TECHNICAL ADVISORY NOTE (TAN)

Diffusion of Value-Adding Technologies for Livelihood Enhancement: Bamboo-based Low-cost Housing Technology

INBAR
INTERNATIONAL NETWORK FOR BAMBOO AND RATTAN

INTRODUCTION

In Tamenglong district, Manipur, India, an ARS programme, established by INBAR in 2002, has successfully developed a technology that enables rural communities to produce high-quality, low-cost housing using local bamboo resources. The project uses simple production techniques, which rely on the gradual transfer of weight from top to ground, enabling rural communities to participate directly in production. This not only helps generate rural livelihoods, but also alleviates local housing shortages.

At the local level, the Tamenglong Bamboo and Cane Development Centre (TAMBAC), a community-based NGO established with support from INBAR, run the construction project. Other national institutions, which have provided support for the development of housing constructing include CIBART, INBAR's national partner in India, IPIRTI, and the District Rural Development Agency (DRDA).

The Context

At present, large numbers of the rural poor in Tamenglong do not have access to safe, affordable housing. This is mainly due to Tamenglong's remote and hilly nature, which raises transportation costs and makes many rural areas inaccessible. Tamenglong is 1,290 m above sea level, with natural forests covering 88% of its land area. The road network is highly underdeveloped, with only 2 motorways accessible throughout the year. There are no railways, while the nearest airport is 153km away. Therefore, This programme focuses on using locally available bamboo resources, which cover 563 sq km, to overcome shortages in traditional construction materials, such as concrete and timber. In addition to overcoming housing shortages, the project also attempts to alleviate rural poverty through the generation of sustainable livelihoods.

At present, Tamenglong has very limited access to regional and national markets due to its poor infrastructure. Around 86% of the population relies on agriculture for their livelihoods. However, returns from agriculture have fallen significantly in recent years due to sustained population growth and the use of unsustainable 'slash-and-burn' farming techniques. It is estimated that around 70% of the population in Tamenglong now live below the poverty line.

Housing is one of a few local off-farm markets, which could provide large numbers of the rural poor with sustainable livelihood opportunities. According to the Government of India Planning Commission, the market for bamboo housing in the North East is potentially worth US$22 million per year. As production techniques introduced during the programme, such as pre-fabrication and *baharaque* walling, require minimal technical capacity, rural communities are able to engage directly in production. This type of housing project also benefits from providing rural communities with greater autonomy over their own housing. In comparison, centralized government housing schemes have made minimal impact on housing shortages, despite large investments.

The Process: building bamboo houses using pre-fabrication techniques

Dried & sorted bamboo stock

Use of fire to straighten bamboo

Pressurised bamboo treatment

Treated & grouped bamboo

Sizing bamboo as per use

Pre fabrication of bamboo walls

Production line pre fabricated CPU

Pre fabricated decorative frame

Prefabricated of walls & doors

Pre fabricated truss

Prefabricated wall with door

Painting prefabricated door

Pre fabricated window component

Pre fabricated of tree house

Pre fabricated Low cost bamboo house

Main Technical Components of the Research Programme

- Training community members in new technology and production techniques, such as chemical preservative treatment of bamboo, *baharaque* walling and pre-fabrication of components.
- Equipping two CFCs to act as training and production bases for community-based construction teams.
- Successfully developing four community-based construction teams, which are provided with technical and logistical support from TAMBAC.
- Creating marketing links through state government agencies.

Scope for Replication

Scaling-up: As the construction programme in Tamenglong has generated large interest from a number of private individuals and government institutions, significant potential exists for up-scaling TAMBAC's production capacity. Strong marketing links have already been made with both the Uttarakhand and Manipur governments. In addition, there is large local need for affordable rural housing, with housing shortage in the North East of India being approximately 460,000 units, with more than 90% of it being in rural areas. The project also benefits from utilizing local bamboo resources, which in comparison with timber an d concrete are competitively priced and require minimal technology. This has encouraged rural community members to participate in training (see picture above). Finally, a strong institutional network, headed by TAMBAC, is also in place to develop further market links.

