information overload or conflicting information. An issue

for agroforestry extension will be to foster a learning environment that helps to impart skills and understanding needed to locate, evaluate, integrate, and apply information from diverse sources.

- Television, radio, and the press should each be used to raise awareness of agroforestry.
- Well prepared publications, some of which are regionally specific, should be used as a cost-effective way of making basic information on agroforestry available to large numbers of people.
- Specialised periodicals such as Agroforestry News to be used for the dissemination of up-to-date information to growers.
- Research findings, government reports, and publications on technical and economic aspects of agroforestry should routinely be made available not only in printed form but also on appropriate World Wide Web sites. There should be hyperlinks to other relevant sites. The use of the Internet to form e-mail newsgroups and other communication networks among agroforesters, extension agents and researchers should also be encouraged.
- Computer based decision support tools relevant to agroforestry should continue to be developed and, as far as possible, made more user-friendly.

3.10.2. One-to-One Advice or Information Exchange

Qualified, independent, one-to-one advisory services on agroforestry should be available. Although some agencies are currently providing personalised services without charge, the trend is toward the provision of one-to-one advice either by private consultants or on a cost recovery / fee for service basis. Nevertheless, because of the public benefits associated with agroforestry, a case can be made for subsidisation of some one-to-one advisory services.

3.10.3. Formal or structured education and training

In addition to events such as field days and Agroforestry Expo, there should be an array of opportunities for formal or structured education and training relevant to agroforestry.

3.10.4. Group facilitation and empowerment

Participatory methodologies involving group facilitation and empowerment should be major elements in publicly funded extension programs for agroforestry.

3.11. Knowledge and Skills required by Extension Agents

In the recruitment and on-going professional development of extension agents, attention should be given to the need for competence in technical and economic aspects of agroforestry and also for skills in communication, teamwork and group facilitation, together with a good understanding of adult learning principles, rural communities, and program planning and evaluation.

3.12. Maintaining Agroforestry Extension and Advisory Programs

Policy makers should consider maintaining or expanding funding for agroforestry extension and advisory programs, in order to achieve the substantial public benefits associated with an increase in well-informed adoption of agroforestry.

4. Improving Agroforestry Extension Program and Processes

4.1. Assessing Target Group Needs

When needs are being determined, it is essential that distinctions are made between needs, wants, and interests. Needs refer to something considered necessary or required to accomplish a purpose. Wants, on the other hand, are considered desirable or useful, but not essential. Interests indicate an individual's concern or curiosity about something. It is not unusual for individuals to confuse needs, wants, and interests. Therefore, extension personnel undertaking efforts to assess target population needs should ensure that they understand the meaning of "needs."

4.2. Participatory Rural Appraisal (PRA)

Rapid rural appraisal refers to the use of several data collection methods to gather practical information on development issues in local communities quickly. These might include interviewing key informants, reviewing secondary data sources, mapping exercises, and conducting semi-structured interviews with groups and individuals.

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4.2.1. Conventional methodologies for learning

Agricultural institutions of all types have long relied on questionnaire surveys and quick rural visits to gather information on rural people and resources. Samples of people selected from a larger population are asked the same set of questions, and so it is assumed that the interviewers do not influence the process. Many informants are selected to account for all variation, and the resulting data are statistically analysed. Such surveys are used at practically all levels, from the large-scale census to small-scale, village-level research; by governments and NGOs; and for planning, research, and extension.

4.2.2. Alternative systems of learning and action

Because of flaws in conventional approaches, there has been a recent rapid expansion in participatory methods and approaches. These began with the development of data-gathering methods which came to be known as rapid rural appraisal. During the late 1980s, this growing experience was supplemented by drawing upon long-established traditions that had put participation, action research, and adult education at the forefront of attempts to emancipate people. The alternative systems of learning and action imply a process of learning leading to action. A more sustainable agroforestry practice, with all its uncertainties and complexities, cannot be envisaged without all actors being involved in continuing processes of learning.

There are many interpretations of the term participation which can be arranged into seven clear types. These range from passive participation, where people are involved merely by being told what is to happen, to self-mobilization, where people take initiatives independent of external institutions. It is clear from this typology that the term participation should not be accepted without the term appropriate qualification. If the objective of development is to achieve sustainable development, then nothing less than functional participation should suffice.

Drawing on these and other suggestions for "goodness" criteria, a set of twelve criteria for establishing trustworthiness have been identified. These criteria can be used to judge information, just as statistical analyses provide the grounds for judgement in positivist or conventional science.

