INTERNATIONAL NETWORK FOR BAMBOO AND RATTAN
(INBAR)

TRANSFER OF TECHNOLOGY MODEL
(TOTEM)

COMMUNITY BAMBOO NURSERY

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TRANSFER OF TECHNOLOGY MODELS (TOTEMS)

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. Each TOTEM consists of a detailed written report of the technology, a PowerPoint presentation, a film, and, where relevant, a set of technical photographs. They also include information on target users, financial analyses of sample set-ups from the partner country preparing the report and information on where to source particular technologies (such as equipment). The TOTEM thus provides all the information required for establishing similar technologies within interested countries and regions.

- The **report** contains all the technical details of the particular processes involved, as well as other relevant information for establishing the technology such as costs of business establishment, running costs and cash flows.

- The **PowerPoint** presentation contains details of the relevant technologies and their applications, and is intended to provide an overview of the potential of the technology for development.

- The **film** provides a visual guide to the processes involved and helps to bring them alive in the minds of the learners.

The different parts of the TOTEM are targeted at slightly different audiences, via the local extension workers. The report and film are intended to be the main means of extension to the individuals and communities who will implement the technology and who will directly benefit from it. The PowerPoint presentation is primarily intended as a tool for the extension worker to sell the technology and its role in development to those who provide the infrastructural, policy and financial support for its implementation, such as government departments, donors and NGOs. There is considerable flexibility, however. Local extension workers will be able to incorporate the TOTEMs in their own work as they wish and adapt and develop the TOTEM to suit their particular requirements and conditions.

This TOTEM on **community bamboo nurseries** has been produced by Carmelita B. Bersalona at the InHand Abra Foundation, Abra, Philippines. It may be used alone, or in conjunction with the TOTEMs on the medium and large-scale bamboo plantation, bamboo shoots production, the homestead bamboo plantation and the smallholder bamboo plantation.

The report part of this TOTEM describes the technology for producing and establishing a community bamboo nursery for rural development in regions where bamboo is available as a raw

material. It is intended to be used in conjunction with the illustrative film included in this TOTEM package

The first part of the report introduces the technology, discusses its history, its development attributes, its benefits and it's applicability. This part also includes examples of community nurseries in the Philippines and the lessons learned from their experiences. The second part of the report provides detailed information on the horticultural and financial aspects of establishing a community nursery and includes a model of a nursery with detailed instructions on how to establish it. **Appendix I** illustrates examples of community bamboo nurseries in the Philippines. **Appendix II** provides full financial analyses for establishing and running a community bamboo nursery.

This TOTEM is one of the first to be produced by INBAR/ InHand Abra and your feedback is most welcome - kindly contact INBAR or InHand Abra with your comments or suggestions.

Note 1: This TOTEM has been edited and adapted at INBAR and differs slightly from the form in which it was received from the author.

Note 2: All calculations in this TOTEM are in Pesos. At the time of writing 40 Pesos = USD$ 1.

COMMUNITY BAMBOO NURSERIES AT-A-GLANCE

What are Community Bamboo Nurseries?

A community bamboo nursery is a cooperative venture between community members who all play a part in running it and all benefit from it. As a larger unit than would be feasible at the individual level, the unit has more leverage in accessing inputs and selling its outputs. Collective facilities can be established for the benefit of all, such as central propagation facilities, advisers and machinery.

What is the market for the bamboos they produce?

The market for bamboo plants varies considerably with location. Bamboo cultivation is being promoted throughout the bamboo growing regions of the world and is ever increasing. Locally, an investigation into the potential market would be beneficial and continuous feedback is necessary to ensure the unit is able to adapt and develop to suit market requirements.

What is the role of a community bamboo nursery in rural development?

The community bamboo nursery fulfills two important roles. Firstly it enhances the livelihoods of poor, rural farmers and does so by drawing upon their own inherent plant cultivation skills. The community nature of the unit will empower each worker with a voice and a role in its running. Secondly it promotes environmental protection, especially if established on degraded lands. Bamboos can be intercropped with other food plants, and so it also helps to improve food security.

How do I establish a community bamboo nursery?

There are eight steps: 1) create a blueprint, 2) develop a strategy, 3) design or define a bamboo technology that accords with market requirements, 4) institute a staged process of development, 5) form support groups and production teams, 6) Monitor progress and returns to facilitate continuous improvement to assure sustainability, 7) establish a system of rewards, 8) Infuse team values of commitment to customer requirements, commitment to excel, teamwork, trust, respect for the individual, and continuous improvement.

PART ONE

INTRODUCTION

DEVELOPMENT ATTRIBUTES, TARGET GROUPS and BENEFITS of

COMMUNITY BAMBOO NURSERIES

1. Introduction

Bamboo farming and bamboo processing are well suited to the twin concerns of livelihood enhancement and environmental protection - the key components for developing third world countries today. Bamboo is ideal for massive rehabilitation of degraded areas. It is superior to trees in grassland areas and capable of polycyclic harvesting with natural capacity to regenerate through its rhizomes. It has an interlocking root system that can inhibit soil erosion. It is tough and adapts to harsh environments. In the Philippines, it is the most frequently utilized material - from food to housing components. The production of these products can be organized and formed as industries that provide material benefits and livelihood development to the people.

In terms of rural development the community is an extremely important and powerful resource. The collective skills and abilities within any community can often be harnessed to produce an organisation far stronger and adaptable than the sum of its individual parts. Establishing a bamboo nursery under the auspices of, owned by, and with inputs from the whole community, has been shown to be a highly successful means of fuelling rural development in bamboo growing areas in the Philippines. This TOTEM explains the Philippines experience (see **Appendix I**) and uses it to develop a model suitable for wider implementation in interested countries and regions throughout the globe.

2. General development attributes and advantages

The main development attributes of the technology are as follows:

- Rehabilitation of degraded or unproductive lands.
- Increasing individuals incomes and skills.
- Increasing community welfare.
- Empowerment of individuals and communities

The main advantages of the technology are:

- Builds on farmers inherent abilities and is easy for them to adopt
- Promotes the wider use of bamboo as a renewable natural resource
- Requires inputs from a range of people with different abilities in the community

3. Suitable agro-ecological regions

Community bamboo nurseries are suitable for all bamboo-growing regions of the world. They are particularly suited to tropical and subtropical regions where larger-culmed species grow well, because many of these can be used for a wide range of different uses and the market for the young plants produced by the nursery will be larger. On the margins of the bamboo growing regions the bamboos are smaller species that may have

indigenous uses, but are not as likely to have the widespread applicability that would be needed for a truly sustainable, and adaptable, enterprise. The nursery is well suited to areas where shifting cultivation has left land degraded and unproductive, and where soil erosion is a problem. Bamboos are excellent for stabilising soil on hillslopes, riverbanks and areas prone to minor flooding.

4. Target groups

The main target groups are the poor rural farmers and other members of the community who will be involved in the nursery. The nursery will require the skills of farmers, transporters, people experienced in marketing and in management and will encompass a wide range of the community members. Cultivating bamboo is gender sensitive.

5. Benefits

The benefits to the community are enormous. The nursery will create sustainable livelihoods for many members of the community and bring them increased prosperity. A successful venture should encourage more and more community members to participate and may even result in neighbouring communities following suit. Increased productivity of the community's land will result if the nursery can be established on presently unused land. Bamboos can be intercropped with a wide range of food crop plants and so the food security of the community will increase. The nursery inherently builds on the plant cultivation skills and capacities of farmers and is easily adopted.

6. Limitations of the technology

The major problems with a community bamboo nursery are that its success is heavily dependent on market demand for the product. As well as ensuring good market information and quality control of the plants, it may be appropriate to cultivate a range of different bamboo species that have different end users to reduce the risk of market difficulties.

7. Requirement for success

The essential requirements for a successful community bamboo nursery are:

- Community with land available for bamboo cultivation
- Some pioneering members of the community willing to participate
- Access to expert advice and assistance for start-up
- Small amount of start-up capital
- Establishment of a community business infrastructure

Concluding remarks

There are many benefits to be derived from a well-run community bamboo nursery. There are many opportunities for community and individual development and the nursery will also provide many environmental benefits. However the overwhelming importance of developing a secure market for the young plants cannot be underestimated. In order to do this it may be beneficial to establish the nursery with the assistance of state agencies or NGOs to ensure the forward linkages are in place.

PART TWO

THE COMMUNITY BAMBOO NURSERY

1. Introduction

The United Nations Development Program (UNDP) funded the Bamboo Research and Development Project for the Philippines in 1987 with the aim of assisting the Philippine government in creating new sources of employment and income levels, particularly in the rural areas. The implementing agency was the Ecosystems Research and Development Bureau (ERDB), while the executing agency was the Food and Agriculture Organization (FAO). Heading the list of research projects was bamboo propagation and nursery techniques for large-scale development of new bamboo plantations. In 1994, ERDB/FAO/UNDP described three methods of bamboo vegetative propagation as (1) clump division, (2) culm cutting, (3) branch cutting.

