TECHNICAL ADVISORY NOTE (TAN)

Project title:

Rural Enterprise Development for Livelihood Enhancement: A Design Centre for Upgrading Village-level Production in the Philippines

INBAR

INTRODUCTION

The Community Enterprise Development Project, also known as the "Design Centre Philippines", was set up by INBAR to develop new processes for bamboo component and product production. The project has focused on promoting village-level production and alleviating rural poverty. To achieve this, the project has veered away from heavy capital investment in machinery. This has resulted in the development of heat-setting resins (like polyester resins), as well as the introduction of fibreglass mats and hemp into traditional village-produced bamboo outputs, such as culm slats, split halves and woven mats. Through these developments, the Philippines ARS has successfully enabled rural producers to access higher-value furniture and resort markets.

At the local level, the project is implemented through InHand Abra, a community NGO with other twenty years of experience in the bamboo sector. The decision to conduct this project in the Philippines was based on three factors: the Philippines' position in international design excellence; its technical expertise in developing new products and processes with a focus on indigenous materials; and its experience using village level workshops for its export industry.

The Context

The Coomunity Enterprise Development Project is located in the landlocked province of Abra, part of the Cordillera Administrative Region in Luzon. Abra has a population of 230,953 (August 2007), with a density of 58 persons per square kilometre. Although much of the terrain is rugged and hilly, Abra's economy is agriculture-based. Its major crops are rice, corn and root crops, and commercial produce are coffee, tobacco and coconut. Extensive grassland and pasture areas are used for livestock production.

In Abra, labour force participation is nearly 66%, but participation of women is only about 50% that of men. The literacy rate is above 90% for both men and women, but the average annual family income is only US$2,480 (August 2000), with around half of Abran families living in poverty.

In the Philippines, close to 60% of cottage industries work with bamboo or rattan, while in Abra alone the number of households involved in commercial use of bamboo is around 1,524, with 930 households concentrated in 18 villages (6 municipalities). In recent years, bamboo industries have suffered from China's entry into the market with high quality industrially produced bamboo products at competitive prices.

However, with growing concerns about the environment many new opportunities are opening up for bamboo production in the region. For example, in the island province of Bohol, which is known for eco-tourism, 10,000 resort rooms worth US$ 224 million need to be built by the year 2010.

MAIN RESEARCH PROGRAM COMPONENTS

Components:

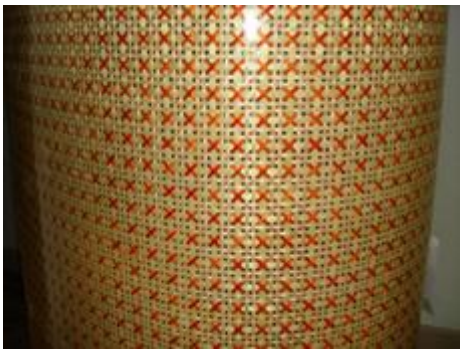
- Process designing – designing processes that improve village artisans' capacity to produce products for the modern market at the right price, quality, and time.

- Establishment of a village (machinery and facilities) factory, equipped with modern machinery
- Product designing and prototyping completed.
- Successful designs for moulds and jigs completed and prepared.
- Introduction of environment-friendly heat-setting resins and other materials.
- Development of charcoal drum pyrolysers.

CONDITIONS FOR REPLICABILITY

Under the project, INBAR and InHand Abra, with support from a network of local and international professionals, have designed the following technologies and process, which have potential for scaling-up locally, as well as scaling out across the Philippines and other bamboo producing countries:

Bamboo woven matting processes



- Bamboo strips are woven into a single layer, with the desired size and shape (for products such as baskets and furniture leg components) using moulds. The products are laminated on one side with fibreglass to make components, such as seats and hollow furniture. This innovation enables bamboo to be shaped into a variety of furniture and home accessories for functional use.
- Bamboo strips are woven into a single layer with fibreglass chair moulds, leaving the mould inside and injected with polyester resin to bind the two together. This process makes beautiful and structurally sound woven chairs of any size and shape.
- Two layers of woven bamboo mats sandwiched with a layer of fibreglass woven mat and bonded with polyester resin can also be moulding into stackable chairs, with seats and backs.
- Intricately woven and coloured open-weave bamboo mats sandwiched between two fibreglass woven mats have been developed to make light diffusers and decorative skylight roofing sheets. This technology creates multiple opportunities for producing lighting fixtures, diffusers and bathroom wall tiles.
- Single-layer, closed-weave finely woven bamboo mats laminated with fibreglass mats and polyester resin and shaped have been shaped into counter tops for bathrooms and kitchen. Other products include tabletops and decorative wall panels.