4.2.3. Towards a new professionalism in extension

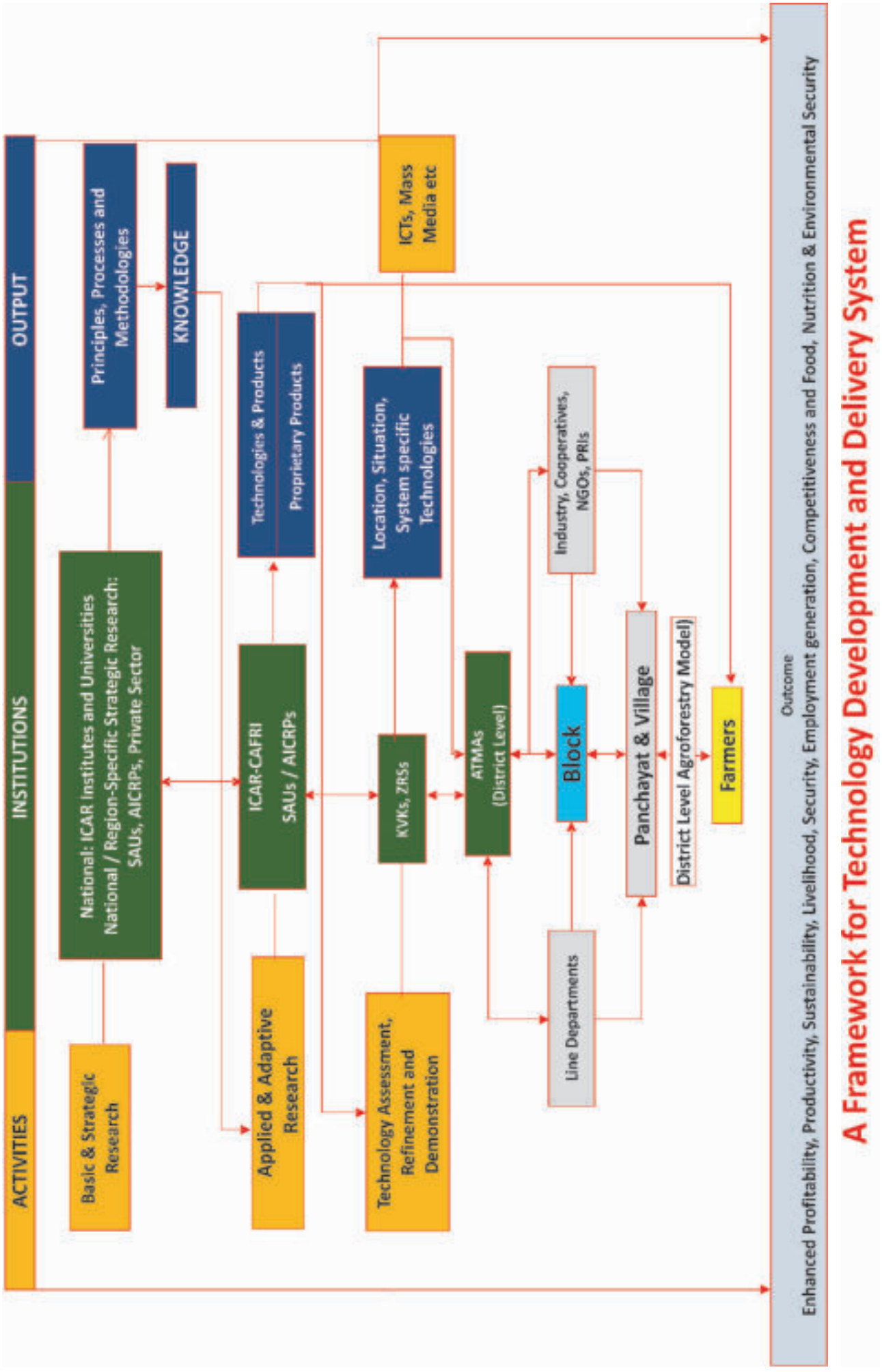
Extension has come to mean extending knowledge from a centre of learning to those presumed to need that knowledge. But this model does not lead to enhanced capacity amongst extensionists and farmers. These participatory methods and approaches represent an opportunity to build better linkages between the various actors and to increase the learning from each other. When PRA and other participatory approaches are used, extensionists and researchers can work together on the same team. They exchange knowledge and experiences and reach some consensus with farmers on what is most needed. As a result, all parties come closer together. Farmers become more confident that professionals can help them, without imposing solutions on them.

4.3. Developing Multi-institutional Extension Agroforestry Network (MEAN) unit

The presence of such a robust agricultural extension system in India can be both a boon and a bane. The existing network has to be leveraged in an appropriate manner in order to achieve the right outputs, and to be considered as a boon. However, the rigidity in adapting to change by the current teams may hinder the growth of the desired objectives. Also, since agroforestry involves various aspects of forestry and the need to partner with multiple institutes and stakeholders in the forestry ecosystem, it is advisable to establish a dedicated national-level programme focused exclusively on agroforestry extension. A dedicated project/program management unit (PMU of MEAN) at central level can function as a facilitator by connecting all the existing stakeholders like SAUs, KVKs, TTCs, SDCc etc. from the agriculture ecosystem and the necessary agencies/institutes from the forestry department like ICFRE, SFRI including relevant state government officials and bureaucrats for the smooth functioning of the extension system. At the national level, ICAR & ICFRE can function as 2 nodal agencies mobilizing the resources from their respective divisions. Officials from both the institutes shall form the central managing team heading the PMU. Various state level agricultural universities shall be reporting to this central team, and piloting the agroforestry mechanisms in coordination with KVKs, TTCs, and other stakeholders. A basic working model for the proposed PMU is given in diagram.

4.3.1. Role of state level institutes

- Identification of the cluster of villages within each piloting state.
- Identify specific agroforestry systems and species for the corresponding districts withing the state
- Study the status, potential & trends in production, processing and marketing of key agroforestry species and identify backward and forward linkages for the produce.
- Identify the extension machinery needs in terms of budget, infrastructure, etc. for the smooth conduct of the extension programs.



A Framework for Technology Development and Delivery System

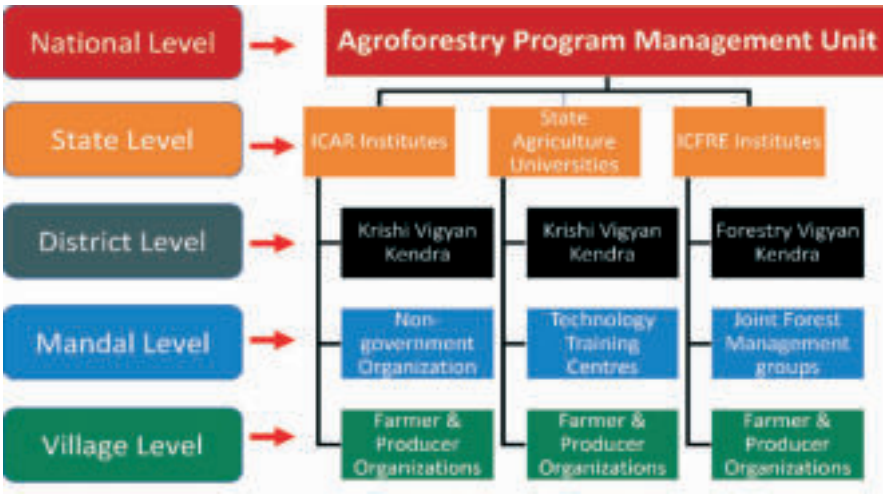
Agroforestry Extension Framework

4.3.2. Role of KVKs, ATMAs, TTCs / Skill Development Centres

- Develop / modify area-specific training modules in coordination with the state level universities.
- Creating awareness about agroforestry practices by conducting workshops and sessions among farmers.
- Liaising with forestry and agricultural department to ensure that the training material is updated with the latest practices.
- TTCs/SDCs would consist of master trainers who would be responsible for the training of the trainers to orient them in the field of agroforestry practices. Village level Mandal Level District Level State Level National Level PMU, ICAR institutes, KVKs, NGOs, Leaders KVK, NGOs, Leaders SAU, TTCs/SDCc Trainers Farmers, SFRI KVKs, NGOs and Farmers
- All these institutions can also help in implementing the market linkages for the produce.