In the Philippines, the one node culm cutting method is the most widely used system of propagating common commercial species such as Kawayan tinik (*Bambusa blumeana*), bayog, (*Bambusa spp.*), laak *(Sphaerobambos philippinensis)* and kayali (*Gigantochloa atter*). There are some procedural variations as found practical and effective by individual propagators like Merdonio Jose Caasi and Ernesto Rey Millan of Tagum, Davao, and Stanley Malab of the Ilocos Region. This particular method is within the reach of small bamboo growers.

Branch cuttings have been transferred and employed in several communities for propagation of giant bamboo - *Dendrocalamus asper*, by Francisco Binoya Jr. of Pototan, Iloilo and Myrna Decipulo of Malaybalay, Bukidnon. This method also employs using a technique called airponics that accelerates the growth of plants in an oxygen-rich environment without using soil. It has been used extensively by Germinio Maravilla, an entrepreneur in Sta. Barbara, Iloilo, in the propagation of giant bamboo *Dendrocalamus asper* in which the plant root zone is suspended in a growing chamber and intermittently pulse-misted with nutrient solution.

Finally the mini clump division method is within reach of entrepreneurs and industrialists. This uses tissue culture-derived plantlets developed by Alfine Zamora and S. Gruezo of the University of the Philippines Institute of Plant Breeding from 1991-94, with funding from the Department of Science and Technology. *Dendrocalamus strictus* and *Schizostachyum lumampao* were successfully produced and planted in Bataan using this technique.

In order to involve more people in bamboo propagation for environmental protection and livelihood development, farmers were organized into cooperatives like the Davao Bamboo Development Cooperative in Tagum, Davao; the TABARGA (Taminia Bamboo & Rattan Growers Association) Multipurpose Cooperative in Duenas, Iloilo; and the Dariwdiw Bamboocraft Association in Batac, Ilocos. The experiences of establishing these cooperatives are discussed below as a basis for developing a model for the transfer of bamboo nursery technology to other communities.

2. Establishment and management of the nursery

2.1 Propagation Technologies

Three of the most commonly used technologies in the three major islands of the Philippines (Mindanao, Visayas, Luzon) for bamboo propagation and nursery establishment are discussed here:

a. The Caasi process uses single node culm cuttings and an incubation method and was established in 1987 through the private initiative of Merdonio Jose Caasi, his son and two other farmers. This was successful in making possible large-scale bamboo propagation for the establishment of bamboo plantations in degraded areas of Davao to produce propping materials for the banana industry .

b. Clonal bamboo propagation established through the research of N. Gigare, A. Repospolo, and F. Binoya Jr.- This is used for the propagation of giant bamboo, *Dendrocalamus asper* in Pototan, Iloilo and Malaybalay, Bukidnon.

c. Single node culm cuttings refined through research by Dr. Stanley Malab *et al*, and used for the propagation of *Bambusa* in the Ilocos Region. This method is similar to the Caasi process.

2.1.1 The Caasi Process

The Caasi Process has been successfully used in the mass propagation of laak, *Sphaerobambos philippinensis,* and kayali, *Gigantochloa atter,* in Davao (Mindanao) and Laguna (Luzon). Other species successfully mass propagated using this method are *Bambusa, Dendrocalamus* and *Gigantochloa.* The research team experimented for several years with each part of the bamboo clump that had rooting potentials. In 1987 they found that cuttings from a culm approximately 15 to 24 months old had the highest survival rate. However, the age of the culm was only the first guide and did not guarantee that it was the right material for plant propagation. The next step was to choose culms with two-node side branches. With additional discoveries such as the effect of rooting hormones and incubation beds, the technology for mass propagation of planting materials was made available A total of 3000 hectares were planted on farms in Davao ranging from 1 to 5 hectares in size. Individual farmer entrepreneurs like Caasi and Millan sold 525, 000 and 83,000 plantlets respectively to government agencies for reforestation between the period of 1989-1994. Today, Caasi has 108 hectares of bamboo plantation while Millan has 100 hectares from where he now harvests 10, 000 laak poles daily and 2, 500 poles of other varieties. These individuals continue to advocate to farmers that bamboo is a worthwhile investment.

2.1.2 Mass Propagation and Production by the Incubation Method

A. **Preparation of Planting Stock**

Collection and Preparation of bamboo culm cuttings for propagation:

- One to two year old bamboo culms from 3 year old clumps are selected .and marked.

Selection tips:

- Six to eight month-old culms can already be used provided that they are planted immediately in polybags without the incubation process (see later). Six to eight month old culms are characterized by their newly emerging roots at the node and their dry and intact sheaths that are about to fall naturally.
- One to two year-old culms are characterized by short dried protruding roots at the node with a very hard bud at the base of the internode and in most cases the sheaths are already detached.

B. **Harvesting and Preparation of Bamboo Culms**

- Selected bamboo culms are cut close to the ground.
- They are prepared by removing all except one of the nodal branches.
- The culms are hauled to a designated cutting area where a big drum containing the treatment solution is located.
- The culms are cut 5 cm above and below the nodes using a sharp machete (bolo) for the *Bambusa* species and a sharp fine saw for *Gigantochloa* and *Dendrocalamus* species to avoid splitting the culm.

C. **Treatment & Incubation of Bamboo Culms**

- (Day 1) Construct an incubation bed or mist bed 1 m wide, 8-10 cm high with damp, but not saturated, dark washed river sand that has been cleaned of silt, dirt and leaves. The bed should be raised 15-20 cm above the ground. Saturate the bed with 1:4 CAPTAN solution. The key ingredients are trace minerals, growth hormones, and NPK fertilizer. The fertilizer alone is not adequate to supply the nutritional requirements essential to propagation success. Leave the bed to dry for one day.
- Sterilize the cuttings by soaking in a 1:4 Hexaplus Foliar: Water solution in large 5 gallon containers. Young one year-old cuttings are soaked for 24 hours while two to three year-old cuttings are soaked for 48 hours.
- (Day 2) Lay out the cuttings on the incubation bed. Scoop the sand across the bed and slant the cuttings at a 30^0 angle and spaced 2.5 cm apart so the nodal branches can overlap. Cover the cuttings with sand making sure that the nodes are fully covered. When the incubation bed is full, saturate the whole bed with 1:4 Hexaplus solution. Cover the whole area with transparent plastic, securing all sides with weights such as wood slabs or stones.

- (Days 3, 8, 13, 18) Spray with Hexaplus solution but do not water the incubation beds.
- (Days 4, 5, 6, 9, 10, 11, 14, 15, 16, 19, 20, 21) Water the plants to keep them moist - do not saturate. Apply pesticides only when necessary in cases of insect and disease attack. Check the cuttings every day for possible problems and keep the plastic sheet in place between waterings.
- (Day 21) Transplant rooted cuttings to one-gallon polyethylene bags.

D. **Preparation of Polyethylene Bags and Soil Medium for Bagging**

- Use 23 cm x 23cm bags or one gallon polybags for 4 cm to 7 cm diameter cutting material.
- Punch at least eight drainage holes in the bases of the bags.
- Prepare soil medium consisting of 1:4 coir/sawdust: clay soil or 1:5 coir/sawdust : Laguna sandy soil.

  The most important consideration is to make the soil medium porous, so use a good sandy loam or other soil mixture with a high humus or organic content. Once mixed, the soil medium should be exposed to the sun and air for about two weeks before filling polybags. Allow the polybags to sit in the sunshine for another two weeks. This preparation time gives the soil elements a chance to mix well. During the rainy season this process should be done in sheltered places and only place the bags outside when the sun is shining.

E. **Potting of Bamboo Culm Cuttings**

- Prior to bagging, sterilize the soil by making a hole in the center (4cm in dia) and saturating it with 1:4 CAPTAN solution or exposing the bags to the sun for several days.
- (Day 21) Carefully uproot the cuttings from the incubation bed and slowly insert the cuttings in the prepared bags. Make sure the roots are given adequate soil contact and not damaged through abrasion by the soil mixture. Firmly tap the soil around each cutting.
- (Day 22). Saturate each polybag with Hexaplus 1:4 solution. Check for effective drainage. Observe carefully for any signs of mould or fungal growth.
- When applying Hexaplus solution, do not water the following day.

F. **(Day 24-41) Care and Maintenance of the Growing Potted Culm Cuttings**

- Keep moist but not saturated.
- On day 42, fertilize the cuttings with 14-14-14-11s (N:P:K:S) fertilizer placed into two holes made in the soil. Water immediately. Keep the soil moist but not saturated.

G. **Hardening of the Established Cuttings**

- Initial hardening begins at 42 days by cutting off 50% of the leaves in the nursery shed. This allows more direct sunlight to be absorbed by the plant and more vegetative growth to be induced.
- If the planting materials are not yet distributed and are more than 60 days old, apply fertilizer at the rate of 1 teaspoon per pot sprinkled around the plant.

H. **Dispersal of Planting Materials (from nursery to the field)**

- When loading planting materials onto vehicles handle the plant by holding the bottom of the bag and never by holding directly onto the plant. To maximize space in the vehicle the plants should be laid on top of each other up to 6 layers deep. The plants should then be covered and transported in the evening to help retain moisture.
- During long periods of transport the plants will be under stress conditions. Each evening carefully unload the plants, arrange them in groups of ten under complete shade and leave them overnight. The following day, the plants are fertilized (one tablespoon per pot) and watered.

