INTERNATIONAL NETWORK FOR BAMBOO
AND RATTAN (INBAR)

TRANSFER OF TECHNOLOGY MODEL (TOTEM)

MANUAL FOR BAMBOO HOUSING TRAINING WORKSHOPS

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Transfer of Technology Models (TOTEMs) are focussed educational tools providing relevant information and distance training on one specific area of bamboo/rattan management, processing or utilization. They are a means of technology transfer between similar regions throughout the world, with the emphasis on South-South transfer for livelihood development. They enable those involved in the management and use of bamboo and rattan resources to more efficiently and effectively develop and use skills relating to these resources.

TOTEMs are primarily intended as practical information resources and teaching aids for those at the local extension level in their communities, who can utilize them to assist local community development.

TOTEMs typically consist of a set of different parts, targeted at slightly different audiences, via the local extension workers. They also typically follow a standard format. This TOTEM differs from the standard form, as it is a training workshop manual rather than a technology information package. The present TOTEM consists of a **manual** with an annex, a **PowerPoint presentation**, and a documentary **video**. Resource persons or development practitioners in the field of bamboo housing will be able to use the material in the design of similar workshops, as an inspiration and as a guideline, adapting it to suit their particular requirements and conditions.

This manual has been produced by Arch. Jorge Moran (Ecuador) and Arch. Juan Carlos Jaramillo (Colombia).

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Foreword

One of the core activities of the International Network for Bamboo and Rattan (INBAR) is technology transfer, especially through South-South cooperation, by using a wide range of media and approaches. Training workshops on a variety of issues feature regularly among these activities. It is against this backdrop that the idea for a bamboo housing training workshop was conceived. In view of the advanced bamboo housing techniques available especially in Colombia, it was decided to bring this knowledge to bear on housing issues in Northeast India, an area with vast bamboo resources.

The workshop in Aizwal in October/November 2001, the first bamboo housing training workshop ever, exposed participants to a range of techniques and applications, including low-cost housing from Ecuador and high-end constructions from Colombia. In Colombia, a unique bamboo culture has evolved, with permanent structures having weathered more than one hundred years and several earthquakes and thus having clearly passed the test of time.

Over and above the immediate impact of the workshop, it was decided to document the experiences of the workshop for replication elsewhere by INBAR or other agencies, NGOs, etc. The present document therefore is intended to provide guidelines, inspiration and selected resource material.

The workshop, on which the present manual is based, was organized and carried out in Aizawl, Mizoram in October/November 2001 by INBAR and the UNIDO Cane and Bamboo Technology Centre (CBTC) in Guwahati, Assam, with support from the local government in Aizawl. INBAR gratefully acknowledges the support received from all concerned, especially from Mr. Kamesh Salam of CBTC. The consultants, Messrs. Moran and Jaramillo, must be commended for their enthusiasm and resourcefulness in conducting the workshop. It is hoped that readers would find the material quite interesting.

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Preface

Among the multiple uses of bamboo, its utilization in the construction of buildings of various types is notable, as it addresses a basic human need *viz*. the need for shelter. A variety of building traditions have evolved in different places, as the technology of building with bamboo is influenced by numerous factors such as the various species and their characteristics, local uses and traditions, seismic factors, topography, soil quality, tools, etc. The scope of possible uses of bamboo in building construction, however, is enormous, ranging from emergency relief to low-cost and to permanent and high-end structures.

In order to address a common misconception about bamboo being the poor man's timber and being a temporary building material at best, bamboo constructions must boast the qualities, which each and every construction must comply with. These include safety and protection from natural disasters, endurance and resistance against atmospheric and other biotic and non-biotic agents, comfort for the inhabitants, easy maintenance, aesthetics and economy.

The present manual is based on a workshop carried out by the authors in Aizawl, Mizoram, in October/November 2001. The annex to the manual provides selected resource material from the workshop. It is the hope of the authors that this document would be used as a guide for future construction workshops which INBAR and other institutions may plan to carry out worldwide.

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IMPORTANT DEFINITIONS

Target Group: The group of people intended to benefit from the activity. Target groups can be defined on the basis of educational background, profession, training needs, cultural background etc., and can include government officers, specialists, professionals, workmen, craftsmen, or anyone interested in the topic or benefiting by living in a bamboo dwelling.

Type of Construction: Bamboo can be used in the construction of dwellings, community centers, schools, medical centers, etc.

Construction System: System of components and procedures permitting the construction of a building.

Demonstration Models: Small-scale models or reproductions enabling a better understanding of the building system.

Building Elements: Parts of a building such as foundations, structures, floors, walls, doors, windows, roofing, etc.

Building Components: Fundamental effective jointing giving a framed construction its structural integrity.