4.3.3. Role of NGOs and other village /farmer bodies

The NGOs partnering in this program will be responsible for the initial mobilisation of local people including the leaders & village heads. Bottom-up approach should be followed to establish a local organisation which can implement the program and also ensuring its continuation after the support ends. The NGOs will also act as a bridge between the PMU team and the local community, facilitating two-way flow of information, which is very essential for the success and effectiveness of extension programs. The institutions will also benefit greatly from the indigenous knowledge (if any), experience and views of the local communities, while seeking solutions which adapt new knowledge and skills to established agroforestry practices.



4.3.4. Single window system Clearence and Certification

Currently, there are regulations imposed by multiple agencies of State governments (Department of Forest, Land, Revenue, etc). on harvesting and transit of tress. Bureaucratic procedures and unpredictable timelines in approvals can prove as a deterrent and discourage the adoption of forestry extension practices by the locals who believe the less they have to deal with officials the better. There is also a need to create a separate central level team focusing exclusively on the regulatory processes with regards to cutting, transporting and selling of agroforestry produce. Provision of a single window application and clearance, automated approval system for certain routes and produce, and 24x7 hotline support are some of the features which can be implemented to encourage the farmers in adopting agroforestry practices.

4.4. Developing and Delivering Extension Programmes

4.4.1. The difficult challenges ahead Extension work

Extension planners throughout the world face the difficult challenges of being creative in their programme development efforts and responsive to the needs of rural communities and farmers. A way to overcome these challenges is to look at different programme development ideas and approaches, analysing how they function in practice, as well as their advantages and disadvantages.

4.4.2. Creating extension program -Making Participation Happen

Creating programmes with the people implies a broad view of people's involvement. Participation should not be seen, as many times in the past, as the occasional presence of rural dwellers in an information meeting, the simple use of public services, the voluntary contribution (with labour, money, etc.) to a project, or as some kind of activity to increase support to pre-planned top-down projects. Participation becomes, then, people's involvement in reflection and action, a process of empowerment and active involvement in decision making throughout a programme, and access and control over resources and institutions.

4.4.3. Facing broader planners' roles and new skills

New roles for extension planners, as well as for programme managers, implementers and evaluators demand knowledge and skills in different areas. If the conventional programme development models stressed technical preparation, particularly in such aspects as designing surveys, analysing and reporting data, or preparing budgets, the emerging models require the same knowledge and skills and demand additional preparation, especially in the political and ethical fields:

4.5. Selecting Appropriate Content and Methods in Programme Delivery

The issue of developing appropriate content is critical to the extension process; the performance of an extension system depends, in large part, on the appropriateness of its message. The more appropriate the message, the better will be the extension-clientele relationship and the more likely extension's programme will be supported.

4.6. Improving WomenFarmers' Access to Extension services

Over the last several decades, considerable effort has been made throughout the world to provide women farmers and women on the farm with efficient, effective, and appropriate technology, training, and information. The positive effects are beginning to show in agricultural production statistics and in indices of family welfare. Yet these successes still fall far short of what is needed at a time when public sector investments in agricultural research and extension are under pressure, when ever-greater demands are being placed on rural women in the face of rapid social transformation, and, in an increasing number of areas, when evidence of environmental degradation is mounting.

4.6.1. The need for gender analysis

The term gender describes the socially determined attributes of men and women, including male and female roles. Gender has proven to be an essential variable for analysing the roles, responsibilities, constraints, opportunities, incentives, costs, and benefits in agroforestry. It is now widely demonstrated that rural women, as well as men, throughout the world are engaged in a range of productive activities essential to household welfare, agricultural productivity, and economic growth. Yet women's substantial contribution continues to be systematically marginalized and undervalued in conventional agricultural and economic analyses and policies, while men's contribution remains the central, often the sole, focus of attention.

Innumerable development projects, government programmes, research studies and theoretical models have demonstrated that the improvement of women's access to agroforestry research and extension services must begin with an analysis of men's and women's participation in the agroforestry production process along with two related dimensions: their role in field and in the household.

4.6.2. Constraints and opportunities: Rural women and extension strategies

The constraints affecting rural women's ability to improve yield, profit, and efficiency in agroforestry include (1) women's legal and cultural status, which affects the degree of control women have over productive resources, inputs such as credit, and the benefits which flow from them; (2) property rights and inheritance laws, which govern access to and use of land and other natural resources; (3) the relationship among ecological factors such as the seasonality of rainfall and availability of fuelwood, economic factors such as product market failures, and gender-determined responsibilities such as feeding the family, which trade off basic household self-provisioning goals and care of the family against production for the market; and (4) the way that agricultural services are staffed, managed, and designed.

4.6.3. Effective extension systems for rural women

It is a mistake to believe that rural women in developing countries do not possess skills and techniques which are an asset to the development process. Where groups already exist, capacity building of existing groups can be more successful than forming a new group to which members are less likely to be committed. Similarly, rural people are less likely to resist adoption of an innovation when the new technique is based upon a concept or procedure they are already familiar with or are currently using.