2.1.3 Plantation Establishment and Maintenance

A. **Selection**

It is best to plant nursery-produced bamboos along riverbanks in flood plains so that shoots can be harvested all year round, and to ensure an evergreen plantation from which to propagate further.

B. **Preparation of Planting Area**

- Clearing and cutting - Line brushing of at least 2 meters wide felling off trees or saplings in the area . Ploughing the area is also done to raise cash crops for the first eight months in order to defray expenses.
- Marking - Use bamboo stakes for marking planting locations at equal distances apart.
- Direction of planting - Plants should be planted along an east-west axis in order to maximise interception of sunlight. A one metre radius around the plant should be kept weed free at least one meter around the stick and raise a small circular ring of soil at least 50 cm from the centre to form a watering pond.

C. **Transplanting of Potted Bamboo Cuttings**

- Prior to planting immerse the plant in a bucket of water until bubbles stop emerging from the compost in order to kill insects and soften the root system.

- Remove the polybag carefully so as not to damage the root system
- Apply 5 teaspoons of complete fertilizer (14-14-14-11s) in the bottom of the planting hole as base fertilizer and cover with at least 5 cm of topsoil before planting the bamboo.
- Cover the plant up to the same level it was in the polybag, water it in with at least 1 liter of water and then slightly compress the soil so that the root system is firmed in the soil.
- Around the 50 cm ring, apply the same quantity of basal fertiliser (5 teaspoons) then lightly work the fertilizer into the surface layers of the soil.
- Mulch the plant with rice straw, cogon or other natural mulching material.

D. **Care and Maintenance**

- After the whole area has been planted, check that all the plants were properly planted.
- After 3 - 4 weeks check for damage by stray animals or pest and diseases. Weeding may be necessary after inspection.
- If possible, construct fences or fire breaks around the perimeter of the plantation. Three rows of banana or cassava may be planted in between clumps for additional income.
- After 2 months, ring weed by cultivating at least 20 cm along the previous ring of 50 cm. Fertilize with 5 teaspoonfuls of 14-14-14-11s, cover with the surrounding soil and then replace the mulch. Repeat the procedure 3 to 4 months later.
- Twelve months later, conduct complete brushing and thinning of the culms. Apply 20 teaspoons of fertilizer around each clump. Fertilize only when clump growth is poor. Mulch the clump using the cleared weeds.

2.2 Clonal propagation of Giant bamboo by N. Gigare, A. Repospolo and F Binoya, Jr.

This process has been successfully used to propagate giant bamboo, *Dendrocalamus asper* in Malaybalay, Bukidnon; Leyte; Taminla, and Duenas, Iloilo; Samar; Los Banos, Laguna and Baguio City since 1991. The clonal propagation technique utilizes Vermi (African crawlers) Composting Technology which produces compost as an additional medium for potting and which generates additional income through the sale of both the compost and the Vermi African crawlers at USD 0.06 per kilo and USD 6.25 per kilo respectively.

Binoya Jr. of Iloilo and Decipulo of Bukidnon have propagated 10, 000 and 20, 000 seedlings respectively for sale to government agencies and business enterprises for reforestation and plantation establishment. There are now a total of 150 - 200 hectares of giant bamboo plantations all over the country.

Despite the availability of the technology, the reason for its lack of application amongst more farmers is lack of information. To promote the technology further, investigations must be conducted into production and processing, as well as the market, to complete the whole business cycle.

A. **Selection/Collection of Planting Stock**

- Select branches from a good mother clump 15 years of age, which is subjected to regulated harvesting and has about 15-18 remaining culms..
- Select culms between one and a half to two years old. One culm can yield 10-15 propagules.
- Collect propagules by climbing the culm and cut only using a sharp saw or machete those branches that are bigger and are found on the upper portion of the culm. Propagules should have at least two nodes with live buds.
- Propagule/branch collection is best during harvesting of culms.

B. **Transport of Collected Propagules**

- Immediately after collection, planting materials must be placed inside wet sacks for ease of transport and protection from direct sunlight.
- If the planting materials are to be transported long distances they must be packed in boxes with wet sawdust and properly arranged to avoid dehydration, which will cause low germination.
- Haul the sacks of propagules from the harvesting area to the main road.
- Transport propagules to nursery.

C. **Planting Stock Preparation .**

- Soak the bottom of the branches in the mixture of 5-10% rooting hormone (1 tbsp. of hormone: 1 liter of water) for at least 3-5 minutes.
- Place the propagules in a clonal chamber (See below).

D. **Clonal Propagation (chamber size: 1 x 5m can contain 1500 propagules)**

- The substrate in the clonal chamber is composed of
  30 cm - 1st layer of washed stones
  30 cm - 2nd layer of washed gravel
  20 cm - 3rd layer of fine san
- Pour 100 liters of boiling water into the chamber as a treatment before use.
- Place the propagules inside the clonal chamber with the nodes completely immersed in the sand. In the absence of the clonal chamber, place the potted cuttings under the shade with 50-60% sunlight mulch with grasses and water daily.
- Leave the cuttings inside the chamber for 2 weeks, maintaining moisture by watering early in the morning.

- Note that high soil moisture contents or over shading favour fungal infection.
- Cover the clonal chamber leaving an opening that would maintain a temperature of 35^0C. A 2.5 cm opening lowers the temperature by 2^0C
- Ensure sunlight of at least 30-40% intensity reaches the clonal chamber.
- The chamber is covered with plastic to maintain a high relative humidity inside, which will hasten the growth of the root system.
- Water daily during the dry season and every other day during the wet season. Make sure the medium is dry before watering.

E. **Care of Stock in the Nursery**

- Pot the sprouted propagules in a one-part sand to two parts compost mix in plastic bags.
- Place the potted stock under the shade. Use a net with half centimetre holes and place leaves on top. One square metre will cover 100 seedlings. After the first month remove leaves to allow 30% sunlight penetration. In the second month increase sunlight penetration to 50-70% and remove the net in the third month.
- Water the potted stock daily at a rate of 5 litres per 100 seedlings. Reduce watering to 2-3 times weekly as the hardening period approaches.

F. **Hardening**

- The plantlets must be hardened off after they have developed leaves and root systems and before planting in the field. Keep for at least one month before planting out.

2.3 Propagation by single node culm cuttings by S.C. Malab, J.T. Agustin, S.Ma Pablico, and L.G. Battad.

This process is the most commonly used in the Ilocos Region to propagate *Bambusa*. The Mariano Marcos State University (MMSU) in Ilocos Norte has an on-going nursery activity from which proceeds of sales are used to purchase equipment for the University.

A. **Selection and Collection of Planting Stock**

- Select 2 to 3-year old culms from healthy clumps.
- Select nodes with well-developed buds. These can be found in the basal, middle, and on the top portions of the culm.
- Cut 5-8cm below the node and 10 to 13 cm above the node. A sharp crosscut saw or knife may be used for this purpose.
- Cut-off unwanted shoots and branches with a sharp knife.

B. **Rooting**

- The cuttings can be planted directly in 18 x 18 cm x 28cm black plastic bags provided sufficient water is available. Use a 2:1 mixture ratio of ordinary garden soil and fine river sand as the potting medium.
- An alternative is to set the cuttings in a misting bed. The misting bed is a rooting bed enclosed with a single line of hollow blocks and filled with river sand. The bed may be as large as 3 m x 5 m if many of cuttings are to be propagated. Use fine river sand as the rooting medium.
- Keep the misting bed moist everyday using a mist sprayer or sprinkler.

C. **Potting**

- Transfer the rooted cuttings to black plastic bags within 20 to 25 days.
- Fill plastic bags with ordinary garden soil mixed with sand in a 1:1 ratio. Compost may be added at 0.5 ratio. Fill half of the plastic bag with the mixture, plant the rooted cuttings and add compost until it is full.
- Apply 20 g 14-14-14 NPK fertilizer per bag and water immediately.

D. **Care & Maintenance of Stock in Nursery**

- Place potted plants under shade.
- Water the plants regularly and apply fungicides to control the spread of diseases.
- Remove weeds that compete with the plants. Cut all roots extending beyond the bottom of the bags as often as necessary to prevent permanent penetration into the soil.
- After two months, transfer the plants into the open to harden the newly developed shoots by exposing them under the sun.
- The plants should be ready for planting after 6 months.

3. Comprehensive input requirements

Cost and Return Analysis for one-node cuttings technology (please note that all costs have not been accounted for by each model as inputs -processes - outputs have not been detailed).