Demonstrative Module: Architectural structures more complex than a building component. They are neither an architectural component nor a constructive component of a building, but rather an independent element of less importance and volume which may be attached to or separated from the main construction, such as gates, bus stops, temporary shelters, guard houses, etc. Said structures tend to be larger than building components.

Model House: a dwelling with its components: foundations, structure, paneling (walls and ceilings), flooring, roofing, electrical wiring, plumbing, doors, windows and paneling (walls and ceilings).

1:1 Scale Model: A real life model.

1. Preparation

1.1 Strategy: Defining the target group, focus and scope

The characteristics of the target group(s), i.e., previous knowledge, academic levels, skills, etc., will determine the focus and scope of the workshop. It should ideally be designed keeping in mind multi-disciplinary groups.

The workshop aims at training participants in such a way that they may build any type of construction with bamboo being its main component. It should therefore not focus on a specific type of construction (dwelling, school, community centre, etc.) but rather on the construction method. This includes understanding the material to work with, preservation methods, the steps to follow in order to accomplish a construction, and the tools to be used.

To adequately accomplish this, consultants should visit the site and familiarize themselves with the local people, their customs and traditions, well before the workshop. Interviews with counterpart(s), observation of building techniques, traditional tools and characteristics of local bamboo species, and ideally a gap analysis as regards participants' training needs can go a long way towards a well-designed event. This would also enable them to get to know the materials and tools available, as well as to visit and choose the location(s) where the theory and practice sessions will take place. It is also important to interview residents and to listen to their opinions regarding their needs and aspirations. The workshop agenda can be developed based on technical visits to various types of constructions in the area while observing positive and/or negative aspects of traditional and local bamboo constructions.

The consultant(s) must be able to rely on the support and assistance from a counterpart with sufficient experience in regional/local construction systems, and ample knowledge on bamboo together with the ability to manage personnel and on-site crews. He should also be responsible for advising on and procuring ahead of time the materials and tools necessary for the workshop. The need for supervision requires that the counterpart be able to attend the workshop full time. An agreement (MOU) should be drawn up, which delineates the responsibilities of each of the cooperating partners.

Local government agencies must be tapped regarding building codes and future housing projects, together with practicing and teaching professionals. Multiplicator agencies for knowledge dissemination should be invited in order to make the event more cost-effective. These could include urban and rural housing agencies, NGOs, etc.

Attendance to workshops should be limited to a maximum of fifty (50) persons and would depend on the number of consultants conducting the workshop, available space and other resources. A workshop should not last more than one week considering the fact that participants have to take time off from their regular work.

A housing training workshop should not be overly ambitious. Building a model house is an option, but it is not a requirement for a successful workshop. Therefore, depending on time and available resources, there may be alternative options such as:

- Building bamboo dwellings prior to the beginning of the workshop.

- Not more than two (2) weeks before the workshop a small dwelling may be begun and concluded during the workshop.
- Building only part of a dwelling (e.g. a completed bedroom)
- Improving a local dwelling might be a relevant contribution to the community.

1.2 Logistics checklist

In order to prepare a workshop, it will be helpful to draw up a checklist of everything that needs to be taken care of, including division of responsibilities and deadlines. The following is a rough guideline, which will require adaptation in a given situation. A steering group consisting of international, if applicable, and local organizers should be established for the purpose.

1.2.1 Location

Generally, accessibility including communications and transport infrastructure and civil amenities are important considerations when planning for a workshop. Bamboo housing training workshops, however, may require to be carried out in remote places where these conditions can rarely be met. The workshop organizers and support staff need to ensure adequate and sufficient:

- assistance to international participants (invitations for visas, relevant information on climate, travel, security issues, vaccination requirements, etc.)
- accommodation, preferably close to the workshop site (theory and practice sessions)
- local transport, to and from the workshop site
- meals, preferably close to the workshop site
- workshop site facilities
  - conference room(s) with sufficient seating capacity and audiovisual equipment
  - facilities for practical sessions (work places, tools, materials, etc.)
  - ventilation, the possibility of darkening the conference site, electric power or the availability of generators, and water
- communication facilities (phone, fax, Email, Internet).

1.2.2 Resources

1.2.2.1 Human resources

Organizers and local support persons are responsible for planning, preparation and implementation of the workshop. The respective responsibilities for administrative and technical matters, procurement, etc., arise from the planning process and need to be assigned clearly. During the workshop, a secretariat responsible for handling and facilitating all aspects of running the workshop smoothly needs to be set up. The necessary human resources for the bamboo housing training workshop include:

- Organizers (international and local), responsible for:
  - administrative and financial aspects
  - assistance to participants and resource persons
  - organizing technical and support personnel
  - purchasing the necessary materials and tools
  - providing the audiovisual, communications and photocopying equipment

- handling all unforeseen matters.

