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DEPARTMENT OF TRADE AND INDUSTRY - COTTAGE INDUSTRY TECHNOLOGY CENTER

FORMULATION OF A MASTER PLAN FOR THE DEVELOPMENT OF BAMBOO AS A RENEWABLE AND SUSTAINABLE RESOURCE

DRAFT FINAL REPORT

July 1997

ORIENT INTEGRATED DEVELOPMENT CONSULTANTS, INC. (OIDCI)

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ORIENT INTEGRATED DEVELOPMENT CONSULTANTS, INC.

29 July 1997

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Subject: Draft Final Report on the Formulation of the Master Plan for the Development of Bamboo as a Renewable and Sustainable Resource

Dear Dir. Navera:

We are pleased to submit three copies of the Draft Final Report on the Formulation of the Master Plan for the Development of Bamboo as a Renewable and Sustainable Resource.

Please let us know if you have any comments.

Thank you.

Very truly yours,

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2

TABLE OF CONTENTS

ACRONYMS

1.0 BACKGROUND 1 - 1

2.0 OBJECTIVES 2 - 1

3.0 SCOPE AND METHODOLOGY 3 - 1

4.0 ASSESSMENT OF THE BAMBOO INDUSTRY 4 - 1

4.1 Bamboo Resources and Production 4 - 1

4.1.1 Bamboo Species 4 - 1
4.1.2 Bamboo Production and Management 4 - 6

4.2 Processing and Utilization 4 - 18

4.2.1 Furniture 4 - 18
4.2.2 Handicraft 4 - 24
4.2.3 Construction Materials 4 - 28
4.2.4 Basketry 4 - 32
4.2.5 Fishing and Agriculture 4 - 32
4.2.6 Food 4 - 32
4.2.7 Pulp and Paper 4 - 33

4.3 Marketing 4 - 38

4.3.1 Philippine Market 4 - 38
4.3.2 World Market 4 - 58

4.4 Institution and Policy Environment

4.4.1 Bamboo Firms and traders as market Institutions 4 - 67
4.4.2 Industry and Trade Associations 4 - 69
4.4.3 Research, Development and Training Agencies and Institutions 4 - 71
4.4.4 Other Supporting Agencies and Institutions 4 - 71
4.4.5 International Organizations: Mandate and Activities 4 - 72

4.5 Policy Environment

4.5.1 General Policy Direction and Goals 4 - 73
4.5.2 Macroeconomic Policies Affecting the Bamboo Industry 4 - 74
4.5.3 Sectoral Policies Affecting the Bamboo Sector 4 - 78
4.5.4 Support Mechanism and Services 4 - 80
4.5.5 Perceptions of Bamboo Enterprises 4 - 85

5.0 DEVELOPMENT ISSUES, PROBLEMS/CONSTRAINTS AND THREATS 5 - 1

5.1 Bamboo Resources and Raw Material Production 5 - 1

5.2 Technology, Processing and Utilization 5 - 2

5.3 Marketing 5 - 3

6.0 STRENGTHS AND OPPORTUNITIES 6 - 1

6.1 Bamboo Resources and Production 6 - 1

6.2 Processing and Utilization in Various Industries 6 - 1

6.3 Marketing and Trade 6 - 2

7.0 THE PLAN 7 - 1

7.1 Vision and Development Thrust 7 - 1

7.2 Development Goals and Objectives 7 - 1

7.3 Development Framework 7 - 1

7.4 Strategic Directions 7 - 3

7.5 Development Scenarios and Growth Targets 7 - 5

7.5.1 Without Intervention and Development Plan 7 - 5
7.5.2 With Intervention and Development Plan 7 - 6
7.5.3 Market Focus 7 - 8

7.6 Agenda For Action 7 - 9

7.6.1 Bamboo Resource Management 7 - 9
7.6.2 Technology Development, Promotion and Commercialization 7 - 11
7.6.3 Market Development 7 - 13
7.6.4 Institutional and Policy Strengthening 7 - 16