Bamboo veneering processes

- Rotary sliced bamboo veneer strips cut to desired widths have been shaped into honeycomb core boards and honeycomb furniture components using polyester resin. Various housing structural components and furniture configurations can be made with this technology, especially if used with even cheaper cashew-based glues found in India.
- Rotary sliced bamboo veneer strips of 2 inch widths have been successfully laminated with polyester resin to form structurally sound furniture components of various sizes and shapes, thus substituting the use of steel and wood. This opens immense possibilities for bamboo in modern furniture manufacture. Prototypes of stools and stackable chairs were produced to demonstrate this.

Thin-walled bamboo culm processing

- Thin-walled bamboo culms have been split and laminated back to back with resin and hemp to make thin, lightweight furniture components. This opens large possibilities for designers to use bamboo in furniture. Two types of prototypes were made to illustrate this: a series of folding chairs with canvass backs, and stackable chairs with woven mat seats.
- Thin- walled culms have also been halved, crushed, bent and laminated back to back with polyester resin and fibreglass mats to make structural building and furniture components. The technology can be used for furniture and building components. Two types of prototypes – outdoor lounge chairs and floorboards for decks – were made to illustrate this.

Typical bamboo slats production for flooring

- Bamboo slats were assembled into 1.2 m x 1.2 m panels held together with paper and then laminated with polyester resin into 10 mm thick plywood boards. This technology enables the village producers to supply finished flooring material to the market without heavy investment in machinery.

Glue development

- The use of polyester resin with fibreglass woven mats or hemp in these processes brings the component to the outdoors. The proportions, combinations and processes have been perfected through repeated trials. Other heat-setting glues, especially cheaper Indian, could be investigated.

Enhanced finishing

- The use of “stop-sag” with gel-coat resins as clear putty or filler and as clear primer is a breakthrough in finishing technology for bamboo products, which allows them to compete with high-end wooden furniture. Besides enabling products to be used outdoor, it also raises aesthetic quality. Penetrating wood stains are sprayed onto bamboo products after the primer, helping to provide nice natural wood-style finishes. The gel-coat is again sprayed on top on the colour to seal it. Then a mat finish polyurethane coat is sprayed as final coat.

Scaling-up: The innovations in this research were designed to rely on village craftspersons for most of the primary processes with the exception of veneering. It also relies on them for producing mats in bulk, with the help of patterns and moulds. These components are brought to a factory linked to a cluster of village producers. At the factory, they undergo curing, veneering, crushing, bending, drying, lamination, and some finishing and assembly. The factory’s clients are different furniture makers, homebuilders and home depots that in turn assemble, finish and deliver the final product to their clients/outlets.

At the centre of these operations is a core group of professionals, who continuously market, research and develop new products and processes in collaboration with village artisans, the factory, and the furniture/home designers and makers.

The production set-up can be scaled up depending on the type of products needed and market requirements, provided adequate quantities of raw materials are available at hand.

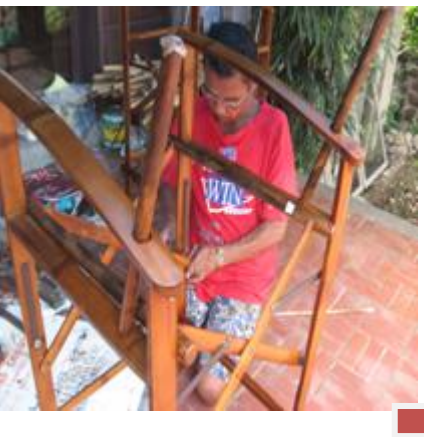
Scaling out: Villages and craftspersons who traditionally work with bamboo exist in almost all bamboo-growing areas. Therefore, labour and processing skills are not an issue for scaling out. through collaboration with bamboo producers, village craftspersons, a factory and furniture makers, home builders, and outlets, any village cluster could replicate this type of production. Drum pyrolysers for the conversion of waste bamboo into charcoal too is easily replicable, as has been already proven through transfer from the Philippines to Ethiopia.