Source:	**CAASI**	**MILLIAN**	**MALAB**
ṘETURNS			
Price/seedling	*25.00*	*30.00*	*25.00*
COST *per seedling*			
Planting Material	***1.21***	***4.00***	***3.56***
Propagules (poles)	1.00	2.50	2.50
transport	0.15	1.50	-
Preparation of cutting			1.06
Chemical treatment	0.06	-	-
Rooting	***0.858***		
Incubation Process	-		*Misting Bed*
Labor:			
Planting	0.225		
Watering	0.225		
Material:			
Chemical treatment	0.208		
Water	0.20		
Potting	***1.945***	***4.50***	***3.62***
Labor:			
Mixing and planting	1.00	1.50	2.12
Polybag holes	0 .045		
Arranging		1.00	
Material:			
Soil and coir dust	0.40	1.00	
Fertilizer			0.25
Black plastic bag	0.50	1.00	1.25
Maintenance	*1.094*	*2.50*	*5.00*
Labor			5.00
Watering	0.60	1.00	
Weeding		1.00	
Pruning roots			
Materials:			
Chemicals	0.094		
Water	0.40	0.50	

Source:	CAASI	MILLIAN	MALAB
Delivery		*0.75*	
Labor: loading		0.50	
Misc. materials:		0.25	
DIRECT COSTS	5.107	11.75	12.18
Labor	2.095	5.00	7.12
Material	3.012	6.75	5.06
INDIRECT COSTS		3.00	
Supervision		1.00	
Food allowance		1.00	
Land lease		1.00	
EQUIPMENT COST	1.18	0.25	1.378
Incubation Site (bed)	1.18	-	1.378
Implements		0.25	
TOTAL COST	6.287	15.00	13.55
(Per seedling)			
NET RETURN	18.713	15.00	11.45
(Per seedling)			
THROUGHPUT TIME	60 days	90 days	150 days

4. Implementation - The Transfer of Technology Model

4.0 Proposed Transfer of Technology Model

4.1 Objectives

- General Objective - the establishment of a sustainable community based bamboo nursery enterprises.

- Strategic Approach

  - Dovetail bamboo seedling development projects with community strategic plans.
  - Institute innovative approaches including the fusing of indigenous and entrepreneurial practices for development of new products (bamboo utilization).
  - Institute the cornerstones for establishing successful sustainable bamboo development programs/enterprises through the crafting of mutually supportive and synergistic organizational structure:

Plan

1.	Creation of vision and blueprint.
2.	Develop an innovative strategy.
3.	Design a Bamboo Technology(and specific skills) portfolio which dovetails with market requirements.

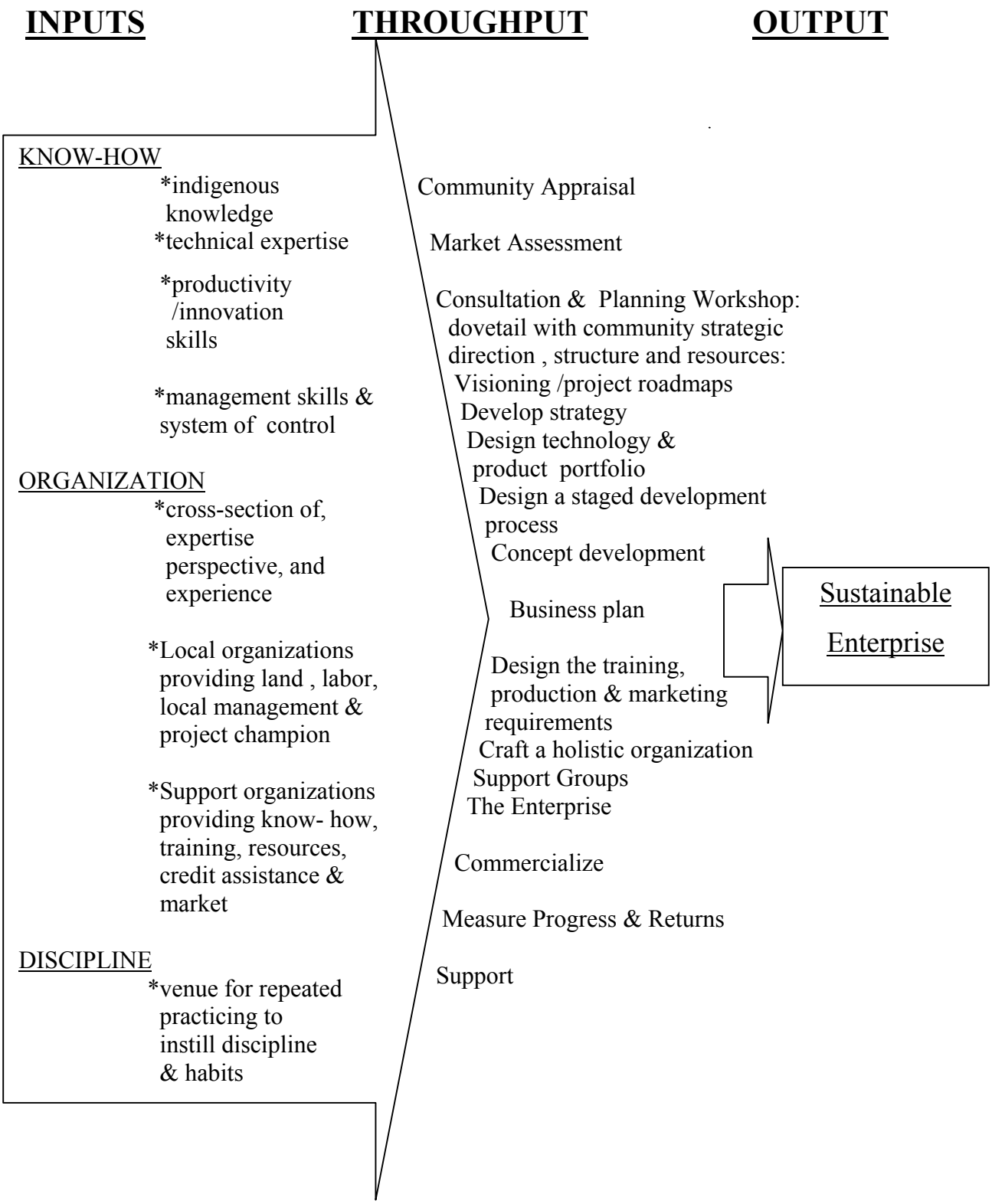
Define a Development Process

4.	Institute a staged development process that may be used for bamboo or any project in the community.

Craft a Holistic Organization

5.	Form Support Groups and Production teams
6.	Measure progress and returns to facilitate/systematize continuous improvement to assure sustainability.
7.	Establish a system of rewards.
8.	Infuse team values of: commitment to customer needs, commitment to excel, teamwork, trust, respect for the individual, and continuous improvement.

4.2 Framework



4.3 Planning Activities

A. Project Area Assessment

Should cover: Physical and natural resources such as type of land and soil to be planted to bamboo, source of water, accessibility; manpower resources and capabilities such as indigenous practices utilized to propagate bamboo, land ownership, sharing systems practiced, socio-economic profile of the community; government plans for the area, its present structure, programs and resources that can be utilized for the project.

B. Community Participation

- Assess the current situation and provide a clear definition of the problem.
- Ask the "community" to envision their future.
- Gather information relevant to project.
- Sort the information into categories to identify the themes and issues to be addressed in order to reach the future vision stated.
- Share the results and offer hope for solutions to address needs in a 7-day workshop.

C. Market Assessment

Establish customer requirements, product benefits, specifications, and scheduled requirements.

D. A 7 day Consultation and Planning Workshop

This will be held for the purposes of dovetailing with community strategic directions, structures and resources. The planning group will represent the desires of the community (Prepare questions to set participants' frame of mind before the workshop. Answers should be prepared before the workshop to serve as excellent discussion starters at the meeting.) - see appendix II: 2.0 for output requirements.

E. Prepare a Business Plan

F. Design

Establish training design, nursery design, test plan, qualification plan and marketing plan.

G. Craft a Holistic Organization & Community Enterprise

1. Craft the Environment.
- Formation of support groups (e.g. technical, market, credit assistance).
- Orientation/Team building/Values re-orientation.
- Install support mechanisms (e.g. infrastructure, policies).

2. Craft the Enterprise.

Form the production teams -take enough time to determine the right mix of team members, the appropriate team leader and the skills required of each. Forming, motivating, leading, and rewarding these teams will be tantamount to success

-

- Training:
    - technical(e.g. bamboo propagation)
    - management - production mgmt (INTACT: process>control>.improve)
        - supervisory skills
        - accounting

- Infuse norms and values - four guiding principles support an innovative culture:
    - Fairness.
    - Freedom to grow.
    - Making one's commitments and keeping them.
    - Consultation with other team members prior to any actin that may adversely affect the reputation or financial stability of the project/enterprise.

These values enable a team to work without a structure - making direct lines of communication possible without any intermediary, commitment to task or function. By creating norms and values that emphasize contributions of the entire team. A more effective organization can be created than one merely tied together through a hierarchical reporting relationships. As soon as these teams are pointed in the right direction through an agreed-upon set of norms, values, and clearly defined team goals, they begin actively to achieve them with the leader nurturing the group.

- Pilot:
    - Contracts and Reward Systems in place.
    - Systems and procedures in place.
    - Qualification or improvement of processes.

- Scale up to a level where "bugs "can be seen and corrected.

- Commercialize

H. Measuring Progress and Returns

Includes:

1. Project wide measures define the performance of resource investment efforts, and resultant return of technologies (skills) introduced.
2. Team performance measures define how well the methods and systems affect the financial returns of the enterprise.
3. Individual performance measures define the team member's contribution to the enterprise.

Support production, training and sales to satisfy customer needs -"whatever it takes". Monitor the project for at least 12 months and evaluate potential changes and improvements to be made.

4.4 Financial Control Model

The example here uses the branch cutting method data by M Decipulo and F. Binoya Jr. to demonstrate the financial model utilizing the InHand method.