7.7 Implementation Structure 7 - 17

7.8 Timetable for Master Plan Programs and Intervention 7 - 18

7.8.1 Resource Management 7 - 18
7.8.2 Technology Development, Promotion and Commercialization 7 - 19
7.8.3 Market Development 7 - 19
7.8.4 Policy and Institutional Strengthening 7 - 20

7.9 Indicative Cost of the Master Plan Activities 7 - 21

LIST OF TABLES

Table 4.1.1 Number of Philippine bamboo taxonomically recognized and published by various authors
Table 4.1.2 Area of utilization and specific uses of bamboo in the Philippines
Table 4.1.3 Specific uses of 10 common bamboo species in the Philippine
Table 4.1.4 Availability of bamboo in nine provinces of the Philippines, 1983
Table 4.1.5 Bamboo resource in dipterocarp forest (RP-German Forest Resources Inventory 1988) in million lineal meters (lm) and million culms
Table 4.1.6 Regional distribution an volume (no. of clumps) of different bamboo species in the Philippines (partial data)
Table 4.1.7 Total number of clumps and aggregate are covered with bamboo by province, Region I
Table 4.1.8 Existing bamboo plantations in Region 3 as of December, 1993
Table 4.1.9 Estimated number of hectares planted to bamboo in Region IV by province
Table 4.1.10 List of existing private bamboo plantations

Table 4.1.11 Total area of DENR bamboo plantation projects by location
Table 4.1.12 Estimated total aggregate area planted to erect bamboos and pole/culm production in the Philippines from various sources
Table 4.1.13 Recommended age, size/number of nodes and portion of the culm for selected bamboo species in the Philippines
Table 4.1.14 Site requirements and geographical distribution of commercially important bamboos in the Philippines
Table 4.1.15 Recorded productivity estimates of some bamboo species in the Philippines
Table 4.1.16 Five-year growth performance of eighth bamboo species variably planted in six plantation sites
Table 4.1.17 Comparative assessment of different methods of propagation
Table 4.1.18 Financial projection of cash flows for bamboo plantation development (in pesos per hectare)
Table 4.2.1 Product lines of bamboo furniture
Table 4.2.2 Aspects of needed product quality improvements by size of enterprise
Table 4.2.3 List of tools, machines and other equipment for bamboo handicraft and furniture production
Table 4.2.4 Facilities, tools and equipment
Table 4.2.5 Design derived from weaving patterns
Table 4.2.6 Fiber dimensions and derived values of some Philippine bamboos
Table 4.2.7 Chemical composition of some Philippine bamboos
Table 4.2.8 Kraft or sulfate pulping and physical test data at 300 ml CSF of some Philippine bamboos
Table 4.3.1 Estimated number of bamboo market participants, Philippines
Table 4.3.2 Number of bamboo firms by location, business type, year established, operator type, number of employees and product type, Philippines
Table 4.3.3 Socio-economic characteristics of bamboo participants, Iloilo, Negros Occidental and Abra, 1995
Table 4.3.4 Roles and function of market participants, CAR and Region VI, 1995
Table 4.3.5 Number of bamboo licensees, allowable cut and harvest, Philippines, 1970-1995
Table 4.3.6 Import volume and value and unit import value of bamboo poles by year, Philippines, 1981-1995
Table 4.3.7 Country sources of bamboo imports and their respective market shares, Philippines, 1981-1995