However, finding a core group of proffessionals, may be a limiting factor, as it requires skills that may not be readily available at all sites. Therefore, capacity building is a pre-requisite for scaling out. In addition, local communities will require strong institutional systems to provide ongoing support till such time as a local core group attains the capability to manage on its own.

EXISTING LINKAGES WITH OTHER IFAD INITIATIVES

- In 2006, INBAR secured funding from IFAD under grant Tag 774 for a project to investigate new ways of producing bamboo products for the modern market with focus on village level workshops and craftspersons.
- Under Tag 774 InHand Abra also hosted the GMI Design Centre, which has collaborated with Philippine government agencies to develop other bamboo processing technologies. From 2009-2011, these collaborations will continue under a new IFAD TAG 1037 grant.

BEFORE – PROCESS – AFTER



THE PROGRAMME IMPLEMENTATION

TARGET GROUPS AND OUTPUTS

Project target group:

- The ARS target groups are rural craftspersons in *155* poor households from six villages and local bamboo smallholders.

Institution involved during the ARS process:

NGOs:
Inhand Abra
Intechdev (provided technology support for developing new processing techniques)

Government
Department of Science and Technology (support development of the Philippines GMI centre)
The Forest Products Research & Development Institute (support development of the Philippines GMI centre)

Outputs:
Processing and community training packages developed for:

- Bamboo woven matting
- Bamboo veneering
- Thin-walled bamboo culm processing
- Bamboo slats production for flooring
- Glue formulation
- Enhanced finishing

IMPACTS

Tangible impacts

Impacts on the human capital:

- Capacity building provided to village craftspersons in the usage of modern production methods and materials.
- Village craftspersons trained in the production of modern bamboo products, such as furniture and housing components, as well as in the production of bamboo charcoal.
- Community stakeholders trained to manage ARS programme activities independently

Impacts on the social capital:

- Adaptation of InHand Abra, an NGO, for ARS project implementation and management.
- Development of a village-level design centre.
- The project provided a fillip to the bamboo sector and re-equipped it to compete in the market.
- Formation of community partnerships with local NGOs, government and inter-governmental organizations, financial institutions, and private sector companies.

Impacts on the natural capital:

- Adoption of environment-friendly adhesive in the production process.
- Effective usage of thin-walled bamboo available in abundance locally, but otherwise unused in industrial production.
- Successful demonstration of laminated bamboo as an alternative to steel and wood.

Intangible Impacts

Charcoal and laminated board processes developed in the Philippines have been successfully replicated in Ethiopia and Ghana.

CONSTRAINTS FACED DURING THE IMPLEMENTATION

Main difficulties faced during the process were:

Internal constraints

- Workplace was too small and affected by changing weather.
- Equipment such as dryers, presses, cutting tools and proper painting equipment were lacking.
- Jigs were temporary and made of wood.
- Pace was slow, as each experiment went through tests before proceeding to next phases.
- Each phase went through a series of trial and error procedures for process elimination as there were no models to follow.

External constraints

- Lack of colour fast dyes.

- Lack of technical data on resins and glues.
- Lack of inexpensive glues in the market, especially thermosetting glues.
- Lack of equipment facilities – such as new types of airless painting equipment –necessary to test the weather resistant qualities of the products.
- Lack of testing equipment to expedites test results such as the effect of UV rays.

Sustainability, Acceptability and Accessibility

Accessibility

Because of InHand Abra's linkages with INBAR, technical and research outputs from the programme are available for replication at both the national and international level. Internationally, action research from the Philippines ARS can 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 operates at the community level. It buys the raw material (bamboo culms or crushed bamboo) from bamboo growers and indigenous people who are traditional harvesters of forest bamboo. It buys the products (primary processed) from the craftspersons, who are trained in processes and equipment operation. As the craftspersons are traditionally bamboo workers, they are easily adapted to the new production set-up. As primary processors work from home, there is no change in production setting for the majority of the people involved. As minimum wages are guaranteed at the factory, workers are not likely to disengage. The programme also cooperates with government agencies, assisting to translate the aims of these agencies at filed level. Thus, the programme incorporates the interests of all stakeholders involved.

