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# National Bamboo Roundtable Proceedings

Unlocking India's Bamboo  
Economy



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# Roundtable Context and Objectives

The National Bamboo Roundtable brought together stakeholders across India's bamboo value chain at the Indian School of Business (ISB), Hyderabad. Community Forest Rights (CFR) collectives, industrial buyers, entrepreneurs, policymakers, researchers, and philanthropic organisations convened to address a fundamental paradox: India holds approximately 30% of the world's bamboo resources yet captures less than 4% of the \$71.63 billion global bamboo market.

Operating under the Chatham House Rule, participants engaged in structured dialogue over two days to:

- Map the current landscape of supply capabilities, industrial demand, and the enabling ecosystem.
- Identify high-potential opportunities for collaborative action through suggestive thematic working groups focused on: (1) CFR governance and sustainable harvesting practices; (2) bamboo plantations with smallholder farmers; and (3) creating bamboo clusters for industrial integration. These working groups are open to additional stakeholders and practitioners to join.
- Design actionable pathways addressing specific barriers and opportunities at local and national levels, with interventions mapped across short-term (3-12 months), medium-term (1-3 years), and long-term (3-7 years) horizons.

The vision extended beyond a one-time convening to seeding a Network of Excellence—a collaborative platform connecting institutions, practitioners, and policymakers for sustained engagement in India's bamboo economy.



# Roundtable Discussions

The roundtable discussions unfolded across four thematic sessions over two days, examining critical challenges and opportunities across India's bamboo value chain. The synthesis below captures the key challenges identified, insights that emerged, and collaborative pathways proposed.

## Session 1: Industrial Demand and Market Opportunities

### Challenges

Industrial demand discussions revealed significant barriers preventing bamboo from becoming a reliable industrial feedstock. Despite compelling market opportunities, manufacturers and industrial buyers face persistent challenges in accessing bamboo at the scale, quality, and consistency required for commercial operations.

The fundamental challenge is the absence of systematic species-to-application mapping. Industrial buyers require specific bamboo characteristics—silica content, lignin ratios, and cellulose structure diameter, wall thickness, straightness—for different applications, yet this information is not documented across India's bamboo species. Without this knowledge, buyers cannot specify requirements or assess whether available bamboo meets their needs.

Equipment and technology gaps compound the problem. Domestic machinery manufacturers will not invest in bamboo processing equipment without sufficient market scale, yet industrial buyers cannot scale without proven processing technologies. Most existing bamboo processing equipment is imported from China without performance guarantees, creating technology risks that discourage investment.

Market development has proven equally challenging. Industrial applications of bamboo—biochar for steel, bamboo pellets for power, and feedstock for ethanol—require not only technical validation but also regulatory approvals, quality standards, and buyer confidence. Individual companies struggle to create these market conditions while simultaneously trying to establish commercial operations.

## Insights

A critical distinction emerged between engineered bamboo products and industrial bamboo applications. Engineered products require precise specifications and quality control, whereas industrial applications use bamboo as a bulk feedstock with less demanding specifications but potentially much larger volumes. These pathways require different strategies and infrastructure.

The five-year visibility problem emerged as a fundamental planning challenge unique to bamboo. Unlike annual crops that respond to current market signals, bamboo requires five years to mature. Decisions made today about what to plant, where, and in what quantities will determine supply availability in 2031. Yet there is minimal clarity about future demand by species, geography, and volume. Without forward visibility into demand, it is impossible to make rational cultivation decisions, build supply chain infrastructure, train labour, or establish processing facilities.

China's trajectory offered important lessons: focus on a single species, achieve commercial sustainability in core products before diversifying, and develop quality standards that enable scale. India's fragmented approach across multiple species and applications has prevented the development of depth in any particular domain.