1. Make a process flow chart (**Appendix II**: 3.1) and layout (see **Appendix II**: 3.2).

2. Make a process sheet that shows all material and labor standards being used (**Appendix II**: 3.3).

3. Check against a formula, that allows the enterprise to grow, to guide you if your process and cost is efficient compared to the price acceptable to the market (**Appendix II**: 3.4).

4. If costs are too high, return to the process sheet and force innovation on process improvement to happen to lower costs. This is done in consultation with the people in the front lines who know best how to do it.

5. Revise your process sheet and cost sheet until such time the percentages conform to the formula. This is the key to sustainability (keep it dynamic). By making processes efficient, using the price the market is willing to pay for the product as the target, the process points to the needed technologies required without compromise to labor earnings and allowing for capital build up, investments in research, development and marketing which allows to enterprise to grow.

6. Make a cost sheet to itemize cost of direct materials and labor, overheads, administrative expenses, interest expense, research and development (include training), and marketing expenses.

7. Cost out investments (3-5 yrs): (**Appendix II**: 3.5) equipment/tools/jigs/land/buildings

8.Make a Cash flow projection for 5 years (**Appendix II** 3.6. See 3.7 for plantation expenses).

9.Budget capital build up and shared returns to future investments for growth allowing one to realize the goals mapped out in the initial blueprint or vision.

APPENDICES

Examples of community bamboo nurseries in the Philippines - successes, failures and lessons learned

The Caasi Experience

In 1985, there was an acute shortage of propping materials for the banana plantations in Davao. Merdonio Caasi, a former schoolteacher and municipal councilor, was then involved in trucking and bamboo farming on leased lands for propping materials for the banana industry. It was not possible to generate enough planting materials to meet the demand. Several high-tech methods were tried to no avail and propagation remained slow, tedious and costly. By 1987, through continuos experimentation, Caasi's eldest son Jodel, together with two other farmers, Cervantes, and Lucas discovered that young bamboo culms 1.5 to 2 years of age were the ideal material for vegetative propagation by culm cutting for laak (*Sphaerobambos philippinensis*). As many as 6-8 cuttings could be produced from one young culm, depending on the number and maturity of the branches that had developed on the culm. With the introduction of rooting hormones and incubation beds, propagules took only 2 months to root and could then be planted out on a flat field. The mortality rate was also reduced to 10 per cent and then to almost zero depending on the management practices.

Thus, massive production of propagules followed on Caasi's three farms. Together with other participating farmers, the Caasis produced over 100,000 planting materials, dispersed propagules to 231 farm families in 15 municipalities in Davao del Norte, and successfully planted 250 hectares in one year.

With massive bamboo propagation technically possible, Caasi mobilized farmers and explained to them the different factors involved in bamboo cultivation. He demonstrated the planting out of the propagules and gave them the opportunity to try the technique under his supervision.

Planting materials and fertilizers were distributed according to the farmer's need and interest. In exchange, they had to return to Caasi six growing bamboo propagules or bamboo poles once able to begin harvesting from their fields. Caasi guaranteed the farmers purchase of any quantity of propagules and poles that they produced.

New groups were guided in terms of proper planting of seedlings. This was followed up with occasional field inspections. After a year and a half, they began propagule production under the supervision of experienced farmers. Once the expertise was acquired, these farmers introduced the bamboo propagation techniques to other farmers in the neighborhood. Thus the process of diffusion was accelerated.

To increase production Caasi mobilized village leaders to collect, stockpile and haul propping materials. They recruited farmers interested in participating in the bamboo planting. Caasi's private enterprise, SAWATA, took care of the hauling of propping materials from the farms to the plantations. Further, Caasi mobilized landowners of idle properties; he promised a percentage per pole for the land use. He also involved landless

farmers to do slash-and-burn cultivation in the area as laborers and caretakers; he paid one peso per pole for their labor. He also mobilized a finance consortium to provide working capital.

In summary, Caasi developed a series of support structures to achieve his goals:

1) The involvement of SAWATA Enterprises enabled the small farmers to access technical know how on bamboo propagation, obtain initial material inputs, facilities, connections for marketing of produce, and transport services for their produce.
2) The mobilization of a small group of financiers to provide working capital.
3) The implementation of three types of management contracts negotiated by Caasi:

a. The lease contract between Caasi as manager and private or public landowners. The contract for 25 years stipulates that in terms of rentals the owners will receive a share of the earnings based on the number of propagules and bamboo poles produced. The owner's share increases from 50 centavos per unit during the first five years to one peso per unit for the last five years of the contract. The plantation is returned to the owner at the end of 25 years. Landless farmers could involve themselves on the basis of labor inputs.

b. A contract was adopted for the development of five hectares of bamboo plantation initially to be utilized for the propagation of planting materials. The capital for the development of the plantation was provided by the finance consortium as the fourth party sharing.

c. The third contract was worked out between the Department of Agriculture (DA), the farmers cooperatives and SAWATA for the development of one-hectare bamboo nurseries in 15 municipalities in the province. Under this agreement, the DA would pay SAWATA for the expenses incurred in developing the nurseries. A similar contract was negotiated between the Department of Agrarian Reform (DAR) for the CARP beneficiaries (beneficiaries of land).

The opportunities for development of a bamboo industry were tremendous because of the needs of the flourishing banana industry at the time. Working capital was, however, the biggest constraint. The Land Bank of the Philippines only dealt with large cooperative federations to provide capital. Thus in February 1989, Caasi formed the Davao Bamboo Development Cooperative (DBDCI) in order to be able to access funds. A series of seminars on cooperative principles and procedures were conducted by the personnel of the Department of Agriculture with 24 bamboo planters.

Cooperative chapters were then organized. Members had to comply with a number of requirements before they could be accredited as fully pledged members of DBDCI. Their attendance in seminars was one basis for the distribution of propagules. Every three months, the farms were visited to check if the propagules were planted and were growing. If the results were satisfactory, the farmers were provided with more seedlings upon their request. By the time they had planted a minimum of one hectare, they would be accepted

as a bonafide member of the cooperative. The cooperative facilitated the transfer of technology, distribution of planting materials and the organizational process

While the cooperative was still building its capital base and strengthening its organizational and technical skills, the threat from well financed trucking firms engaged in the hauling of propping materials who dealt directly with banana plantations made it even harder to build up capital and maintain cohesiveness within the organization. It was tempting for individual farmers to sell directly to these buyers, bypassing the cooperatives and avoiding the related deductions which contributed to their capital build up.

By 1993, the world price for bananas had crashed leaving the bamboo industry without a market for their produce. Industrialists looked into the possibilities of paper pulp production using bamboo as one of the major raw materials, but there were not enough bamboo stands to begin with and the prices offered to the farmers were half of what they were used to. Meanwhile, loans had to be paid back - by farmer beneficiaries, the cooperatives and management teams and the whole bamboo industry collapsed in Davao. Though other products were looked into (e.g. floor board, incense sticks, chop sticks), the basic problem was that the farmers cooperatives were not well organized and the price they wanted for their produce was too high for the quality of their produce

The TABARGA Experience

The Department of Natural Resources through its Ecosystems Research and Development Service, Region VI, Iloilo City initiated the Research Development Project: *Demonstration and Pilot Application of Technology Packages and Production Systems on Bamboo and Rattan.* The R&D aspect of the project was spearheaded by Binoya Jr.

The project's objective was to transfer and commercialize technologies for the propagation and utilization of bamboo and rattan via radiation for improved ecological and livelihood security. The starting point was an area selected representing a lowland community that is essentially a wasteland. The people were not skilled on ways to rehabilitate or reclaim the area. Through the municipal mayor of Duenas, a ten-hectare property was utilized as pilot area. The soil was generally silty loam, the climate - dry from November to May and wet the rest of the year, the topography was flat to rolling in character.

The TABARGA Multi-Purpose Cooperative was formed with 22 members - 68% who were farm owners, and the remaining 32% who were laborers with an average annual income of 9500 pesos. Ninety two percent of the beneficiaries were married with 6.7% average household members. Of the beneficiaries, 40% had completed a primary level education, 32% had finished the secondary level, and 28 % had graduated from technical courses or obtained a Bachelor's degree.

The project was implemented in 1994 through the DENR-ERDS as implementers, the Municipality of Duenas as conduit implementers and the Association and individual farmer cooperators as beneficiaries with a contract binding for a period of 20 years.

At the start of the project, a staff house was constructed in the area for the science research specialists: a nursery lath house; and vermi-clonal chambers; and water pumps. Twenty thousand rattan germinants were propagated by the beneficiaries and family members. A total of twenty thousand rattan germinants and 408 bamboo propagules were produced in the nursery in preparation for planting-out during the rainy season. A three hectare rattan plantation and two-hectare bamboo plantation were established in the ten-hectare project site. Nurse trees, Ipil-ipil and *Acacia mangium*, were planted 1 metres away from the rattan. Two hectares of communal forest were established with the same variety of trees and 2 hectare pili-nut trees. During the long gestation period of bamboo and rattan, other livelihood components were implemented. Sericulture was introduced after establishing a one-half hectare Mulberry nursery plantation. A cocoon rearing house was also constructed. In addition, swine production, vegetable production and upgrading the native chicken breed were started.