4.7. Implementing Strategic Extension Campaigns (SEC)

The SEC programme follows a systems approach, which starts with a farmers' Knowledge, Attitude, and Practice (KAP) survey whose results are used as planning inputs and benchmark-baseline for summative evaluation purposes. In addition, a series of practical and participatory approach workshops are conducted to train extension personnel, subject-matter specialists, trainers, and farmer leaders together on the skills of extension programme planning, strategy development, message design and positioning, multimedia materials development, pretesting and production, as well as management planning, implementation, monitoring, and evaluation. One of the strengths of this approach is in orienting and training relevant extension personnel to apply a systematic, rational, and pragmatic approach to planning, implementing, managing, monitoring, and evaluating regular or routine programmes of an agricultural extension service.

4.7.1. Specific Extension Support Materials and Training

Most extension services suffer from the lack of relevant and practical extension and training materials to support the field activities of their extension workers. Many extension workers rely primarily on their interpersonal communication skills, and thus their time during farmers' meetings may not be used as effectively as it should be.

Providing specifically designed and relevant agroforestry training support materials to extension workers will not only facilitate their tasks and reduce their heavy workload. It will also ensure a certain degree of quality control in the delivery of technical information or extension message contents. Experience has also shown that extension workers' motivation, enthusiasm, confidence, and credibility increase when they are given relevant and attractive multi-media support materials which they can use to improve the effectiveness of their extension and training work.

4.8. Evaluating Extension Programmes

Although extension educators, funders, and administrators are in favour of evaluating extension programmes, honesty requires us to admit that most of us are not overly enthusiastic about undertaking it. It is not uncommon to use the occasion of evaluation to mask our insecurity with distrust or criticism of others' intentions, motivations, competency, or adequacy of effort. We are sometimes caught in a bind between our own reluctance to ask ourselves hard evaluation questions and our resentment of outsiders asking questions.

There are at least five major elements in most evaluations:

1. Focus questions,
2. Objects or events to be evaluated,
3. Data or evidence,
4. Analysis and interpretation using judgement perspectives, and
5. Judgements, conclusions, or findings.

Purposes and approaches or models may vary, but these elements will be present in one form or another.

5. Farmer Entrepreneurship

Entrepreneurship, value chains and market linkages are terms that are being used more and more when talking about agriculture and farming. A lot is being said these days about farmers becoming 'entrepreneurs. But what is entrepreneurship? What does it take to be entrepreneurial? How can an entrepreneurial behaviour be created and sustained? How can entrepreneurial skills be developed? How do entrepreneurial farmers respond to the changing farming environment? What strategies do they use? What actions do they take? And how can extension workers help farmers develop entrepreneurial capacity?

There are two parts to entrepreneurship. The first is the managerial skills needed to start and run a profitable farm business. The second is 'entrepreneurial spirit'. Both are important. Managerial skills can be taught, but an entrepreneurial spirit cannot be taught. Many farmers are already excellent managers and many also have some of the spirit of an entrepreneur. As 'price takers' many farmers have developed outstanding abilities to make the most of their resources. But being 'price takers' suggests that these farmers are not innovative, do not take risks, and lack the drive that is usually associated with an entrepreneurial spirit.

5.1. Farmer as Entrepreneur

Many small-scale farmers and extension organisations understand that there is little future for farmers unless they become more entrepreneurial in the way they run their farms. They must increasingly produce for markets and for profits. Becoming more entrepreneurial can be a challenge for small-scale farmers.

Can small-scale farmers become entrepreneurs? Yes. Small-scale farmers all over the world have shown a remarkable ability to adapt. They look for better ways to organise their farms. They try new crops and cultivars, better animals, and alternative technologies to increase productivity, diversify production, reduce risk – and to increase profits. They have become more market oriented and have learned to take calculated risks to open or create new markets for their products. Many small-scale farmers have many of the qualities of an entrepreneur. For small-scale farmers to become entrepreneurs they need all of these qualities and more. They need to be innovative and forward-looking. They need to manage their businesses as long-term ventures with a view to making them sustainable. They need to be able to identify opportunities and seize them.

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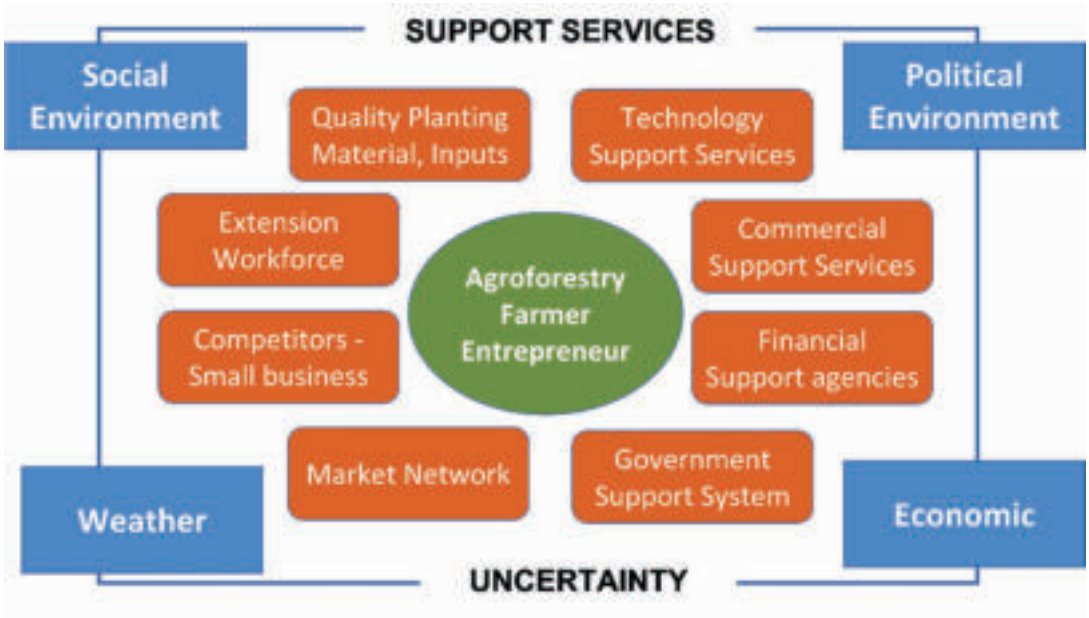
Some small-scale farmers do have these qualities, but they still focus on maintaining their traditional way of life. Their production decisions are based on what they need -- not on what is possible. The farmer-entrepreneur produces a clear picture in his mind of what is possible and the future he wants. He knows that what is possible is determined by the market. The farmer-entrepreneur is always looking for new opportunities. He knows that new opportunities are found in the market. The farmer-entrepreneur wants to make profits. He knows that profits are made in the market. An entrepreneurial farmer has the initiative, drive, capacity and ability to take advantage of opportunities. In spite of all that, they will need help from extension workers and other institutions.