Species-specific versus species-agnostic demand represents another critical distinction. Some applications—cement manufacturing and thermal power generation using bamboo as a direct coal substitute—are species-agnostic and care primarily about calorific value. These represent enormous scale opportunities given India's cement production capacity and thermal power reliance. Other applications require highly species-specific characteristics. Even within a single species, regional variations in silica content have major implications for processing equipment, combustion characteristics, and product quality.

The bamboo economic atlas emerged as an essential planning infrastructure. This is not a simple geographic map but an integrated planning tool answering: Who needs which bamboo? In what quantities? Where should it be grown to optimise productivity and minimise transport costs? What infrastructure connects supply and demand? Currently, this atlas does not exist. Investors and entrepreneurs lack the country-level strategic intelligence needed to assess risks, identify opportunities, and make informed capital allocation decisions.

Compelling market opportunities exist despite current barriers. India's steel sector requires 37 million tonnes annually of imported coal as a reductant. With production projected to double and carbon border taxes emerging, biochar economics are shifting fundamentally. Bio-oil markets are projected to grow from \$6.82 billion to \$200 billion within 10 years. Biochar for electric vehicle (EV) batteries, wood vinegar, green hydrogen, green methanol, and carbon black for rubber, all represent billion-dollar import substitution opportunities.

Two major demand sectors notably absent from current planning are coal substitution for cement and thermal power (species-agnostic, high-volume applications), and textiles as an environmentally superior alternative to cotton and synthetics—requiring less water, minimal fertiliser, no pesticides, and offering superior per-hectare yields. Without systematic demand projections and species mapping for these sectors, coordinated supply development remains impossible.

Value addition potential is substantial—raw bamboo at ₹3,000-3,500 per tonne can yield finished products at ₹3,00,000 per cubic metre. However, realising this requires integrating bamboo processing with existing industrial infrastructure through sustained collaboration between producers, technology providers, and industrial end-users.

# Session 2: Supply Architecture and Technology Development

## Challenges

Supply architecture discussions revealed critical gaps in cultivation practices, aggregation infrastructure, and technology development that prevent bamboo from reaching industrial buyers at the required scale and quality.

Basic cultivation standards are surprisingly absent across India's bamboo-growing regions. Proper 10 to 20-foot spacing between plants, depending upon the species and its final use, is rarely followed, particularly in government-subsidised plantation programmes. Without appropriate spacing, achieving commercial-quality bamboo is impossible. Tissue culture labs can produce millions of saplings annually, but poor planting and care regimes lead to disappointing yields that discourage farmers and waste public resources. The distinction between cultivating bamboo as an agricultural cash crop versus treating it as a forest product requires fundamentally different mindsets, technical support systems, and institutional arrangements.

Supply depletion compounds cultivation challenges. Companies that initially sourced bamboo within a 10–12-kilometre radius now travel 75 kilometres as nearby resources are exhausted. Natural bamboo habitats are harvested without regeneration plans and treated as gifts of nature rather than managed resources requiring systematic silviculture. This depletion pattern is not unique to one region but reflects a nationwide approach where existing stands are mined rather than cultivated.

Aggregation infrastructure remains largely non-existent. There are no bamboo depots where producers can bring material for grading, sorting, and consolidated sales. No cooperatives or Producer Companies operate at sufficient scale to aggregate across multiple villages, negotiate with buyers, provide quality testing, or offer advance payments that would give producers confidence to invest in cultivation. Individual farmers or communities may have harvestable bamboo, but volumes are insufficient to attract industrial buyers requiring consistent supply measured in tonnes rather than kilograms.

Harvesting infrastructure and mechanisation remain underdeveloped. Even basic tasks like cutting bamboo lack appropriate tools—battery-operated saws and other implements have not worked as hoped in field conditions. Harvesting in difficult terrain, particularly in the Northeast's hill forests, creates massive logistical challenges. Treatment plants for bamboo preservation are non-functional in many locations due to a five-hour continuous electricity requirement, though solarisation is being explored as an alternative.