In terms of project implementation, in the first year, the management style was more autocratic, in the second year it was more democratic and in the last year (the phase out period of the scientists) a laissez-faire style was used to turn over smoothly the cooperative transactions to the members. In terms of sharing the cooperative provides the planting materials. When sold, the cost is deducted and the balance derived is divided in two. Half is added to the farmer's capital share in the cooperative and half is remitted to the farmer.

At present, the Cooperative has a Sari-sari store (convenience store). Rattan poles are now 5-8 meters in length. The cooperative is worth 8 million pesos today including their plantation.

The Dariwdiw Bamboo Craft Association Experience

Agricultural schools in the country have fourfold functions of instruction, research, extension and production. They generate and promote technologies as well as provide public services in response to various clientele. The Dariwdiw Association in Batac, Ilocos Norte was the result of a bamboo project implemented by the Mariano Marcos State University (MMSU) to promote knowledge of existing bamboo technologies stored in the University. Dariwdiw was selected due to the bamboo stands that abound in the community. It is basically a farming community settled along hillsides and around a lake. The residents grow rice, garlic, tobacco, tomatoes, vegetables and fish.

The bamboo stand owners wanted to know how to increase the productivity of their old bamboo clumps, control of rat infestation, and increase the present number of clumps. They also wanted to be trained in the latest technologies for furniture making and acquire the tools and machinery necessary for doing so. They also had a great need for marketing.

The activities undertaken by the University were a series of training programs and study tours. The cooperators were trained on-site in bamboo production including nursery operation, plantation establishment, and old clump rehabilitation. One of the important results was the learning of how to propagate bamboo planting materials using the one-node cutting technology, which was refined at the University. The cooperators were taught the horseshoe and cross pattern techniques to rehabilitate their old bamboo clumps. They made them realize that cleaning provides wider space enabling the development of the shoots and reduction of damage caused by rats.

To prepare the cooperators for bamboo craft and furniture manufacture, the project staff brought them to CITC to see different machinery and technologies available for the processing of bamboo as well as recent designs of kawayan furniture and crafts. After the field tour, the cooperators went through a series of training programs on bamboo furniture manufacture at the Mariano Marcos State University Bamboo Training Center. A 24 square meter training hall at the project site was built to house different tools given to the cooperators. After training, the cooperators individually produced furniture. However, with the lack of market, only a few continue to do so today.

Lessons Learned from the Three experiences shared

On the Technology

1. Branch cuttings are also used as propagules.

2. A rooting system through root hormones and misting is done before potting to increase survival rate.

3. Other income can be generated simultaneously through vermi-culture composting which are support systems to bamboo propagation.

4. Standards arrived at for the one-node cuttings technology :

-
- Bamboo propagation ratio : 2 culms gives an average of 3 new shoots
- 1-2 year old culms from three year old clumps are the best propagules
- 10 (*S. philippinensis*) to 15 (*Bambusa*) cuttings can be taken from one culm
- The growth and pattern of a clump is shown below: (please note that the more one cuts off the old culms , the better the growth rate of new culms)

Year of Harvest	Total culms per clump	Culms cut for propagules	Culms left standing
Year 1	1-2 culms		
Year 2	3 culms		3 culms
Year 3	5 culms	2 culms	3 culms
Year 4	7 culms	3 culms	4 culms

Year 5	11 culms	4 culms	7 culms
Year 6	17 culms	7culms	10 culms
Year 7	25 culms	10 culms	15 culms
Year 8	37 culms	15 culms	22 culms

- At 400 to 500 clumps per hectare, depending on the species, the number of cuttings that can be cut for propagules annually is: (400 clumps/ha; at 10 cuttings/culm)

Year of Harvest	No. of culms harvested for propagules	No. of cuttings generated annually
3rd yr.	2 culms	8,000 cuttings
4th yr.	3 culms	12,000 cuttings
5th yr	4 culms	16,000 cuttings
6th yr.	7 culms	28,000 cuttings
7th yr.	10 culms	40,000 cuttings
8 th yr	15 culms	60,000 cuttings

- Land requirements for 60, 000 seedlings:
  Nursery: 3000sq. m. of flat land for 10, 000 seedling capacity x 6 cycles (60 days/ cycle) = 60, 000 seedlings
  Propagule plantation : 1 hectare for 60, 000 seedlings

On the Enterprise

- The development of a bamboo business should be planned carefully in line of trends and development in its intended market especially if the market is agriculturally-based with an export orientation.

- The Davao experience demonstrates that an enterprise cannot stand alone. If related services and infrastructure are lacking, then support groups of anchor groups must first be put into place to support and nurture the enterprise to its maturity. Anchor units can take the place of formal support structures not yet in place. Anchor units are effective because they share the interest, concerns and circumstances of the farmers group that it wishes to influence in addition to providing farmers with the technology, material inputs, emergency requirements or market.

- A system of sharing that works, and is easy to comprehend, may be used as the basis for facilitating joint ventures with private investors, or land owners and even the local government in order to provide the capital base needed to get a project underway. Imposing a complex organizational structure on a group in a rural community that is not familiar with its implications is counterproductive. Organizational structures for self-help should be allowed to evolve. All inter-related operating units may eventually

evolve into multi-layered and complex organizational structures as the project itself evolves.

- When a group or community begins to interact with formal institutions, particularly the financial sector, it should be prepared for more complex organizational and administrative tasks. External professional organizational assistance is needed at this stage together with accounting and control system skills

- Ways to provide opportunities for the farmers to see the new technologies at work are: visits to other farms where the new technologies have been successfully implemented; involvement of experienced farm management groups in setting up and managing the farm for a specific period of time with the farmer-beneficiary as apprentice.

- Self help programs are more effective when headed or led by those in the community who enjoy a certain degree of esteem, are financially secure, and with keen interest in innovative approaches to community development.

- In the experiences of Iloilo and Ilocos, transfer of technology by the government agencies and universities were not sustainable as they did id not consider the entire business cycle, from production to consumption in the planning process. It is necessary to complete the business cycle or open the channels from raw material supply, to product development and production/ processing and finally to the market in order to be successful in implementing a sustainable business..

Appendix II

1.0 COST & RETURN ANALYSIS (exchange 40pesos: 1 US dollar)

1.1 Source: Caasi for 10,000 Laak plantings

	COST
A. Acquisition of Materials	
1. cuttings - 10,000 pcs x 1.00	10,000
2. packing	
3. transport	1,500
4. treatment (Captan) x 2 no	600
sub-total	12,100
B. Incubation site	
1. materials for shed	3,000
2. labor of incubation site (4 mp x 3 md x 150/da)	1,800
3. drum	7,000
sub-total	11,800
C. Incubation process	
1. labor for planting (5mp x 3 da x 150/da)	2,250
2. treatment (4 kgs Captan x 300/kg)	1,200
(4 bot - Hexaplus x 120)	480
3. water bill for 10 cu. l x 10 days x 20 / cu. l.	2,000
4. sevin Larsban (1 x 400)	400
5. labor for watering for 15 days (1mp x15da x 150)	2,250
sub-total	8,580
D. Bagging/transplanting	
1. soil mix = 1part soil : 1 part coir dust	
(1 liter/ bag)(1 cu. m. : 100 bags)	
(10,000 planting = 10 cu.m. x 300)	3,000
(coir dust = 10 cu.m. x 100)	1,000
2. labor for soil mix and planting (10,000pcs x 1/bag)	10,000
3. plastic bags (10,000 x 0.50/bag)	5,000
4. punching plastic bag (3 md x 150)	450
sub-total	19,450
E. Maintenance	
1. insecticide/fungicide (every 7 days:	
2 bot Hexaplus x 120 = 240	
1 bot larsban x 400 = 400	
1 kg Captan x 300 = 300	
940	940
2. labor for everyday watering	
21-60 = 40 days x 1md x 150	6,000
3. water 1 cu m/da x 40 da = 40 cu m. x 100	4,000
Sub total	10,940
Total Expense	62,870
Cost per Seedling (material & labor)	6.287

REVENUE: 10,000 PLANTINGS x 25 pesos	**250, 000**
RETURN: 297% IN 72 DAYS	**187, 130**

1.2 Source: Millan for laak in Davao

Davao costings	phase 1	phase 2	phase 3
Cuttings	2.50	1.25	3.75
Transport cuttings	1.50	0.75	2.25
Soil	1.00	0.50	1.50
Plastic bag	1.00	0.50	1.50
Bagging	1.50	0.25	2.25
Water	0.50	0.25	0.75
Watering	1.00	0.50	1.50
Weeding	1.00	0.50	1.50
Arranging	1.00	0.50	1.50
Loading	0.50		0.50
Land rental	1.00		1.00
Implements	0.25		0.25
Food allowance	1.00		1.00
Supervision	1.00		1.00
Miscellaneous	0.25		0.50
Sub-total	15.00	5.50	20.50

Additional costs for Manila Operation

Air freight of cuttings	10.00
Packing	2.00
Handling	3.00
Travel Expenses	5.00
	20.00

Davao Price	30.00	Manila Price	50.00
Production	20.50	Production	40.50
Net	9.50	Net	9.50
Return	46.34%		

1.3 Source: Malab et al 1994, Bamboo Technology, MMSU Batac Ilocos Norte

Cost and return analysis of bamboo material production per 100 culms.