- Resource persons (architects, engineers, builders, agency and NGO representatives, community leaders, etc.), responsible for:
  - assisting those organizing the workshop in developing the agenda
  - preparing all printed material as well as audiovisual material necessary for the presentations and practical sessions
  - requesting beforehand all equipment required
  - preparing a list with the specification and numbers of tools required
  - preparing a list with the materials needed for the practice sessions
  - whenever the construction of a model house is planned, sending the architectural and structural drafts beforehand -with details and installations- together with all technical specifications and with the amount of materials
  - attending the planning meetings for the theory and practice sessions
  - organizing the work groups, taking into account the various working methods
  - advising the work groups on design work and practices
  - attending support and discussion round tables
  - preparing the evaluation
  - preparing the reports and manuals resulting from the workshop.

- Support staff
  - Conference technical and managerial support
  - Masons, carpenters, craftsmen, etc.

A variety of government departments concerned with bamboo development at the various stages of the production to consumption spectrum may be considered for providing counterpart services and for co-financing the event. These may include forestry, agriculture, housing, industry, tourism, etc. Apart from official departments, a special effort must be made to tap into the resources of NGOs and private sector businesses.

If it is decided to construct a model house, this may have implications for the training of masons, carpenters and craftsmen. Moreover, this is always an ambitious goal and may require construction to begin well before the official inauguration of the workshop.

1.2.2.2 Material resources

Compared to a cut-and-dried and theory-based workshop, a bamboo housing training workshop requires a range of materials, which can pose a significant challenge to the organizers, especially in a remote locale.

- Equipment, materials and tools for construction and for practical training sessions: Specification and quantification of tools and construction equipment will result from the planning process and will have to strike a balance between the availability of local materials and tools and the requirements of the resource persons. Allow for a sufficient period of time for this purpose. Construction materials should be procured well before the beginning of the workshop, preferably locally, as the utilization of locally available materials is one of the objectives of promoting bamboo houses. Materials for practical training sessions may have to be obtained during the workshop, depending on participants' requirements as to design and practical sessions.

- Audiovisual equipment: This is very much standard equipment and includes overhead projector, slide projector, PC and LCD projector, liquid marker boards, projection screens, laser pointer, paper board, video equipment (VCR, DVD player, TV monitor), etc. As bamboo housing training workshops may tend to take place in remote locations, availability of certain items may be restricted. Resource persons should be aware of this and be prepared to use low-tech means of presentation.
- Participants will generally need to stay in touch and communicate with their home base. Especially in remote locations, communication facilities including phone, fax, Internet and Email (temporary accounts) may have to be provided timely and specifically for the event.

1.3 Marketing the event

Apart from capable resource persons, a relevant curriculum and stimulating contents, the success of the workshop depends heavily on promoting the event across the spectrum of stakeholders. It cannot be assumed that there is always a natural tendency to share knowledge across different government departments and to include also the non-government sector. Although local advertising is the responsibility of the local counterpart, the steering group in charge of organizing the event is well advised to look into and to ensure balanced participation by local, regional and international stakeholders. Last but not least, the need for further dissemination of knowledge as a follow-up to the event requires that key multiplicators (agencies, NGOs, community leaders, business associations, etc.) are informed and invited to the workshop.

Depending on the scope of the workshop, national or international promotion of the event is the responsibility of the national and international sponsors, as applicable, using the range of available media including web sites, Newsletters, etc.

2. Implementation

The workshop concept is an interactive one, allowing for participants' inputs and creativity while infusing the audience with ideas and inspirations, which can then be moulded into new approaches combining local traditions and "exotic" elements.

The objective is to familiarize participants with general and basic concepts of bamboo treatment, utilization and handling. They should not intend to copy foreign construction methods but rather learn about diverse traditions and tools, adopting and adapting them for their own purposes.

The workshop features three main modules *viz.* (i) theory, (ii) design and construction of jointing systems, and (iii) design and construction of complex structures. Modules (ii) and (iii) each have an evaluation component, which can be watersheds, separating dreams from reality. Throughout modules (ii) and (iii), participants and resource persons interact closely.

2.1 Module 1: Theory

Theory sessions consist of lectures by resource persons and participants' contributions, perhaps interspersed with field demonstrations to maintain the attention curve. These sessions, particularly the participants' contributions, need to have chairpersons or moderators to manage the sessions and to limit them to the time allotted to them. Discussions can be held at the end of the sessions.

- Resource persons' lectures. Suitable subject areas for theory sessions could include the following:
  - History of the use of bamboo as a building material
  - Bamboo utilization and local traditions
  - General characteristics of bamboo and especially of local species
  - Natural and chemical preservation methods
  - Moisture and drying techniques
  - Construction systems
  - Building techniques
  - Seismicity considerations
  - Lack of and/or need for building codes
  - Social aspects

- Participants' contributions. This will involve participants by giving them opportunity to suggest and discuss topics of interest to them and by sharing experiences. It will also contribute to a better understanding of local issues.