Scaling out: In India, where bamboo resources are widespread, there is large potential to expand the housing programme to other regions. This has already been demonstrated through TAMBAC's work in Uttarakhand, where two structures have been built in Haldwani & Kotdwar respectively. Since 1996, the Indian Supreme Court has placed a ban of commercial tree felling, causing the price of wood products to rise significantly. There is a large shortage of low-cost, safe housing for the rural poor. According to estimates from the Government of India Planning Commission, national markets for bamboo housing could already be worth as much as US$163 million per year. The programme offers a number of advantages to traditional building projects, as it uses technology and production techniques that are accessible to the rural poor. Individuals from local communities can therefore produce housing, which helps to generate rural employment. Production costs are also low, with a typical 350 sft house costing around US$2,000. If production can be linked to government housing programmes and micro-financing schemes, considerable scope exists for vastly extending the programme.

In addition to India, the project also has significant potential for out-scaling to other developing countries in Asia, Africa, and Latin America, where there is also a severe shortage of affordable housing for the rural poor. According to United Nations statistics, over a billion people living in these regions still do not have access to safe homes.

SECTION ONE: THE INSTITUTIONAL CONTEXT

- Cluster-based enterprise development in Tamenglong district of Manipur is one of several INBAR ARS Programmes developed under INBAR Livelihood and Economic Development Programme (LEDP), via IFAD grants TAG 518 and TAG 774.
- The project primarily targets four blocks (Tamei, Tousem, Tamenglong, and Nungba), covering 68 target villages in Tamenglong district, Manipur, India.

SECTION TWO : THE PROGRAMME IMPLEMENTATION

Target Groups and Outputs

Target groups: The project primarily targets unemployed Youth, artisans and carpenters, who come from households currently living below the poverty.

The main outputs from the project are:

- chemical preservative treatment of bamboo, baharaque walling and pre-fabrication technologies successfully introduced to Tamenglong District
- Community training model developed for bamboo construction
- Thirteen structures erected by construction teams in Manipur and Uttraranchal, using newly introduced technology and production techniques.

Impacts

Tangible Impacts:

Impacts on the human capital:

- Three people trained at IPIRTI, Bangalore, and twenty community members trained as trainers at Tamenglong.
- Four construction teams formed with the trained people.
- Fifty community members trained in resource management and silvicultural (see picture above right).

Impacts on the social capital:

- Formation of community partnership between TAMBAC and the governments of Manipur and Uttarakhand.
- Equipping of two CFCs with construction technology.

Impacts on the natural capital:

- Nearly 500,000 saplings of *D. hamiltonii* were raised and planted in community plantations on an area of 1,241 ha.
- Individual farmers planted more than 400,000 seedlings of D. hamiltonii on homesteads and farmlands.

Intangible Impacts

- A typical bamboo structure generates around 200 working days of employment for rural construction workers

Constraints Faced During the Programme Implementation

Internal:

- Rural communities' production capacities are poor, as they lack access to new technology and training.
- Institutional systems are underdeveloped, resulting in producers having limited access to raw materials and end markets.
- Rural poor have minimal funds for housing.

External:

- Government inertia, leading to under-investment in affordable public housing programmes.
- Local perceptions towards bamboo trades are often unfavourable.
- Poor transport network makes accessing regional and national markets very difficult.
- Limited access to credit financing for community producers.

Accessibility

Because of TAMBAC's linkages with CIBART and INBAR, technical and research outputs from the programme are available for replication at both the national and international level. In India, institutional linkages are established through CIBART, which manages four Indian ARS programmes (Tripura, Tamenglong, Himachal and Konkan). Internationally, action research from Tamenglong can also be adaptively replicated across INBAR's network of 34 countries. In addition, research outputs are available at low or no cost to individuals and community groups operating in INBAR member countries.

Institutional Sustainability and Degree of Farmers' Involvement in the Research Programme

The programme is run by TAMBAC, a community-based NGO, which was established by INBAR in 2002. Community stakeholders (master trainers and local development professionals) play an active role in decision-making, with external partners (INBAR and CIBART) providing technical and logistical support. Community ownership of TAMBAC ensures that the organization remains directly rooted to the local area, thus ensuring continuity and sustainability.

TAMBAC is supported by a vast village extension network, with 112 officers providing rural communities with training and technical support at the field level. In addition to field-staff, TAMBAC has also established 35 village development councils, which play an active role in determining ARS activities. 58 Joint Forestry Committees, responsible for management and development of the local resource base, have also been established. Finally, production is coordinated through two TAMBAC managed CFCs and 75 SHGs.