5.2. Entrepreneurial Environment

Being an entrepreneur is a way of life and a way of looking at the world. Entrepreneurs enjoy independence and freedom. They decide for themselves what to do and when to do it. Entrepreneurs also face risks, work under pressure and are immediately accountable for the outcomes – good or bad – of their decisions. While farmer-entrepreneurs are free and independent, they do not work alone. They operate in a complex and dynamic environment. They are part of a larger collection of people including other farmers, suppliers, traders, transporters, and processors, each of whom has a role to play in the value chain.

Agroforestry extension workers will be better able to help farmers develop the skills and spirit of an entrepreneur. Many existing farmers want to make changes to their farming systems by introducing high value enterprises directed to the market. There are also many newcomers (young and old, male, and female) entering farming who are starting with their first farming enterprise. While field level extension workers will rarely be responsible for designing and organizing trainings in entrepreneurship development, it is useful for them to understand what works and what doesn't. Sometimes they may work closely with Subject Matter Specialists who have experience in management training or even in facilitating external trainers.



5.3. Young Farmers as Group Entrepreneurship

Entrepreneurship can also occur among groups of farmers who want to form a business together. These farmers have similar goals and objectives and a willingness to share the benefits and risks. Ownership and control of the enterprise are divided among the group members. The group is the financial investor, employee and risktaker. Group entrepreneurship is particularly attractive among those farmers who would not be able to start an entrepreneurial business on their own. Often these are the poorest farmers in the community or the farmers with the weakest links to the economy. They seek security through group activities which allow them to pool their resources, share the risks and develop a social 'safety net'. To meet the challenges will require developing strong managerial capacity and a system of discipline within the group. When a group is able to apply its rules, even against powerful members of the group, it shows signs of true group entrepreneurship.

Not all farmers can benefit from general programmes designed to develop entrepreneurship. Extension workers need to ask questions to clarify exactly what training the farmers need and what strategy and package of actions will work best. They need to be clear about where the farmers are along the entrepreneurial ladder so they can design programmes that match the farmers' capacity and focus.

Market-oriented farmers selling surplus produce may need help to improve business skills, but at a basic level. This may also need to be accompanied by literacy and numeracy training. Farmers who have made a conscious decision to run their farms as a profit-making business and to invest profits back into the business to generate

long-term growth will benefit from more specialised training in entrepreneurship. Such a training programme focuses entirely on business and entrepreneurial skills.

5.4. Participation of Youth for Agroforestry Upscaling

Young people are key beneficiaries of the 2030 Agenda, but they are also actively engaged in the processes that support the implementation of the Sustainable Development Goals and related targets. The transition from youth to adulthood is seen as transformative, bringing with it expectations of increased economic independence, political involvement and participation in community life. The socioeconomic and political environment in which young people live, however, can have a serious impact on the ability of young people to successfully navigate this transition. The share of youth in the global labour force declined from 21 per cent in 2000 to 15 per cent in 2018 (UN, 2020). Youth labour force participation as a share of the total youth population also fell during this period, dropping from 52.7 per cent (573 million of 1.089 billion) in 2000 to 42.9 per cent (511 million of 1.19 billion) in 2018. There is a need to target this human resource for upscaling agroforestry and developing them as entrepreneurs.

5.5. Social Entrepreneurship in Agroforestry: A self-employment route for Youth

Worldwide, approximately 560 million people live in agroforestry ecosystems with more than 10% tree cover, which equates to 31% of all humans inhabiting farmland (Kumar et., al., 2014). Growing trees on farms has become part of the smallholder's investment strategy in agricultural enterprises along with annual crops. There is a growing interest in and excitement around investing in sustainable agricultural systems, including agroforestry. According to a recent survey by Global Impact Investing Network, 63 percent of impact investors said they were putting their dollars into food and agriculture, and impact investment in the sector has grown at an annual rate of 32.5 percent since 2013 (Mudaliar, Pineiro and Bass, 2016). Indian Agroforestry system is a viable option for doubling the farmer's income and is scientifically proved with the comparative economic viability of poplar-based agroforestry system and rice-wheat cropping system. It showed that agroforestry system is able to enhance farmers' income more than double in seven years and triple, if farmers get value of their carbon sequestered by agroforestry systems.

Social entrepreneurship in agroforestry can generate economic empowerment for youth and social development for the community.By strengthening young people's capabilities, social enterprises can enhance their opportunities to improve their situation while also fostering the long-term development of their communities. Social enterprises can involve youth as employees or target them as beneficiaries. By helping young people acquire skills and channel their frustrations into productive activity, such enterprises support youth empowerment and participation in the economic and social spheres, providing a pathway for young people to contribute to their communities in more general terms. All of this serves to strengthen the social fabric of local communities, which in turn contributes to overall political, social and economic stability.

Some youth connect with social entrepreneurship as beneficiaries, but young people are also able to take the lead in social enterprises that seek to help transform local communities. Typically, young social entrepreneurs follow their personal values and naturally develop business models and funding sources that are aligned with the aim of producing social good. The business ideas they adopt may not appeal to commercial enterprise developers and often do not represent what would traditionally be considered a strong “business case”. Young social entrepreneurs are motivated not by profit but by their desire to engage their communities in developing solutions to real problems and to ensure that others will not face the same challenges. They understand that successful social entrepreneurship is often based on a deep understanding of the local socioeconomic context and accountability to the people living in the community.