2.2 Module 2: Design and construction of selected jointing systems

Design sessions are essential for a thorough understanding of the concepts presented and taught during the theory sessions. This enables participants to grasp, realize and in some cases improve on the teachings of their fellows. By being free to choose the subject, they become more involved and inclined to share their experiences, allowing them to question established concepts while acquiring further knowledge.

2.2.1 Working groups

Design sessions are best done in working groups of no more than 8 persons. If people with different backgrounds (e.g., city planners, architects, engineers, craftsmen, students, etc.) are attending the workshop, it is best to divide them among the groups, instead of organizing them according to their specialties. Each group should choose a spokesperson to present the results of its work. The resource persons supervising the group work will specify the topics to be discussed as well as the time allotted for that purpose. Participants should follow the presentation techniques established earlier.

2.2.2 Design evaluation

Group designs will be evaluated in plenary sessions. Evaluation by resource persons should be done in an encouraging fashion so as to pinpoint the best work and highlight innovations shared by participants. This adds an element of competition to the workshop.

At the end, designs should be handed over to the resource persons for documentary purposes.

2.3 Module 3: Design and construction of specific and complex structures

2.3.1 Models

New working groups should be formed for this purpose. Group exercises include the building of various multi-purpose structures (e.g., a kiosk, bus stop, gate, etc.) because the solutions groups develop can be used in the future to improving the concepts of roofing, to increase spans or in other types of construction. Merely building a model house might set limits and keep the mind from wandering and dreaming. The purpose of this type of session therefore is to design a variety of structures, which will grant a broad understanding of the constructive system.

For the practice sessions, participants will be required to design and produce 1:1 scale models of construction elements or of stand-alone constructions which must, however, be feasible in the time span available. As with the design sessions, groups should appoint spokespersons that will represent the groups and explain each group's work at the end of the session.

The practical sessions will require backstopping and assistance from experienced craftsmen, etc., as not all participants are familiar with the manual aspects of working with bamboo, including proper handling of tools and materials. The risk of accidents and the need for protective clothing have to be pointed out. A First Aid kit is a must, however.

Following are a few issues to consider when it is decided to construct a model house:

- The plans -with specifications and quantification of materials and tools, together with constructive details- must be developed beforehand in order to give sufficient time to local counterparts to prepare for the workshop.
- Making a model house requires sufficient time. Therefore, its size will depend on the duration of the workshop. Hence, it may be advisable to build only a part of the house. Another matter to consider is whether said house is simply a design or practice exercise to be scrapped or used for a specific purpose later.
- Workshops will always tend to be too short to build a complete model house. On the other hand, beginning the construction before the workshop will not allow participants to partake in those first steps. Also, considering the total number of participants, they will have to be organized in groups, taking turns, in order for everyone to share in the construction of the model house.
- Another option might be to schedule the workshop solely for the construction of a specific model house. However, the number of participants would have to be limited and the theory sessions would have to be kept short.

2.3.2 Evaluation of models

As with the design sessions, group works will be evaluated in plenary sessions. Presentation of the models will be the responsibility of the groups' representatives. They will be required to report on the design and building process, the main parts of the model, its

problems and pertinent solutions. The resource persons will then critically assess the work and point out strong and weak points.

3. Workshop evaluation

With a view to improving future similar events, it may be useful to evaluate the workshop from the point of view of the participants, the resource persons, and the organizers/sponsors, respectively. Such evaluation sessions should be kept short and could address *inter alia* the following issues:

- Positive aspects of the workshop
- Aspects which could be improved at similar events
- Resource persons, interactions between resource persons and participants
- Theory sessions
- Design sessions and results
- Practice sessions and results
- Technical and personnel support, facilities, materials and tools supply, accommodation, food, logistics, interaction between participants, etc.
- Participants' attendance
- Resource persons' suitability

4. Recommendations

The present Manual provides an outline and recommendations for the implementation of bamboo construction workshops, to be carried out in various places in the world. The Manual does not provide a blueprint, however, and must be adjusted to local conditions, to existing human and financial resources, to the physical and mechanical characteristics of the local bamboos, and most of all to the local customs and traditions.

Last but not least, this is a workshop aimed at participants with various degrees or levels of knowledge and/or expertise in the field of bamboo construction and in the handling of tools. They can contribute greatly to the workshop. Their potential must be utilized and care must be taken not to stifle creativity and initiative by a paternalistic approach. Together, participants and resource persons will be complementary in spreading knowledge about bamboo construction.