Gender dimension

At least one woman is involved in the production of bamboo components in every target household, with at least 155 women currently benefiting. A high proportion of these women are involved in high-value adding segments of the value chain, such as marketing and selling. In the local factory, most of the workers in the assemble section are also women, who earn at least minimum wage.

DISSEMINATION PATHWAYS

- *Communication strategies at the village level:*
  - Training workshops and activities in the field;
  - Face-to-face meetings;
  - Farmer-to-farmer communication;
  - Meetings with technical experts in the sector;
  - Development of instructive materials for diffusion of local experiences

- Communication strategies a the national and international level:
  - Regional, national and international workshops;
  - Product workshops and trade fairs;
  - Technical reports and publications;

FURTHER RESEARCH NEEDS

- Further development and refining of technology; For furniture and building materials, the production processes still need to be refined with proper presses, jigs, moulds, spray equipment and knock down hardware developed and tested.
- Development of prototype houses, upon completion of technology refinement.
- Creating final costings and equipment listing for all products to enable final commercialization.

ANNEX ONE: DATA ENTRY BOX

The Research Programme

The challenge of the research programme was to find appropriate methods to enable bamboo producers to continue with their craft, but at the same time answer the needs of the local and international market in the 21st century. However, given the rural conditions in developing nations such as the Philippines, production design has to take into account the high cost and unsteady supply of electricity. Therefore, the focus was to minimize machinery, particularly electric machinery.

Another issue was the effect of tropical weather on products. Initial research found that the adhesive and the process employed had a major role in the poor quality of products. Despite the use of costly polyurethane glues, the absence of appropriate processes hampered quality. Standard thickness of bamboo strips was critical to the process for proper bonding. Also critical was the use of proper jigs and clamping system.

Different resins were tested using woven mats. Polyester resins proved to be the best suited but not environment friendly. Collaborative work with the manufacturer resulted in water-based, environmentally friendly resins, which provided weather-proof (except for colour fading on prolonged exposure to sun) products. Sandwiching of the bamboo material in the heat-setting polyester resin (mixed with a hardener) provided weather resistance. Polyester resin proved to work well with bamboo and was also the least expensive of heat-setting resins. Rotary-cut bamboo veneer was successfully tried as an alternative to bamboo strips in furniture components. Jigs and mould were used for manufacturing furniture components.

Another process innovation was the utilization of thin-walled (¼" thickness) bamboo culm (3.5" diameter) pieces and with long internodes. These were processed and laminated back to back with polyester resins. The pieces are heat-bent to desired shapes before lamination. The production process of bent bamboo furniture was refined and proper jigs and moulds developed and tested on new designs for patio furniture.

1. Capacity Building on Marketing:

From 2005 to 2007, the Abra Provincial Bamboo Industry Cluster Committee of which the In-Hand Abra Foundation represents the private sector, intensified training on marketing through Trade Fairs at the local, regional and national levels.

ABRA PROVINCE BAMBOO TRADE FAIR SALES (2005 - 2007)

Trade Fair	Date	Venue	Sales		Participants
			Cash	Booked Order	
2005					
PADAYA 2005	Mar. 6-10, 2005	LRA-RTC & LTO Grounds, Bangued, Abra	107,461.00	-	FRB Enterprises, LGUs of Lagangilang, Dolores, Pidigan, La Paz, Pilar, Villaviciosa, Lacub, Tayum, Bucay, Malibcong, Balbin's Quality Furniture
National Trade Fair 2005	Mar. 9-13, 2005	SM Megamall, Mandaluyong City	209,000.00	1,379,200.00	Balbin's Furniture
IMPAKABSAT 2005	Nov. 30-Dec. 4, 2005	SM Megamall, Mandaluyong City	155,225.00	1,800.00	Balbin's Furniture Calixterio's Handicraft, Western Bucay Farmers MPC, F. Barcena's Bamboocraft, Oria's Bamboocraft
Christmas Sale 2005	Dec. 12-16, 2005	LRA-RTC Grounds, Bangued, Abra	8,805.00	-	Valbin's Enterprises, K. Atbp., Balaoang Savings & Loans Ass'n
2006					
PADAYA 2006	Mar. 6-10, 2006	LRA-RTC & LTO Grounds, Bangued, Abra	72,723.00	-	LGUs of Pidigan, Bucay, Tubo, Lagangilang, La Paz, K. Atbp., F. Barcena's Bamboocraft
Panagbenga 2006	Feb. 27-Mar. 5, 2006	Baguio City	60,000.00	-	K. Atbp.
Summer Bazaar	Apr. 13-16, 2006	Tagaytay Hi-Land	55,000.00	-	K. Atbp., F. Barcena's Bamboocraft
Viva Vigan Trade Fair	Apr. 28-May 3, 2006	Vigan City	47,374.00	-	Glory's Bamboocraft, Oria's Bamboocraft
1st OTOP Luzon Island Fair	Aug. 16-20, 2006	SM Megamall,	93,185.00	48,220.00	K. Atbp., F. Barcena's Bam-