ITEM		COST
I. Costs		
Materials		
100 bamboo culms		3,000
6 cu m fine river sand		1,000
100 pcs hollow block 20 cm		400
100 pcs. 18x18x28 cm black plastic		1,500
Fertilizer 14-14-14 NPK		300
Labor		
Preparation of cuttings		1,270
Construction of misting bed		254
Soil media preparation and bagging		2,540
Maintenance (watering, weeding, root pruning)		6,000
Total Cost		16,264
II. Returns	Php pesos	30,000
Number of seedlings that can be produced		1,200
Price per seedling	Php pesos	**25**
III. Net Return		13,736
Cost per Seedling		**13.97**
IV. Return Above Variable Cost (RAVC)		**84%**

Appendix II: 2.0 The 7-day Consultation Workshop

2.1 Agenda

- Define goals of the community and gaps to be filled.
- Develop the bamboo vision and blueprint, covering broad goals and expectations, dovetailing with the community's strategic direction.
- Design a development process, including decision points.
- Identify people, resource requirements and potential leaders and members.
- Define rewards, compensation, and measurement approaches.
- Establish norms and values to guide communications and behavior.
- Summarize Project Plan.

2.2 The written outputs of the Consultation Workshop (Project Plan) can be summarized as follows:

1 The description of the vision
2 The project blueprint
3 The strategy -

- Financial growth gap the project will fill in the next 5 - 10 years
- The objectives to be met with emphasis on financial objectives
- The strategic roles the project will try to satisfy
- The screening criteria to be used for moving ideas and concepts through the development process. This will separate "can do" from "would like to do" concepts.

4 The technology portfolio plan and technical areas of expertise necessary for developing the project.

5 Define the development process: (see box below)

6 An assessment of people and resources required to activate the strategy

7 A list of potential leaders, and team leaders for the project - full time, dedicated team leaders and team members should represent a mix of different functional areas to provide a cross-section of expertise, perspective, and experience.

8 A description of the compensation system for the participants according to expectations and tangible results.

9 A compendium of rewards to use to motivate teams - rewards that recognize performance.

10 The criteria and measurement approach for evaluating effectiveness of the enterprise, the team, and the individual.

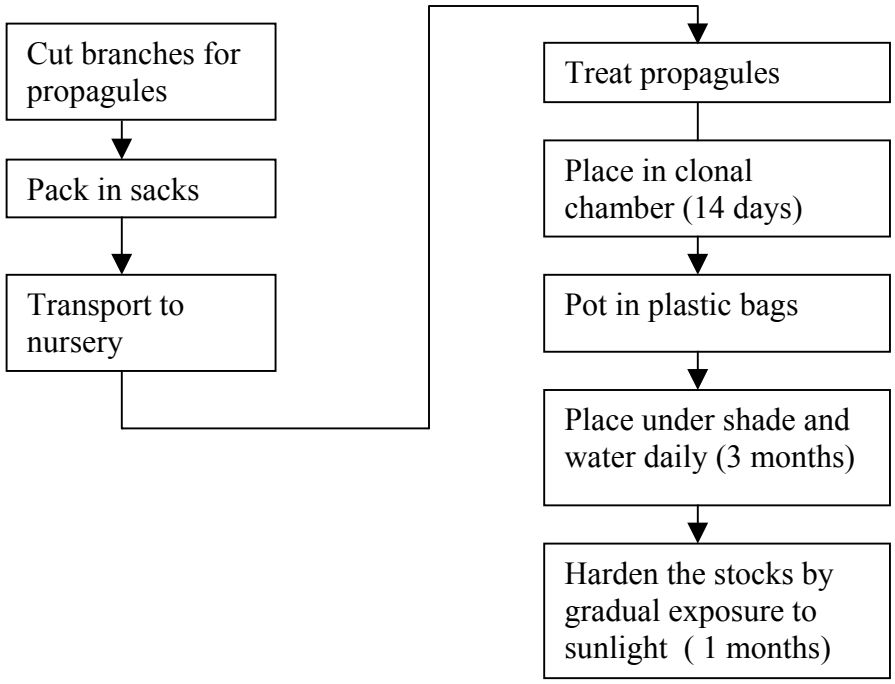
11 An initial set of innovation norms and values-based leadership - values are shared goals, beliefs, ideals, and purposes of a group. They invoke inner convictions and emotional feelings among group members.

12 The communications plan

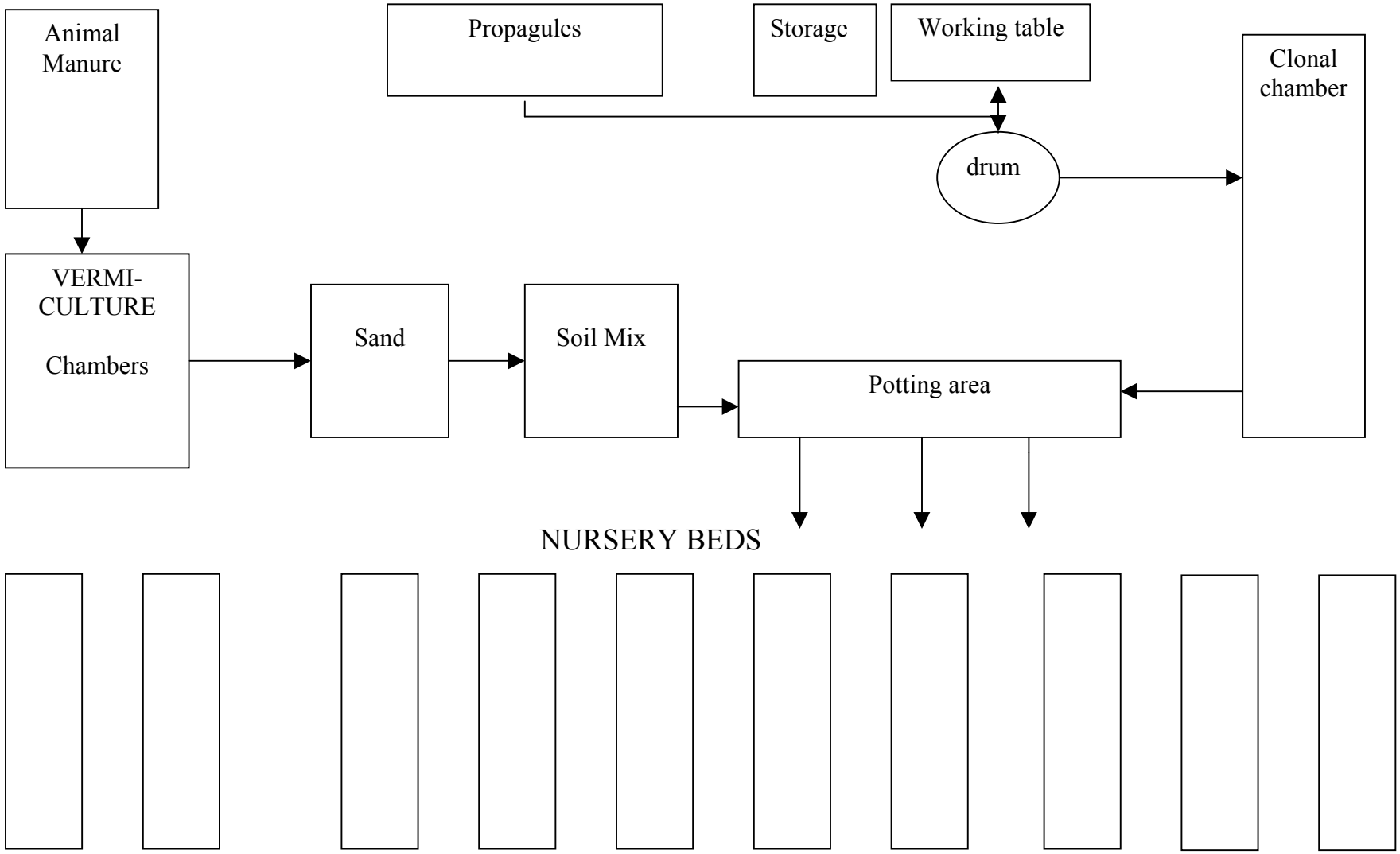
Refer 5 above: THE DEVELOPMENT PROCESS

ADVANCED PLANNING
Plan the directions of the project. Synchronizing product, technology, manufacturing, infrastructure, and training roadmaps.
DEFINITION
Define the development of the project participants. Match customer needs with product benefits. Establish resource requirements and market assessments. Prepare a business plan.
DESIGN
Establish training design decisions, propagation and marketing decisions. Develop specifications for the product output and specifications for suppliers of materials
DEMONSTRATION
Train the participants on the core expertise required to run the project. Dovetail training with *pilot* acceptance test runs to appraise performance.
Scale up to a level with large enough quantities to identify "bugs and problems".
Market test - select a market or area; educate target buyers or farmers
COMMERCIALIZE - introduce the project or product to the market/community by initiating awareness.
SUPPORT
Support production, training and sales to satisfy customer needs -"whatever it takes". Monitor the project for at least 12 months and evaluate potential changes and improvements to be made.