Species-specific knowledge remains fragmented and proprietary. India cultivates multiple bamboo species, but systematic documentation linking species characteristics to optimal applications does not exist. Chemical composition data, including silica content, lignin ratios, and cellulose structure, are not documented, making it impossible for cultivators to make informed species selection decisions or for buyers to specify requirements. Some entrepreneurs have developed deep knowledge of specific *Bambusa* species and vertically integrated supply chains, but this expertise remains proprietary rather than shared as public infrastructure.

The pricing paradox operates from the supply side as well. Farmgate prices barely cover harvesting and transport costs, providing no return on years of cultivation investment. The absence of quality-based price differentiation means that farmers who invest in superior planting material, maintain proper spacing, and harvest at optimal maturity receive the same price per kilogram as those harvesting wild-grown bamboo. This eliminates any economic incentive for quality improvement or intensive cultivation practices.



## Insights

The cooperative model from sugar and dairy sectors offers a proven pathway forward. Cooperatives providing credit, planting material, harvesting services, and transport force private companies to compete and drive up prices paid to farmers. Applied to bamboo, this model requires payment per pole rather than per weight to incentivise quality rather than just volume. Establishing cooperative infrastructure now, while Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) plantations are maturing, is critical. Waiting until harvest creates crisis conditions where farmers must sell immediately to whoever offers any price, perpetuating exploitative pricing.

Cluster-based aggregation combining CFR land and private farmland can achieve the scale needed to attract industrial buyers while maintaining community and smallholder participation. Success stories demonstrate this is possible—sustained stakeholder collaboration in locations like Nandurbar, Maharashtra, enabled bamboo to move legally from communities to buyers, proving that barriers are surmountable through systematic coordination rather than requiring new policies or infrastructure.

Fly-ash land emerged as an unexpected cultivation opportunity. In India, ash ponds associated with coal-based thermal power plants occupy approximately 65,000 acres of land. Research demonstrates that bamboo grows successfully on this degraded land without biodiversity concerns, offering cultivation potential without competing for productive agricultural or forest land. Bamboo silage for livestock fodder creates additional value streams, addressing dairy farming challenges in regions like Chandrapur, Maharashtra, while utilising bamboo by-products.

Technology and innovation needs extend beyond processing to cultivation and ecosystem integration. Examples include WhatsApp-based artificial intelligence (AI) tools that provide location-specific cultivation guidance, processing information, and loan data. Treatment plant solarisation addresses electricity constraints preventing bamboo preservation in remote areas. Machinery requirements vary by terrain—equipment that works in the Northeast does not work in Karnataka, requiring region-specific tool development and adaptation.

Creating public goods infrastructure—species databases, application guides, cultivation protocols, and best practice documentation—would enable broader sector development beyond the current pattern where knowledge remains proprietary to individual successful enterprises. Systematic feedstock assessment characterising chemical composition of priority species would enable appropriate technology selection, yield prediction, and species-to-application matching essential for industrial-scale development.

# Session 3: Governance and Sustainability

## Challenges

Governance discussions revealed that colonial legacy continues shaping forest administration. The Indian Forest Act, 1927, and the Forest (Conservation) Act, 1980, conceptualised forests as government property managed by professionals, repositioning communities from resource managers to rule-followers. This mindset persists despite the evolution of formal law.

The Forest Rights Act, 2006, represented a fundamental shift, recognising community rights to forest resources, including bamboo. However, implementation remains slow, contested, and incomplete. Many eligible communities lack formal recognition. Among titled communities, rights are often specified as user rights without explicitly addressing commercial sale or management authority.

The urgent challenge is transitioning communities from forest users to forest managers. Eighty-six million hectares have CFR potential, with 44 million hectares suitable for bamboo cultivation. However, rights are granted as user rights rather than management rights, leaving communities without clear boundaries, management guidance, or commercial pathways. Even where CFR titles exist, widespread confusion persists about harvest quantities, buyer choice, required approvals, and documentation. Forest officials and community leaders offer conflicting interpretations, leaving buyers unwilling to invest in relationships that may be deemed illegal.