5.6. Supporting Youth Access to Networks and Resources

Marginalized groups, including youth, often lack opportunities and the resources they need to build their future. Successful social entrepreneurship in agroforestry can help build the resilience of depleted communities and lower or remove the barriers that prevent marginalized individuals from being active agents of their own development and productive members of the community. Creating a sense of belonging and enhancing self-esteem can be equally important.

Social entrepreneurs typically set up a single enterprise but often become part of a collective effort that brings together youth, opportunities, and resources. To address challenges stemming from the scarcity of resources and the complexity of problems experienced at the last mile, for example, social enterprises can share information and resources and work together in several ways to support each other's efforts. One reason social enterprises need to form tight networks is that other entities engaged in social development may not be willing to partner with working ventures serving stigmatized groups.

5.7. Youth Social Entrepreneurship: Potential and Challenges.

Social entrepreneurship in agroforestry may have great potential to mobilize youth to engage in efforts to achieve major social objectives, including employment creation, poverty reduction, inclusion and integration. Dedicated to serving the common good, social enterprises established by young people can directly contribute to the achievement of a number of Sustainable Development Goals.

What is it that enables youth to succeed or impedes their success as social entrepreneurs? Two key questions are addressed: What activities, settings and conditions (including support structures or the lack thereof) promote or impede the success of youth social entrepreneurship? What do practitioners, researchers and policy experts suggest is most needed in this field?

5.8. The Cooperative Movement

Cooperatives are essentially horizontal, people-centred enterprises driven by the desire for shared prosperity rather than individual profit. Social entrepreneurship is driven by similar values and also employs democratic decision-making. The parallels between social entrepreneurship and the cooperative movement are encouraging, particularly given the success of the latter.

6.9. Leveraging New Technologies for Youth Social Entrepreneurship

The global youth NEET (not in employment, education or training) rate has changed very little over the past 10-15 years. According to the most recent data available, almost 185 million young people -around 30 per cent of young women and 13 per cent of young men, accounting for 22.2 per cent of the total youth population -are not in employment, education or training (UN, 2020). NEET youth, represent enormous untapped potential for economic development and, more specifically for the achievement of the 2030 Agenda.

In this second machine age, new and emerging technologies both drive and reflect the fusion of physical and digital production and consumption. The convergence of advances in Artificial Intelligence (AI), Internet of Thing (IoT), advanced materials, digital platforms, robotics, big data analytics, the Interface of Things, and other such technologies has created a world of new possibilities, and innovators have already tapped into these technologies to develop solutions such as mass customization through 3D printing (additive manufacturing), production-as-a-service through digitization, and new operational frameworks such as the sharing-economy and on-demand-economy business models. Reductions in the costs of computing power, data storage and bandwidth are facilitating this convergence.

Some of the ways these new technologies are changing the face of production and consumption are through the reduced use and optimization of physical products and assets and through the development of non-material solutions. Manufacturers can keep less stock, products use fewer physical inputs and last longer, and the potential exists for resource sharing, regeneration and recovery.

Those whose jobs are at risk may wish to acquire new skills that make them more employable in the age of new technology; however, this may prove difficult in some settings. Even securing basic digital connectivity has been a challenge for individuals and businesses in different parts of the world.

Part of creating an enabling environment is ensuring that mechanisms are in place to prepare individuals to function optimally in the new age of advanced technology. Agroforestry education needs to focus on practical, higher-order and experiential learning. Youth need to learn twenty-first century skills and develop the appropriate competencies. A strong and comprehensive technology education needs to start early and keep up with developments in the digital world.

Innovation and its commercialization are rarely the work of a lone entrepreneur and do not take place in a vacuum; typically, this process involves the efforts of multiple agents that are often clustered in a particular geographic area and are embedded in a support system.

A national innovation system comprises of a set of organizations, systems and incentives that encourage the generation and adaption of technology start-ups. In these institutional support systems, the three key parties are usually the Government, commercial businesses and scientific institutions.

5.10. Tailoring support networks to the needs of Young Social Entrepreneurs

For youth social entrepreneurship to contribute optimally to youth development and the achievement of the 2030 Agenda, youth-friendly support systems and networks are critical. The following recommendations highlight several networking options that can be tailored to the needs of young social entrepreneurs:

- Ensure that business development services provided by the public and private sectors include support tailored to the needs of young social entrepreneurs. In adapting these services, consideration needs to be given to (a) the strengths and weaknesses of youth that may affect or inform their experience as social entrepreneurs and (b) the specific challenges associated with social enterprises and the opportunities they offer to address social needs at the community level.

- Create in-person or online mentoring systems linking young social entrepreneurs with their more established counterparts. The mentoring should be managed so that it is well structured and represents a safe space for young people. This mentoring can involve local, national and international participants as well as participants across various sectors to ensure a broad exchange of ideas and foster innovation.
- Establish peer-support systems, as these allow a broad diffusion of knowledge in informal contexts, which can reduce risks and failures among young entrepreneurs. Social networks are important for a number of reasons but play an especially critical role in reducing the feelings and effects of isolation among young entrepreneurs.
- Encourage both the public and private sectors to open dedicated channels for young social entrepreneurs — either through quotas or by pairing them with well-established enterprises — so that they have access to local, national and/or international markets. Such approaches will help young social entrepreneurs refine and expand their knowledge, skills and networks.
- Encourage incubators and accelerators to offer services adapted to youth social entrepreneurship. Business incubators and accelerators are gaining recognition as effective support mechanisms for young entrepreneurs endeavouring to start and grow their businesses. These structures take a variety of different forms, including physical institutions, virtual platforms, or combinations of the two. Their focus can be sector-specific (such as incubators in the ICT and agribusiness sector) or designed to provide targeted services (including market linkages and access to investors).

5.11. Ensuring access to Financial Services and Products

Obtaining financing is a challenge for virtually all entrepreneurs but is especially problematic for young people pursuing social entrepreneurship. Financial service providers generally identify youth as a high-risk group because the vast majority lack a credit history, an employment record and collateral.