		Mandaluyong City			boocraft, Oria's Bamboocraft, Carlo's Bamboocraft & Furnis.
IMPAKABSAT 2006	Nov. 3-12, 2006	Festival Mall, Muntinlupa City	406,309.00	-	Carlo's Bamboocraft & Furnis., Glory's Bamboocraft, Oria's Bamboocraft, F. Barcena's Bamboocraft, Western Bucay Farmers MPC, Balbin's Furniture, K. Atbp.
			Sales		
Trade Fair	Date	Venue	Cash	Booked Order	Participants
Global Development Village Trade Fair	Dec. 6-10, 2006	Bucay, Abra	193,732.00	-	Calixterio's Handicraft, Western Bucay Farmers MPC, F. Barcena's Bamboocraft, Oria's Bamboocraft, K. Atbp., Glory's Bamboocraft, Carlo's Bamboocraft & Furnishings
Christmas Sale 2006	Dec. 13-16, 2006	LRA-RTC Grounds, Bangued, Abra	28,520.00		Glory's Bamboocraft, Oria's Bamboocraft, F. Barcena's Bamboocraft, Calixterio's Handicraft, Carlo's Bamboocraft & Furnishings, K. Atbp.
Christmas Gift Expo 2006	Dec. 20-30, 2006	SM Megamall, Mandaluyong City	155,000.00	-	Carlo's Bamboocraft & Furnis., F. Barcena's Bamboocraft
2007					
ISPSC Agri Trade Fair & Exhibit	Feb. 20-23, 2007	Sta. Maria, Ilocos Sur	26,520.00	-	Carlo's Bamboocraft & Furnis., Glory's Bamboocraft
Panagbenga 2007	Feb. 26-Mar. 3, 2007	Baguio City	20,000.00	-	K. Atbp.
PADAYA 2007	Mar. 6-10, 2007	LRA-RTC Grounds, Bangued, Abra	92,514.00	-	Carlo's Bamboocraft & Furnis., F. Barcena's Bamboocraft, Glory's Bamboocraft, Oria's Bamboocraft, Western Bucay Farmers MPC, K. Atbp.
Aliwan Fiesta 2007 Bazaar	Apr. 26-29, 2007	CCP Grounds, Roxas Blvd., Pasay City	68,000.00	-	Carlo's Bamboocraft & Furnis., F. Barcena's Bamboocraft

Viva Vigan Crafts & Plants Trade Fair	Apr. 27-May 3, 2007	Vigan City	15,029.00	-	Glory's Bamboocraft
Gawang Pinoy Fair	May 12-21, 2007	Gateway Mall. Araneta Center, Cubao, QC	86,000.00	-	Carlo's Bamboocraft & Furnis., Oria's Bamboocraft
Agraryo Trade Fair	June 6-10, 2007	SM Megamall, Mandaluyong City	42,000.00	-	Western Bucay Farmers MPC, F. Barcena's Bamboocraft
Festival Mall Trade Fair	May 28-June 3, 2007	Alabang, Mun. City	25,000.00	-	Carlo's Bamboocraft & Furnis.
Gawang Pinoy Fair Trade Fair Extension	May 31-June 12, 2007	Gateway Mall. Araneta Center, Cubao, QC	40,000.00	-	Carlo's Bamboocraft & Furnis.
Makati Enterprise Center Trade Fair	July 12-13, 2007	Makati City	25,000.00	-	Carlo's Bamboocraft & Furnis.
Fairview Big Tent Trade Fair	July 14-15, 2007	Fairview, QC	25,000.00	-	Carlo's Bamboocraft & Furnis.