Transit permits emerged as the most immediate regulatory barrier. Even where communities have clear harvest rights and willing buyers exist, bamboo cannot move without permits. Processes vary dramatically across states and districts—efficient in some contexts but opaque and discretionary in others.

Research and development remain academic rather than business-oriented. India has only one operational bamboo-based biorefinery using imported technology, with commercial viability still under evaluation after several years. Technologies developed today will serve the nation for 5–20 years, making it critical to invest in proven, scalable solutions rather than experimental approaches.

Government competition with the private sector emerged as problematic. Government entities sometimes sell products at prices that make private operations unviable. Subsidised processing facilities across India—500 units currently lying idle—were set up by non-entrepreneurs, producing poor quality products that damage the sector's reputation. Government bodies should focus on research, training, and standards rather than participating in commercial markets.

## Insights

Success stories exist where officers took initiative despite systemic constraints—40,000 saplings were planted in Chandrapur, Maharashtra, through Gram Sabha mobilisation. However, these remain exceptions dependent on individuals rather than systematic practices. A four-level problem analysis was proposed: individual mindset, institutional culture, financial mechanisms, and governance structures. The first task is moving beyond the 1927 mindset to recognise forests as production spaces.

Communities need clear boundaries, management guidance, and commercial pathways. Capacity building must address nursery management, species selection, harvesting practices, and regulatory relationships across short-, medium-, and long-term timeframes.

The proposal emerged for a Network of Excellence rather than a Centre of Excellence, connecting institutions for business strategy, technology and innovation, silviculture research, and grassroots CFR implementation. This would enable existing institutions to collaborate without creating new bureaucracy. Research outputs must reach practitioners who can apply them, while researchers must engage with market realities.

High-potential applications requiring immediate research and development (R&D) include bio-carbon for EV batteries, wood vinegar for agriculture and pharmaceuticals, green hydrogen and green methanol for aviation and shipping, and carbon black for rubber, which has a feedstock demand of approximately 1 million tonnes annually. Biochar is now part of circular carbon solutions in Japan and Europe, driven by Extended Producer Responsibility (EPR) policies.

Quality standards and third-party certification were emphasised repeatedly. The Forest Research Institute developed a bamboo treatment methodology in 1954 that is widely used globally but remains underutilised in India. Standards enable contract enforcement, dispute resolution, and consumer confidence that are essential for market development.

Maharashtra's policy requiring 25–50% of government furniture and products procured by the state to be made from bamboo demonstrates the transformative potential of guaranteed markets. National awareness campaigns and the integration of bamboo into environmental science curricula would strengthen cultural alongside physical regeneration.

# Session 4: Collaborative Pathways

## Forward

The final session synthesised insights to identify priority interventions and collaborative opportunities. The Network of Excellence vision emerged as a structural response to coordination gaps. ISB acting as a short-term secretariat, would facilitate working groups focused on specific challenges, with outputs anchored centrally and supported by volunteer expertise.

### Immediate Priorities

Unblocking raw bamboo movement for large-scale industrial applications, including cement, steel, ethanol, and thermal power, emerged as the most urgent priority. Legal frameworks already exist—what is needed is streamlined implementation. Resolving transit permit bottlenecks, clarifying harvest rights under CFR, and establishing legal commerce precedents would unlock billion-tonne-scale supply.

Establishing forward market linkages for MNREGA plantations reaching maturity within 1-2 years represents a time-sensitive opportunity. Pilot cooperative models should test payment per pole, quality-based pricing, and cooperative service provision.

Initiating the bamboo economic atlas would address the planning tool gap by mapping species locations, identifying knowledge gaps, and establishing frameworks for matching resources with industrial demand.