The following actions can greatly improve access of young social entrepreneurs in agroforestry to financial services and products:

- Reform the financial ecosystem
- Employ a holistic approach that combines training and support (such as advisory services) with the provision of financial products.
- Support young people's efforts to build a credit history by offering saving incentives.
- Raise awareness among financial service providers of the need to offer financial products and services tailored to the needs of young entrepreneurs, including young social entrepreneurs.
- Support the development and adoption of innovations that can make financial service provision more inclusive.
- Develop mechanisms to assess financial products and services tailored to young people.
- Ensure that young social entrepreneurs have access to impartial and accurate information on youth-oriented financial services and products available from financial service providers.
- Activate measures that increase youth access to financial products, such as government guarantees for loans from financial service providers and collateral-free loans for pre-approved clients. Modify impact accelerators so that they can better leverage funding to bridge the “valley of death” (the critical period between idea formation and positive revenue growth) for young social entrepreneurs in the field of agroforestry.
- Offer special funding schemes for youth social enterprises that may be perceived as high risk, including those focusing on innovation, new technologies, the green economy, vulnerable groups, and last-mile communities.
- Provide better social protection to young people transitioning to social entrepreneurship, as this can represent a major risk-reduction incentive. Ensure that such protection is gender sensitive.
- Introduce innovations to diversify and expand the range of financial products and services available to young social entrepreneurs.

Thus, it can be safely concluded that to overcome the multiplicity and increasing complexity of problems being faced by the young farmers, we now need 'Farmer First' approach. This can be promoted with twin objectives; on one hand, to better understand the critical agroforestry extension needs of farmers, and on the other to identify options that can address these needs in a manner that would benefit all involved in agroforestry value chain. This all can be best delivered through pluralistic agroforestry extension, i.e., a mix of public-private sector participation.

Annexures: Agroforestry and Allied Sectors Initiatives

In order to strengthen the agroforestry as a successful joint venture of farmers various initiative have been taken by government, NGOs, Industries, Financial institutions, Social entrepreneurs, Societies, Community and farmer organization will act as a base for scaling up activities, the brief is as follows:

National Agroforestry Policy 2014 and impact

The National Agroforestry Policy of India was prepared by interactive consultations with the national and state level institutions, industry, financial institutions, farmer organizations, civil societies and international R&D and financial institutions. After incorporating the suggestions of all these stakeholders and arriving at conflict resolutions, the Government of India put this policy in place in February, 2014. Within a short span, the policy has contributed to the expansion of agroforestry area by more than 140,000 ha, an additional planting of more than 50 million trees, establishment of more than 3000 wood based industries and 368 new nurseries for production of quality planting materials. The Government of India has also been able to provide financial support to the tune of US$ 350 million through two of its major programs (Singha, 2019). These trends are continuing at an accelerated rate

Farm-based Production Enterprises

In recent years, farmers have emerged as major suppliers of wood, especially as the supplies from the state forests have declined due to a greater emphasis on conservation and the imposition of a green felling ban in several states. There are 105.29 million operational holdings in the country. While it is not possible to determine the number of farmers engaged in farm and agroforestry, their involvement is substantial as it is estimated that 50% of India's wood supply is currently coming from non-forest sources (Saigal and Bose, 2003). Farmers mainly grow block or field bund plantations of commercially valuable fast-growing species such as eucalyptus, poplar, acacias, casuarinas, Leucaena, etc. Farmers also produce certain non-wood forest products, including some medicinal plants, though production of non-wood products is still limited compared to wood products such as poles, fuelwood, pulpwood and timber.

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Business Incubation Ecosystem for Farmers -SEWA Model

More than 60 per cent of the farmers in India are small and marginal and the greatest burden is on women. Yet women continue to have limited access to productive resources and services, markets, and marketing facilities in agriculture. The Self-employed Women's Association (SEWA) is a movement of self-employed women in rural and urban India. With more than 40 years' experience, small farmers and forest producers from rural areas have successful in their twin goals of full employment and self-reliance. SEWA is both an organisation and a movement. The SEWA movement is enhanced by its being a sangam or confluence of three movements: the labour movement, the cooperative movement and the women's movement. But it is also a movement of self-employed workers: their own, homegrown movement with women as the leaders.

Consortium mode for Upscaling agroforestry

Forestry and agroforestry policy directives on promotion of agroforestry with increased participation of wood-based industries along with the complete ban on felling in natural forests by the Hon'ble Supreme court of India have ushered in a total mismatch between demand and supply. Considering the growing demand of wood and wood products, Tamil Nadu Agricultural University (TNAU) implemented a 'Value Chain Model' to ensure sustainability in generation of industrial wood and its supply in the state. Later, a “Consortium of Industrial Agroforestry”, CIAF, was established to align with the objectives envisaged in the National Agroforestry Policy of 2014 with a view to address issues related to production, processing and consumption of agroforestry.

Consortium Mode of Industrial Agroforestry

To further strengthen the organizational linkages and to create institutional mechanisms, the research group of TNAU has pioneered in conceptualization and establishment of an exclusive institution called Consortium of Industrial Agroforestry (CIAF) to sustain the organizational structure and resolve the issues from the entire production to consumption system in agroforestry. The consortium is designed on a self-sustainability model and incorporates all supply and value chain players of various wood-based industries in order to strengthen and facilitate organized agroforestry promotion and development (Parthiban et al., 2019).

Contract farming-Design and Deployment of Value Chain-based Agroforestry

Tree Farming Before implementation of the value chain-based agroforestry, the agroforestry supply chain is highly unorganized. The supply chain players, from farmers to industries, existed, although they never interacted, which exhibited a multipartite and highly unorganized supply chain. This was resolved by designing an organized value chain model to replace the multipartite supply chain. Accordingly, a three contract tree farming models were designed and implemented in association with the pulp and paper, energy, match wood, plywood and timber industries.