The Gender Dimension

Because of the physically intensive nature of construction, the project has specifically targeted male youths, artisans and carpenters. However, promotion of housing has resulted in a number of indirect benefits for women in the Tamenglong ARS. Firstly, housing projects have increased

the profile of bamboo-based livelihood activities in Tamenglong. This has led to the establishment of 75 SHGs, with women being organized into production units for handicraft goods and charcoal. These activities have significantly increased local women's earning capacity, with one group even supplying handicrafts to the United Kingdom. The housing programme has also helped to strengthen local community networks, which support rural women. For example, TAMBAC's office was constructed through the housing programme. Finally women are also employed through TAMBAC's CFCs to process bamboo, which is used in the construction industry. In the future, larger numbers of women will also benefit from having access to homes, which are safe, clean and affordable.

Dissemination Pathways

Communication strategies at the village level:

- CFC-based training courses led by master trainers;
- Face to face meetings;
- Village extension system training and awareness raising events;
- Quarterly newsletter
- Communication strategies at the national and international levels:
- Housing demonstrations
- Technical reports and publications
- Workshops and trade fairs

Future Needs

- Encourage private-CSO partnerships to enable rural communities to access working credit funds, such as bank loans. This will assist community enterprises in meeting growing working capital needs, based on their positive cash flow and annual growth.
- Develop pro-poor rural housing loan credit schemes to enable communities to purchase housing.
- Expand marketing links to larger federal government housing programmes.

Annex 1: Data Box

The Research Programme

The research programme helps rural communities to develop technologies and processing techniques for local bamboo resources, thereby generating enhanced livelihood and income-earning opportunities. At the local level, the programme is implemented by TAMBAC, a community-based NGO. TAMBAC focuses on developing bamboo products and business models for community enterprise. It has two CFCs in the district, which operate as bases for community training, production, and marketing. Participatory approaches are consolidated through a village extension network, where members of the community act as local trainers and policy implementers.

Chemical preservation treatment of bamboo: Before construction commences, selected culms of Dendrocalamus hamiltonii and Melocanna baciferra are chemically treated to pro-long the components' lifespan. Two different forms of treatment are administered depending on where the bamboo will be used. All bamboo that will touch the ground is given hot-cold treatment to protect against termites. The treatment is administered to dried bamboo using combination of fuel oil and coal-tar. Culms are dipped into the mixture and boiled till the liquid

reaches boiling point (usually 4 hours). The culms are then left to cool for 24 hours. Finally, holes are also drilled on alternate sides of the culm internode, with a maximum of 30 ml of wax/glass putty injected into the node. This ensures weight is equally distributed. For bamboo pieces that do not come into contact with the ground during construction, the dip-diffusion method is used. This involves dipping culms, which have holes drilled into their internodes, into a mixture of water and boric acid and borax. Culms are immersed in the liquid for 48 hours and then left to dry for a further 48 hours.

Baharaque walling: Traditional bahareque uses wooden and bamboo poles to construct main wall frames. Bamboo slats (laths) are placed horizontally at 5-cm spacing on both sides of the main frame. The hollow space between the laths is then packed with mud. This is also known as a solid bahareque. While the wall is traditionally given a plastering of mud and cow dung mixed with rice straw, in the project a cement plaster is used.Pre-fabrication: All key building components – such as trusses, columns and walls – are pre-fabricated off-site. Pre-fabrication also uses lamination and flattening technology to produce bamboo boards, which can be used in construction. Once individual components have been made at a CFC, community members can assemble the final structure directly at the building site. This approach enables rural communities to participate in all stages of production.

Costs: A standard 350 sft house costs Rs 80,629 (US$2,015). The cost of materials accounts for roughly 80% of the total, with labour-cost, which go directly to the rural community, accounting for approximately 18%.

SECTION THREE: USEFUL INFORMATION

Keywords:

Bamboo, Manipur, Tamenglong, artisan, charcoal, housing, village cluster, enterprise

Useful links:

www.inbar.int

www.inbar.int/livelihood/ldmain.htm *INBAR's Livelihood Development Programme*

http://www.cibart.org/tribac.asp

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Acronyms:

ARS	: Action Research Site
CFC	: Common Facility Centre
CIBART	: Centre for Indian Bamboo Resource and Technology
CSO	: Civil Society Organisation
DRDA	: District Rural Development Agency
IFAD	: International Fund for Agricultural Development
INBAR	: International Network for Bamboo and Rattan
IPIRTI	: Indian Plywood Industry Research and Training Institute
NGO	: Non-governmental organisation
SHG	: Self-help group
TAMBAC	: Tamenglong Bamboo and Cane Development Centre