### Suggested Working Groups

Three thematic groups were proposed:

**CFR Governance Best Practices Group** would focus on transitioning communities from forest users to managers, addressing nursery management, species selection, working capital, harvesting practices, and regulatory relationships across timeframes.

**Bamboo Plantation with Smallholder Farmers Group** would develop protocols for variety selection, planting material quality, care regimes, and farmer-to-farmer knowledge sharing.

**Bamboo Clusters Group** would build infrastructure for industrial-scale procurement, including decentralised depots, pre-processing and grading standards, industry clustering, and assured offtake mechanisms.

Working groups would operate with clear timelines: 3–12 months for short-term outputs, 1–3 years for medium-term goals, and 3–7 years for the long-term vision.

### **Medium- and Long-Term Agenda**

Systematic feedstock assessment should begin with priority species, characterising chemical composition to enable technology selection. Policy advocacy should focus on clarifying commercial rights under CFR, standardising transit permits, enabling quality-based pricing through grading standards, and establishing government procurement specifications. Learning exchanges would enable systematic learning from proven models in India as well as from countries such as China, Vietnam, Indonesia, and the Philippines.

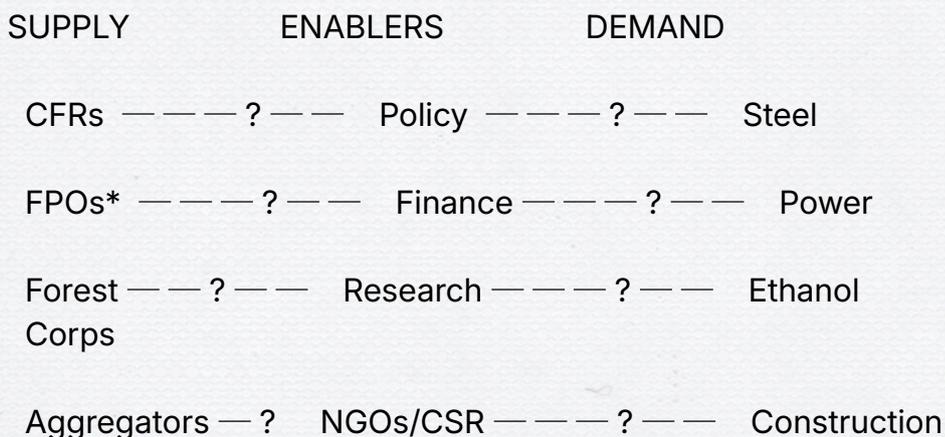
The roundtable concluded with a commitment to reconvene. Participants agreed that India does not lack bamboo, technology, or entrepreneurial talent. What has been missing is a platform for actors to connect, collaborate, and amplify collective impact. The National Bamboo Roundtable represents a pivotal step towards building that platform.