Small-scale Industry enterprises

The small-scale industry (SSI) sector in India accounts for around 95 per cent of the industrial units (Saigal and Bose, 2003), 40 per cent of the manufacturing sector output, 45-50 per cent of exports (directly and through export houses etc). Forest-based enterprises under the Khadi and Village Industries Commission's purview include 1. Handmade paper, 2. Manufacture of Katha (Katha is used as an ingredient of paan (betel leaf) and paan masala chewing confectionery in India), 3. Manufacture of gums and resins, 4. Manufacture of shellac, 5. Cottage match industry, manufacture of fireworks and agarbattis (incense sticks), 6. Bamboo and cane work, 7. Manufacture of paper cups, plates, bags, and other paper containers, 8. Manufacture of exercise book binding, envelope making, register making, including all other stationery items made out of paper, 9. Khus tattis (grass mats) and broom making, 10. Collection, processing and packing of forest products, 11. Photo framing etc.

Small and Medium Forest Enterprises

Small-scale forestry enterprises (SSFEs)play an important role in the national economy. SSFEs are involved in production of forest products as well as processing a wide range of products. The sector produces a wide range of products such as poles, fuelwood, charcoal, sawn timber, furniture, veneer, plywood, blockboard, fibreboard, particle board, paper, safety matches, sports goods, handicrafts, herbal medicines and other non-timber forest products.

Social Entrepreneurship in India

Post the industrial reforms in 1990s, Indian economy has witnessed loss of large-scale agricultural lands to deforestation. Agriculture provides livelihood to more than 70% of India's rural population and has a large number of social enterprises, with 44% of enterprises launching in the sector in 2010 or 2011-19 (SWISSnex Inda 2015) One-third of agriculture enterprises provide some kind of service to farmers such as teaching organic farming practices including nursery raising and quality planting material production. Agriculture / agroforestry social enterprises can be broadly categorized into: 1 Those supporting the value chain pre-harvest with an objective to increase agroforestry components yield in an economically and environmentally sustainable

manner. 2. Those supporting post-harvest operations with an objective to eliminate supply chain inefficiencies while ensuring economic profits for all value chain actors e.g., Field Fresh Food, Mother Earth and Star Agri are 3 such enterprises operating in the post-harvest space. 3. Those that work with the dairy value chain engaging in dairy farming, fisheries and allied activities.

Agroforestry an Option for Farmer Producer Organisations (FPOs)

In India, 126 million marginal and small farms together operate on 74 million hectares of agricultural land, with 0.58 hectares of average size of holding. Being small entities in terms of landholdings, they face numerous challenges in the form of poor access to markets and finances. It is now realised that some of the constraints related to product and financial markets that marginal and small farmers face can be mitigated by aggregating the farm produce by forming farmers' groups and then linking these groups to an integrated value chain that brings chain actors together. Till date, 7,000 farmer producer organisations (FPOs) have been promoted in the country by various agencies (Financial Express 2020). In fact, the NABARD alone has promoted 4,484 FPOs under its various promotional initiatives. During the Covid-19 crisis, the government of India, through its various ministries, announced various relief measures including “Atmanirbhar Bharat” having medium and long-term solutions. The government launched new features on the e-NAM platform to help farmers sell their produce without physically visiting wholesale mandis during the Covid-19 crisis. These were (1) warehouse-based trading module based on e-NWR, and (2) FPO trading module whereby FPOs can sell their produce at a collection centre without bringing the produce to agricultural produce market committees (APMCs). Further, direct buying facility by bulk buyers outside the mandi premises without any licensing or registration process or as decided by states/Union territories were also allowed.

FPOs with One District, One Product (ODOP) Partnership

Since operational guidelines for promoting 10,000 new FPOs with One District, One Product (ODOP) motto have already been issued, some protocols need to be followed while implementing the scheme and also creating a greater number of sustainable groups. The best part of this scheme is the creation of credit guarantee funds by the NABARD and the NCDC (National Cooperative Development Corporation), besides augmenting the corpus of equity grant fund earlier set up in the SFAC (Small Farmers' Agribusiness Consortium). The scheme also enables states/UTs to avail assistance for FPOs under the Agri-Market Infrastructure Fund (AMIF) for the development of marketing and farm-level value addition infrastructure for FPOs.

Sub-Mission on Agroforestry (SMAF)

SMAF is Under National Mission for Sustainable Agriculture (NMSA). The National Agroforestry Policy in 2014. The policy recommends for setting up of a Mission or Board to address development of agroforestry sector which was implemented in 2016 in an organised manner. The aim of the submission is to expand the tree coverage on farmland in complementary with agricultural crops. The Sub-Mission will have the following five broad components: (i) Nursery Development for quality planting material(NDQPM) (ii) Peripheral and Boundary Plantation (PBP) (iii) Low Density Plantation on Farm Lands(LDPFL) (iv) High Density Block Plantation(HDBP) (v) Demonstration of Agroforestry Models (vi) Capacity Building & Trainings. The State Forest Department, if they are not implementing department, will be actively associated in planning & implementation of the programme. Additional area taken up under plantation would be periodically intimated to State Forest Department to appropriately accommodate in their Wood Development Plan for issue of licenses to processing industries.

Convergence of Government Schemes

Since trees as part of farming system are to be converged with Crops & Cropping system, therefore, to make SMAF a system approach; crop/cropping system/livestock development programmes like NFSM, RKVY, NMOOP, NMSA and various other state funded agriculture, forestry programmes related to crop demonstration etc., to be converged. Oil palm and TBOs are being promoted under NMOOP. Intercropping these oilseed crops with other trees and crops will make it more sustainable. Specific activities like nursery development for quality seeds/planting material, land & water management, reclamation of waste land/problem soils, precision irrigation, value addition and processing, conservation agriculture etc. shall be converged with the ongoing programmes like MIDH, RKVY, MGNREGA, PMKSY, NMSA through a process of resource mapping during planning process.

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For further details :

FAO Representation in India
New Delhi Building, 55 Lodi Estate, Max Muller Marg,
New Delhi 110003, India
Tel : +91-11-24628877
Fax : +91-11-24620115
Email : FAO-IN@fao.org

ICAR-Central Agroforestry Research Institute
Jhansi 284003 (Uttar Pradesh), India
Tel : +91-510-2730214
Fax.: +91-510-2730364
E.mail : director.cafri@icar.gov.in
Website : https://www.cafri.icar.gov.in