

Value chain on industrial agroforestry

in Tamil Nadu for sustaining raw material security and mitigating climate change

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A value chain model on industrial agroforestry has been designed to resolve the issues in the entire production to consumption system in agroforestry through a value added technological, organizational and marketing interventions. This value chain model has increased the productivity and profitability which attracted both farmers and wood based industries towards promoting industry based agroforestry.

Keywords: Agroforestry, Silviculture, Value chain system

FORESTS in India have played a significant role in meeting the domestic and industrial wood requirements before the enactment of Forest Conservation Act (1980) and the National Forest Policy (1988). Owing to policy and legal implications, there has been a paradigm shift in the forest management strategy of the country with more emphasis on conservation oriented management which resulted in restricted supply of wood from natural forests. India being one of the major consumers in the Asia Pacific region, it is estimated that the country would need 152 million m³ of wood in 2020. This demand has been estimated for 12 organized wood based industries and does not include the fuelwood demand of the country which is also on the rise.

In 2010, world's agricultural lands occupied 4,889 Mha, an increase of 7% (311 Mha) since 1970 whereas agricultural land area has decreased by 53 Mha since 2000. Increasing wood demand coupled with changes in land use pattern have necessitated significant interest towards agroforestry, a land use system which is being practiced across the country in various forms since time immemorial.

Though agroforestry is an age old practice as an important form of subsistence farming, in the recent past, it is valued as a commercial and profitable land use system across the world. Approximately, 1.2 billion people (20% of the world's population) depend directly on agroforestry products and services in rural and urban areas of developing countries. Agroforestry systems are superior to other land uses at the global, regional, watershed and farm scales since they optimize tradeoffs between increased food production, poverty alleviation and environmental conservation.

The current area under agroforestry is of the order of 400 Mha, of which 300 Mha are 'arable lands' and 100 Mha are 'forest lands'. It is estimated that an additional 630 Mha of croplands and grasslands could be converted into agroforestry, primarily in the tropics. FAO has also emphasized that agroforestry must be integrated in the Clean Development Mechanism (CDM) to broaden the scope of agroforestry. In India, several traditional agroforestry systems are successfully established with the tree-crop combinations like home garden, Silviculture, Silviculture, Plantation crop based

agroforestry, wind break, shelterbelts, etc., which attest the significance of agroforestry in India.

Recognizing the growing importance of agroforestry, the Indian Government directed the wood based industries to generate their own raw material in the National Forest Policy of 1988. However, policy directives were not taken seriously by many wood based industries barring a few exceptions. Growing demand for wood and wood products and legal issues in wood supply from Government owned natural forests ushered in a total mismatch between demand and supply of wood and wood products.

Under such circumstances, Tamil Nadu Agricultural University (TNAU) conceived and implemented “A Value Chain on Industrial Agroforestry” to create sustainability in raw material generation by involving a wide range of stakeholders. This model of Industrial Agroforestry was implemented between 2008 and 2018 which witnessed successful establishment of over 80,000 ha of organized Industrial Agroforestry plantations. To sustain the positive impacts generated by this value chain model, an institutional mechanism called

“Consortium of Industrial Agroforestry” (CIAF), was established which is first of its kind in the country and addresses the issues related to production, processing and consumption in Agroforestry. Further the institution has been strengthened by establishing India’s First Agroforestry Business Incubator which caters to the need of Business Development in Agroforestry sector. In a holistic perspective, the value chain in Agroforestry is a lucrative model for ensuring raw material security besides acting as an alternate land use system to mitigate climate change and has an excellent replication potential across the tropical countries.

Agroforestry – constraints and interventions

The wood based industries in Tamil Nadu, India have been interacted for ascertaining the existing supply chain system. Based on the interactions and the consultations with the industries, tree growing farmers, non-governmental organization involved in promotion of agroforestry and other stakeholders, Forest College and Research Institute of Tamil Nadu Agricultural University has identified several constraints towards promotion and popularization of agroforestry. These constraints have been grouped into three levels *viz.*, production related constraints, processing associated constraints and the consumption related constraints.

Interventions through value chain approach

The constraints identified in the entire Production to Consumption System (PCS) in Agroforestry have been resolved through strong research and development mechanism coupled with the associated supply chain process. The entire PCS based industrial agroforestry has been value added through innovative technologies resulting in massive industrial agroforestry development in association with several wood based industries. The interventions have been done through technology development, organizational linkage and facilitating market support

system in association with respective wood based industries which are briefed below.

Development of HYSR clones

One of the major breakthroughs in promotion of industrial agroforestry is the development of High Yielding and Short Rotation Clones (HYSR) particularly for pulp, paper, match splint, dendro power and plywood industries. The HYSR clones developed in *Casuarina*, *Melia*, *Kadam*, *Sissoo*, *Eucalyptus*, Mahogany, *Morus*, *Toona* etc. have created significant productivity impact which ranged between 25 m³/ha/annum and 50 m³/ha/annum.

Mini clonal technology

Development of mini clonal technology for most tree crops has ensured availability of quality planting materials in a required quantity and period. This technology has eliminated epigenetic variation, ensured clonal fidelity with improved productivity. Above all, the rapid multiplication process with limited space and period has attracted this technology for adoption by all levels of stakeholders.

Precision silviculture

Replacement of traditional silvicultural systems with precision management practices like optimal spacing, drip fertigation management coupled with systematic tending operations have led to improvement in productivity and wood quality.