# Appendix

## APPENDIX A: Visualising the Bamboo Economy

### Current Fragmented Reality

CURRENT STATE: Fragmented Coordination



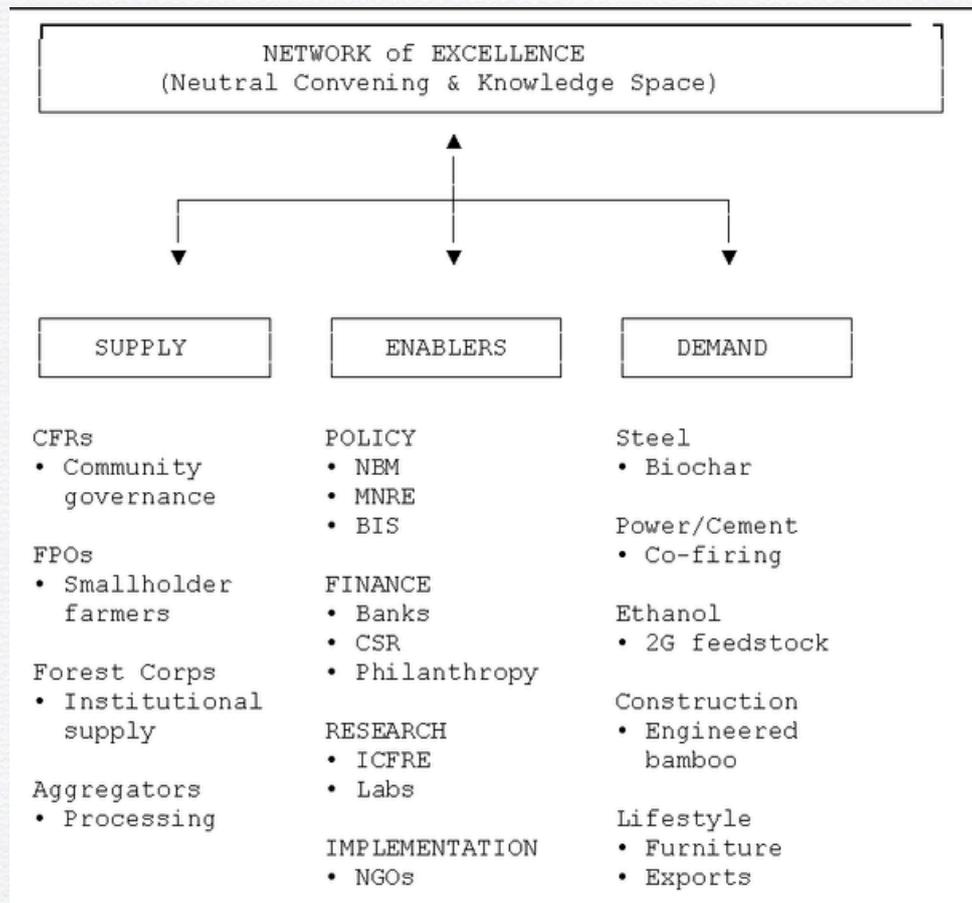
### Key Problems:

- Information gaps (who needs what, and in what quantities?)
- No mapping of bamboo species to specific use cases
- Fragmented or absent quality standards
- High transaction costs across the value chain
- Isolated operations with limited coordination between supply, enablers, and demand

**The Result:** The current ecosystem is characterised by actors operating within their domains without systematic mechanisms for cross-sector engagement. Supply-side organisations have limited visibility into industrial demand specifications. Industrial buyers lack information about which supply clusters can deliver required volumes and quality. Enabling institutions design programmes and policies without comprehensive input from both supply and demand actors. Potential transactions fail to materialise due to information gaps rather than any fundamental economic incompatibility.

FPO - Farmer Producer Organisation, NGO - Non-Governmental Organisation, CSR - Corporate Social Responsibility

## Network of Excellence: Coordinated Ecosystem



The Network positions itself as a neutral platform enabling stakeholders to act more effectively within their own domains. Rather than attempting to execute transactions or implement projects directly, the Network facilitates knowledge exchange, species-to-application mapping, quality standards development, and relationship building that reduce transaction costs and enable collaboration at scale.