Table 4.3.8 Estimates of raw material requirements (poles) for furniture, handicraft and basket making industry in Region I
Table 4.3.9 Distribution of bamboo users and bamboo sources, number of bamboo poles used per dwelling unit, and household bamboo users market index, by province, Central Visayas
Table 4.3.10 Projected demand for bamboo by province, Central Visayas 1990-2015
Table 4.3.11 Projected demand for bamboo, Philippines, 1995-2015 ('000 culm)
Table 4.3.12 Volume and value of bamboo exports by product type and year, Philippines, 1981-1995
Table 4.3.13 Bamboo by product category, Philippines, 1996-1997, FOB value in US$
Table 4.3.14 Country destinations of bamboo furniture exports and their respective market shares, Philippines, 1987-1995
Table 4.3.15 List of destination countries of Philippine bamboo products by type of product export, 1996-1997
Table 4.3.16 Average annual prices of raw bamboo poles, Philippines, 1970-1995
Table 4.3.17 Unit export values of bamboo export by product type and year, Philippines, 1981-1995
Table 4.3.18 Average selling price and estimated cost of bamboo products
Table 4.3.19 Marketing practices and determination; bamboo manufacturers and traders
Table 4.3.20 Bamboo enterprises which experience various forms of rejects for their products by size of enterprises, Philippines, 1997
Table 4.3.21 Promotional methods used by size of bamboo enterprise, Philippines, 1997
Table 4.3.22 Perceptions of bamboo enterprises on the future outlook of the bamboo industry
Table 4.3.23 Future outlook in terms of competitiveness of bamboo products with other countries
Table 4.3.24 Bamboo species and genera, selected Asian countries
Table 4.3.25 Bamboo poles harvest by year, selected Asian Countries, 1980-1995
Table 4.3.26 Bamboo products output and value China, 1980-1993
Table 4.3.27 Estimated annual value of bamboo exports by product type, selected Asian countries
Table 4.3.28 Volume of bamboo exports by product type and year, China, 1981-1993

Table 4.3.29 Value of bamboo export product type and year, China, 1981-1993
Table 4.3.30 Volume and value of bamboo exports by product type and year, India, 1990-1995
Table 4.3.31 Projected demand for and supply of bamboo in selected Asian countries, 2000-2010
Table 4.3.32 Average nominal prices of bamboo by product type and year, China, 1980-1993
Table 4.4.1 Tools, machines and equipment and its uses
Table 4.4.2 Industry associations whose membership includes bamboo using enterprises
Table 4.4.3 Function/mandate of agencies under DTI
Table 4.4.4 Financing schemes available from different lending institutions showing interest rates and collateral required for bamboo industry development
Table 4.4.5 ERDB-DENR/UNDP FAO bamboo pilot plantation sites cum research for various species planted in different sites
Table 4.4.6 Perceptions of bamboo enterprises as to existence of government support
Table 4.4.7 List of government agencies and nature of assistance
Table 4.4.8 Problems and constraints according to bamboo enterprises
Table 4.4.9 Recommendations to improve the services of government agencies
Table 4.4.10 Forms of marketing assistance needed to improve sales and competitiveness in sourcing raw materials and selling products
Table 5.1.1 Strengths, weaknesses, opportunities and threats relating to proper resource management
Table 5.2.1 Strengths, weaknesses, opportunities and threats relating to technology development, promotion and commercialization
Table 5.3.1 Strengths , weaknesses, opportunities and threats relating to market development
Table 5.5.1 Projected supply (domestic production and imports) of bamboo ('000 culms), Philippines, 1998-2007 (without intervention
Table 5.5.2a Projected demand for bamboo by industry, Philippines, 1998-2007 (without intervention)
Table 5.5.2b Projected demand for bamboo by industry including other bamboo products (in '000 culms), Plan A scenario, Philippines, 1998-2007
Table 5.5.2c Projected demand for bamboo by industry including other bamboo products and higher export growth (in '000 culms), Plan B scenario, Philippines, 1998-2007