Multifunctional agroforestry

Cogeneration of wood and food in the same unit of land is the major success of Industrial Agroforestry in Tamil Nadu, India. Incorporation of HYSR clones with agricultural, horticultural and grass components have ensured sustained income and employment generation activities particularly for small and medium farmers.

Value addition technology

One of the major technological interventions in Industrial agroforestry is the development of value addition process for both forestry and

agricultural residues. It is estimated that 1 ha of Industrial Agroforestry plantations is able to generate 5-10 tonnes of plantation residues which are either unutilized or underutilized. This issue has been resolved through value addition process which led to production of pellets, briquettes, activated charcoal, feed pellets, particle board etc. and extended additional revenue to the farmers and development of new value addition industries.

Mechanization

The entire Production to Consumption System in Agroforestry has been facilitated through suitable mechanization process which resolves the issues of labour crisis, human drudgery, efficiency improvement and the issues related to felling and conversion.

Price supportive system

The most significant attraction of Industrial Agroforestry is extending price supportive system for farm grown trees in association with respective wood based industries. Initially the price supportive mechanism has been extended through pulp and paper industries which attracted promotion of pulp wood based Industrial Agroforestry. The price supportive system coupled with assured buy back has attracted more stakeholders towards tree husbandry. This price and buy back support system has been extended now to timber, veneer and ply wood, dendro power and match splints industries which lead to intensive promotion of Industrial Agroforestry

Insurance mechanism

The agroforestry plantations have witnessed damages due to both biotic and abiotic factors due to the growing climate change associated risks and uncertainties. This has resulted in huge crop and income loss to farmers which have been resolved through implementation of comprehensive tree insurance mechanism for major industrial wood species. The perils included all the damages due to abiotic and abiotic factors and the premium is fixed at the lowest level of 1.25% of the input cost.

Impact of the value chain system

The value chain model conceived and implemented for industrial Agroforestry plantations have made significant impacts which are discussed here.

Area expansion: The interventions made through technological, organizational and marketing system have attracted intensive implementation of Industrial Agroforestry plantations both by the farmers and the wood based Industries. During the last one decade of value chain based Industrial Agroforestry promotion has witnessed establishment of over 80,000 ha of plantations and extended sustainable supply of raw materials to the various wood based industries and translated unutilized fallow land into productive plantations.

Productivity impact: The value chain system has made tremendous impact in the productivity of plantations which has been enhanced from the base line status of 10 m³/ha/annum to the tune of 25-50 m³/ha/annum and ensured doubling the productivity of land use system.

Economic impact: Due to the productivity impact, the income generated from the land use system has been enhanced triple times with a BC ratio of 1:3.5 and above depending on the species deployed and the associated industrial utility.

Increased participation of industries: Initially the value chain model was implemented only with two pulp and paper industries, which has now attracted over 30 wood based

industries which included timber, veneer and plywood, particle board, match splints, dendro power, packing case and several value addition industries which ensured successful adoption of the Agroforestry value chain system.

Environmental impact: The industrial Agroforestry plantations has been analysed for its environmental impacts and it is clearly evident that these plantations have made significant contribution towards carbon sequestration. The C sequestration potential of *Casuarina*, *Eucalyptus*, *Ailanthus*, *Melia*, Kadam etc. have been assessed and it is estimated that on an average 50 mg of Carbon is sequestered from 1 ha of plantation. The entire plantation made through this Industrial Agroforestry plantation has sequestered 4 million mg of carbon which has benefitted the environment and created a clean developmental process. Promotion of dendro biomass based energy generation process also ensured clean and green energy generation.

SUMMARY

The growing demand for wood and wood products and reducing supply from natural forests coupled with unorganised supply chain have demanded sustainability plan to ensure raw material security and to stabilize the ecosystem and the environment. The existing agro and plantation forestry developments have experienced wide range of constraints and problem from the entire value chain to consumption

system. Hence, a value chain model has been designed exclusively for industrial agroforestry and resolved the issues through technological, organisational and marketing interventions. The development and deployment of HYSR clones, precision silviculture and multifunctional agroforestry have increased the productivity and enhanced the profitability which attracted several farmers towards tree husbandry in farmlands. To sustain these value chain systems, an Institution called Consortium of Industrial Agroforestry has been established and linked all stakeholders involved in the entire Production to Consumption System. Similarly, another institution called agroforestry business incubator has been established which caters to the need of skill development and involved in creation of start-ups, entrepreneurs and new industries which ensured sustainable income and employment generation opportunities. This model of Industrial Agroforestry value chain and the associated consortium and incubator development has a very good replication potential across India for productivity and profitability improvement besides acting as an alternate land use system for mitigating the growing concerns on climate change.

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The Council has created the following portals for effective governance by utilizing the information and communication technology.

- ICAR Data Centre and Unified Communication portals to secure institute information and information transmission.
- ICAR-Enterprise resource planning (ERP) System to this manage the human resource in information of the council including pay roll, finance and budgeting.
- KVK Knowledge Network Portal (<http://kvk.icar.gov.in>) to share basic information and facilities of KVKs with contingency plans, demonstration schedule, and advisories.
- Management System for Post-Graduate Education (MSPGE) enabling academic and e-learning modules while also being a repository of academic records
- E-Samvad, an online interface of the Council to answer citizens queries.
- KRISHI – A knowledge repository portal of digital information pertaining to research experiments, outputs, publications, etc.
- E-Krishi Manch, a dedicated portal for farmer-scientist interaction.
- ICAR FFP Portal (<http://ffp.icar.gov.in>) is a platform to interact with all the stakeholders and showcase the outcome of the programme.