## APPENDIX B: Participants

- **Abhishek Sharma**, Professor, Department of Chemical Engineering, BITS Pilani
- **Anil Mutha**, Founder & Chairman, Mutha Industries Pvt. Ltd., Agartala, Tripura
- **Annway Jambhulkar**, CSR Officer, Maharashtra Forest Department
- **Ashwini Chhatre**, Associate Professor and Executive Director of Bharti Institute of Public Policy, Indian School of Business
- **Dhanapal G**, Senior Research Fellow, Indian School of Business
- **Ganesh Verma**, Managing Director, Bhavya Srishti Udyog
- **Harshita Prakash**, Content Developer, Indian School of Business
- **Kalpesh Dhodia**, Head, CIBART Bamboo Project
- **Mridula Tangirala**, Head - Tourism and Non-farm Portfolio, Tata Trusts
- **Nandkumar Verma**, Director General, MGNREGA, Govt of Maharashtra
- **Pramod S Takawale**, Programme Director - Agriculture Research, BAIF Development Research Foundation
- **Ravinderjit Singh**, Head - Rural Upliftment Portfolio, Tata Trusts
- **Sailabala Panda**, Integrator-Lead, Centre of Excellence - Forest, PRADAN
- **Sandip Chowdhury**, National Coordinator, Indian School of Business
- **Sandhya Singh**, Lead - Evidence, Learning and Partnerships, Indian School of Business
- **Sanjeev Karpe**, Director, KONBAC
- **Shramana Ganguly**, Manager, Partnerships, Tata Trusts
- **Shashank Joshi**, CEO & Managing Director, Agrotechners Farmer Producer Company Limited (AFPCL)
- **Tejashwini Yalawar**, Program Manager, SELCO Foundation
- **Vijay Dethé**, Founder, Paryavaran Mitra
- **Vishal H Jadkar**, Coordinator – Community Enterprise, Indian School of Business
- **Yashwini Chandra**, Research and Development, Tata Trusts

# Institution Profiles

## Tata Trusts

One of India's oldest and most respected philanthropic organisations, Tata Trusts brings decades of experience in catalysing systemic change across rural livelihoods, natural resource management, and inclusive development. With a legacy spanning over a century, the Trusts have pioneered interventions in agriculture, water, sanitation, health, education, and rural prosperity, reaching millions across India.

Tata Trusts' approach combines patient capital with strategic partnership-building, enabling innovative solutions that balance economic viability with social and environmental impact. The Trusts have played pivotal roles in establishing multi-stakeholder platforms and convening diverse actors—from government agencies to grassroots communities and private enterprises—around shared development objectives.

As anchor partner for the National Bamboo Roundtable, Tata Trusts provides convening authority and credibility across government, industry, and civil society organisations. The Trusts bring strategic guidance on stakeholder engagement and pathway design, long-term commitment to bamboo sector development beyond immediate projects, and risk capital for innovative coordination models that bridge gaps where traditional funding falls short.

## Bharti Institute of Public Policy, Indian School of Business

ISB is a premier educational institution creating research-based knowledge that influences scholarship, practice, and policy. The Bharti Institute of Public Policy (BIPP), established as a research centre within ISB, focuses on addressing critical policy challenges affecting India's marginalised populations across diverse domains including Agriculture and Food, Environment and Forests, Education, Public Finance, and Digital Governance. BIPP's action research programmes work directly with rural and tribal communities to create evidence-based solutions for sustainable development.

**Initiative on the Forest Economy (IoFE)**, BIPP's flagship programme on forest governance and livelihoods, works to formalise India's forest economy by empowering forest-dependent communities through secure tenure, technology platforms, formal market access, and collaborative governance models. Over nearly a decade, IoFE has operated across Jharkhand, Odisha, Himachal Pradesh, Andhra Pradesh, and Maharashtra, demonstrating that when communities secure land rights under the Forest Rights Act, achieve aggregation through Producer Companies, and access appropriate technology and finance, they generate shared prosperity while protecting biodiversity.

IoFE's work encompasses several dimensions: facilitating the legal recognition of Community Forest Resource Rights across landscapes, supporting communities to organise into formal enterprises capable of commercial operations, developing technology platforms including JharFRA for Community Forest Rights tracking and nCount for forest inventory, establishing partnerships between community enterprises and industrial buyers for sustainable raw material supply, and generating evidence on forest governance models that inform state and national policy.

As roundtable host and secretariat, IoFE provides a neutral institutional platform with credibility across diverse stakeholders, operational experience in implementing community-industry partnerships on the ground, analytical and research capacity for evidence generation and synthesis, convening infrastructure and facilitation expertise, and established networks spanning government agencies, forest communities, industry partners, research institutions, and civil society organisations.