Appendix II: 3.1 Propagation flow chart



Appendix II: 3.2 Nursery flow chart



Appendix II: 3.3 Process Sheet (Branch Cutting Method)

INPUT *Material*	*UC*	PROCESS		*MP / Equip*	OUTPUT	COST *Labor*	*Materials*
		1.0 Propagule Collection					
D. asper clump 15 years old with 15-18 culms		1.1.1 Select a 4 year old culm.					
A 4-yr old culm can yield 10-15 propagules with at least 2 nodes w/ live buds		1.1.2 Climb the culm. (or cut the culm for utilization)					
		1.1.3 Cut the branches for propagules.	1	"Bolo"	150 pcs/md	1.00/prop	
150 propagules/sac jute sacks	8 /sac	1.2.1 Pack the propagules in sacks.	1	Sacks	10 sacs/md	0.01/prop	
4 sacs of propagules per sled	150/sled	1.2.2 Haul the sacks to the main road.		Carabao sled			0.25
16 sacks /multicab	240/trip	1.3.1 Load the sacks in the multicab.					
		1.3.2 Transport the sacks to the nursery.		Multicab			0.10
Unit cost /propagule = 1.36						**1.01**	**0.35**

INPUT *Material*	*UC*	PROCESS	*MP*	*Equipment*	OUTPUT	COST *Labor*	*Materials*
		2.0 Nursery Activities					
Rooting hormone (10 ml per litre water) 1600 p/120mg pot	120/120mg	2.1 Treat propagules with rooting hormone (3-5 min submerged)	1	Drum	2500p/md	0.06	0.075
100 litres boiling water		2.2 Treat clonal chamber					0.02
1500 propagules in a 1x5m chamber		2.3 Place in clonal chamber (15 days for propagules to sprout).	1	Clonal chamb.	3000p/md	0.05	1.36
10 l water/d (15 days) 150 liters /1500 p	0.03/l	Water every day in the morning during dry season.	1	5 litre sprinkler	10,000/md	0.225	0.003
Sprouted propagule		2.4 Pot into plastic bags.	1		150 pots/md	1.00	
Plastic bag 15x20cm	0.50/bag	Punch holes in bags.	1		3333/md	0.045	
1.3 kg bag of soil mix:							
1 sand 0.45kg :	600/m^3				3000 bags/m^3		0.18
2 compost 0.9kg	2.50/kg						2.25
		2.5 Place pots under the shade.	1	Nursery shade w/net	150 pots/md	1.00	
5 liter water / 25 pots 4 liter/pot for 90 days	0.03/l	Water daily for 3 months in the morning.	1	5 liter sprinkler	10,000/md	1.35	0.12
Water 3 times per week	0.03/l	2.6 Harden the stocks through exposure to sunlight for 1 month.	1	Hose	10,000/md	0.18	0.12
unit cost: 8.038		**throughput : 140 days**				**3.91**	**4.128**

INPUT		PROCESS		OUTPUT	COSTS	
Material	*UC*		*Equipment*		*Labor*	*Materials*
		3.0 Vermi-Culture				
1000 kgs of Animal manure	0.50/kg	3.1 Place manure in vermi chamber. Leave until temperature reaches 25 -30^{0}C.	1m x 1.5 m x 0.9 m Vermi - chamber Alcohol thermometer	1 chamber/md	150	500
1 kg vermi-breeders	250/kg	3.2 Put breeders into chamber keep in chamber for 2 months.				250
Water source		Water as required once a week.				
		3.3 Harvest 80%of the total weight of the compost. Leave 20% for the vermi breeders for continued production.				800 kgs
1000 kgs				800 kgs	150	750

UNIT COST(labor and materials) $\frac{900}{800} = 1.125$

Return: 2.50 / kg

Net return: 1.375/kg

Appendix II: 3.4 Branch Cutting Seedlings Cost and Return Analysis (40 pesos = US $1) **using the InHand Formula**

100%	***Return***:	*Annually*					
	Price per seedling	20.10 nursery gate	x 3 turnovers annually	x 20,000 seedlings	=	pesos	1,206,000
	Cost:						
	Labor	3.91					234,600
	Material:	4.128					247,680
40%	L&M	8.038 (see appendix 3.3 for details)					482,280
10%	Overhead	2.01					120,600
5%	Admin Exp	1.005					60,300
5%	Tools, Equipment	1.005					60,300
2%	Working capital interest expenses	0.402					24,120
5%	R&D investment	1.005					60,300
5%	Marketing expenses	1.005					60,300
72%	Total Cost	14.472					868,320
10%	Capital Build-up	2.01					120,600
6%	Capital share	1.206					72,360
6%	Mgmt share	1.206					72,360
6%	Labor share	1.206					72,360
28%	Net returns	5.628					337,680

Profit Margin 28% ROI: 28% x 2.70 = 75.6%

Rate of Turnover: 1,206,000 = 2.70
446,300 (see appendix 3.6)

Appendix II: 3.5 Investments Costs for 20, 000 seedlings x 3 turnovers annually

		Cost	
Land - 3000 sq. m	(50 pesos/sq. m)	150,000	Community investment
Perimeter fence 260 m	(100 pesos /lm)	26,000	
Shed: 210 sq. m.	(1000 pesos/sq. m)	210,000	
Sub-Total:		386,000	Earns cash returns through capital share over 5 years

Equipment Investments (1st year)

1 no. -	10 sq m clonal chamber with 3 layers of stone, gravel, sand	(1000 pesos/sq.m.) 10,000	
1 no. -	plastic treatment drum	1,000	
	working tables/vats	4,500	
1 no. -	thermometer	200	
6 set-	plastic 5-liter sprinkler	1,200	
1720m -	net with half a cm hole (20)	34,400	
150 m	garden hose	2,700	
6 no.-	vermi culture chamber 1.5/sq.m/chamber	4,500	
1 no. -	cart	1,800	
Sub-Total: Equipment Investment		60.300	Payments taken from T/J/Equipment budget

TOTAL INVESTMENTS 1st year 446,300

NOTE: Investment for 2nd year to come from capital build-up portion of the 1st year.

One hectare land near water source required for propagule plantation.

Appendix II: 3.6 CASH FLOW (P4 0= USD$1)	**YR 1**	**YR2**	**YR3**	**YR4**	**YR5**
INFLOWS:					
Community Capital Investment	236,000				
Loan for working capital at 12% / annum:	200,000				
Loan for Equipment Expenditures at 12%	60,300				
Sub-Total Inflows	496,300				
Cash Sales Inflows for 40,000 seedlings	804,000				
Cash Sales Inflows for 60,000 seedlings		1,206,000	1,206,000	1,206,000	1,206,000
TOTAL INFLOWS	1,300,300	1,206,000	1,206,000	1,206,000	1,206,000
Cumulative Inflows	1,300,300	2,506,300	3,712,300	4,918,300	6,124,300
OUTFLOWS:					
Equipment expenditures 1st yr	60,300				
Shed and fence	236,000				
1 hectare plantation land purchase		200,000			
plantation expenses		10,600	2,450	2,100	2,100
Material and labor for 60,000 seedlings	482,280	482,280	482,280	482,280	482,280
Overheads and admin exps for 60,000 seedlings	180,900	180,900	180,900	180,900	180,900
Interest for working capital	24,120	24,120	24,120	24,120	24,120
R and D and marketing expenses	120,600	120,600	120,600	120,600	120,600
TOTAL OUTFLOWS	1,104,200	1,018,500	810,350	810,000	810,000
Cumulative Outflows	1,104,200	2,122,700	2,933,050	3,743,050	4,553,050
DIFFERENCE BETWEEN ANNUAL TOTALS	**196,100**	**187,500**	**395,650**	**396,000**	**396,000**

Appendix II: 3.7 Source: One-hectare giant bamboo plantation in Western Visayas for ten years

Activities	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	TOTAL
A. Materials											
1. Giant Bamboo (potted)	5.500										5,500
2. Fertilizers (14 -14 -14)	400	400	400	400	400	400	400	400	400	400	4,000
Subtotal	5,900	400	400	400	400	400	400	400	400	400	9,500
B. Plantation Establishment											
1. Site Preparation (Staking, strip brushing hole digging)	2.000										2,000
2. Planting (hauling, distribution)	1,500	350.									1,850
Subtotal	3,500	350									3,850
C. Maintenance											
1. Weeding, brushing and fertilizer	1,200	1,700	1,700	1,400	1,400	1,400	1,400	1,200	1,200	1,200	13,800
Subtotal	1,200	1,700	1,700	1,400	1,400	1,400	1,400	1,200	1,200	1,200	13,800
D. Harvesting Cost					4,000	4,000	5,000	5,000	5,000	5,000	28,000
E. Total Expenses	10,600	2,450	2,100	1,800	5,800	5,800	6,800	6,600	6,600	6,600	55,150
F. Gross Production					50,000	50,000	60,000	60,000	60,000	60,000	340,000
G. Net Income					44,200	44,200	53,200	53,400	53,000	53,400	284,850
H. Return of Investment (ROI)					194%	762%	782%	809%	803%	809%	516%

Assumptions: Seedling Cost = 50 pesos
Ave no. of culms/yr/clump = 5 (yrs 5-8)
Price per culm = 100 pesos
Planting distance = 10m x 10m