			Sales		
Trade Fair	Date	Venue	Cash	Booked Order	Participants
OTOP Luzon Island Fair	Aug. 8-12, 2007	SM Megamall, Mandaluyong City	263,383.00	-	Carlo's Bamboocraft & Furnis., F. Barcena's Bamboocraft, Oria's Bamboocraft, K. Atbp.
IMPAKABSAT 2007	Nov. 2-11, 2007	Festival Mall, Muntinlupa City	284,085.00	-	Carlo's Bamboocraft & Furnis., Balbin's Furniture, K. Atbp., F. Barcena's Bamboocraft Oria's Bamboocraft, Ria's Handicraft
Christmas Sale 2007	Dec. 10-14, 2007	LRA-RTC Grounds Bangued, Abra	15,096.00	-	Glory's Bamboocraft, K. Atbp., Hillside Farmers MPC
World Bazaar Festival	Dec. 6-16, 2007	World Trade Center	151,000.00	-	Carlo's Bamboocraft & Furnis., Ria's Handicraft
Paskong Pinoy Trade Fair	Dec. 18-21, 2007	CCP Complex, Roxas Blvd., Pasay City	17,000.00	-	F. Barcena's Bamboocraft

2. Bamboo resource regeneration:

Cyrtochloa, locally known as puser is used extensively for weaving because of its long internodes and fine fibers. It flowered towards the end of 2007. Seeds and wildlings were collected and taken to the Ecosystems Research & Development Bureau for test propagation. Communities were trained to propagate them in nurseries for planting during the rainy season of 2008. The Dept. of Environment and Natural Resources was tasked to identify public lands for the plantation under the Community Based Forestry ManagementProgram.

3. Projects carried out by IN-Hand Abra:

Before transferring newly developed technology/ies to the production communities, In-Hand commercializes it. The following were the orders on the bent laminated furniture in 2007.

Projects	Client	Amount (In Peso)	Remarks
Bamboo houses	Private (3)	1.9 M	These are showcases on the use of bamboo in contemporary houses
Chairs (with upsholtered seats	Bizu, Greenbelt, Makati	40,000	Restaurant in Metro Manila's Commercial Center
Chairs (like Vienna Chairs)	Stone Hedge Enterprises, Power Plant, Rockwell Mall, Makati	132,000	Operator of a Chain of Fine Dining Restaurants
Chairs	Private	36,000	Private Home
Bamboo mats	Church	60,000	For wall
Total		2,168,000	

4. ARS Expansion

The Action Research Site was expanded to Kapangan, Benguet in the Cordillera Region and to Paitan, Mindoro in Southern Luzon. Indigenous peoples like the Mangyans in Mindoro and the Cordillerans in Benguet inhabit both.

TRAINING	PLACE	CO-SPONSOR	NO. OF PARTICIPANTS
Bamboo Plantation & Management	Kapangan, Benguet	CORDNET, DENR	80 (32 women, 48 men)
Basic Skills	Kapangan, Benguet	PEACE, Balikbayan Foundation	36 (16 women, 20 men)
Charcoal Making	Abra	LGUs, TESDA	259 (79 women, 180 men)
Bamboo Harvesting & Primary Processing	Paitan, Mindoro	Holy Spirit Mission	32 (18 women, 14 men)

USEFUL INFORMATION

Key words

Bamboo, Philippines, InHand Abra, village enterprises, craftspersons, furniture, housing

Useful links

www.inbar.int

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

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Acronyms:

ARS	Action Research Site
CORDNET	Caucus of Development NGO Networks
DENR	Department of Environment and Natural Resources
GMI	Global Market Initiative (a sub-programme of INBAR)
INBAR	International Network for Bamboo and Rattan
IFAD	International Fund for Agricultural Development
LED	Livelihoods and Economic Development
LGUs	Local Government Units
NGO	Non-governmental Organization
TESDA	Technical Education and Skills Development Authority