Table 5.5.3a Projected demand and supply deficit/surplus (in '000 culms), Plan A scenario (without intervention), Philippines, 1998-2007
Table 5.5.3b Projected demand and supply deficit/surplus (in '000 culms), Plan B scenario (without intervention), Philippines, 1998-2007
Table 5.5.3c Projected demand and supply deficit/surplus (in '000 culms), base case scenario (without intervention), Philippines, 1998-2007
Table 7.5.4 Export revenue targets under Plan A and Plan B scenarios (in '000US$)
Table 7.6.1 Specific programs and interventions relating to proper resource management
Table 7.6.2 Specific programs and interventions relating to technology development, promotion and commercialization
Table 7.6.3 Specific programs and interventions relating to market development
Table 7.6.4 Specific programs and interventions relating to policy and institutional strengthening
Table 7.8.1 Timeframe of Master Plan and Intervention

LIST OF FIGURES

Figure 3.1 Philippine Bamboo Master Planning
Figure 4.2.1 Process flow common for most bamboo products
Figure 4.3.1 Distribution (%) of bamboo poles traded by province
Figure 4.3.2 Distribution channels for bamboo poles and products, Philippines
Figure 4.3.3 Product flow and value addition of bamboo sala set in Iloilo
Figure 4.3.4 Product flow and value addition of bamboo raw materials and bamboo mats (*sawali*) in Iloilo
Figure 4.3.5 Product flow and value of bamboo poles from Abra
Figure 7.4.1 Development framework for the Philippine bamboo industry
Figure 7.4.2 Bamboo agribusiness system within the context of socio-economic and physical environment
Figure 7.5.1a Supply and demand gap for Philippine bamboo, base case scenario
Figure 7.5.1b Supply and demand gap for Philippine bamboo, Plan A scenario
Figure 7.5.1c Supply and demand gap for Philippine bamboo, Plan B scenario

Figure 7.5.2 Export revenue targets under Plan A and Plan B scenarios
Figure 7.6 Implementation Structure for the Bamboo Master Plan

LIST OF APPENDIX TABLES

Appendix Table 4.1.1 Bamboos reported found in the Philippines, 1996
Appendix Table 4.1.2 Important bamboos according to Plant Resources of SouthEast Asia (PROSEA)
Appendix Table 4.1.3 A to Z of bamboo uses
Appendix Table 4.1.4 Estimated number of hectares planted to bamboo by municipality, Region IV
Appendix Table 4.1.5 Giant bamboo clonal propagation and production
Appendix Table 4.1.6 Branch marcotting method of propagating kauayan tinik
Appendix Table 4.1.7 Kawayan technology: planting material production
Appendix Table 4.1.8 The Caasi process for mass propagation of bamboo
Appendix Table 4.2.1 Source of tools and equipment
Appendix Table 4.2.2 Proximate chemical composition of six species of Philippine bamboo shoots at three different age levels
Appendix Table 4.2.3 Mineral and vitamin contents of six species of Philippine bamboo shoots at three different levels
Appendix Table 4.3.1 Giant bamboo clonal propagation
Appendix Table 4.4.1 Bamboo contact outside the USA
Appendix Table 4.4.2 Lending institutions financing schemes in bamboo development
Appendix Table 4.4.3 Published manuals guides and brochures on bamboo production indicating titles authors and year published
Appendix Table 4.4.4 List of on-going/new R&D projects

ACRONYMS

A&D	Alienable and Disposable
AAC	Annual Allowable Cut
ABS	American Bamboo Society
ADC	Antique Development Corporation
AFMA	Aklan Furniture Makers Association
AFTA	ASEAN Free Trade Area
APEC	Asia Pacific Economic Cooperation
ARMM	Autonomous Region of Muslim Mindanao
ASEAN	Association of Southeast Asian Nations
BCR	Benefit Cost Ratio
BCRI	Bukidnon Resources Commodities, Inc.
BDTP	Bureau of Domestic Trade Promotion
BETP	Bureau of Export and Trade Relation
BIS	Bureau of Import Services
BITR	Bureau of International Trade Relation
BOI	Board of Investment
BPPMI	Bataan Pulp and Paper Mills, Inc.
BPS	Bureau of Product Standards
BPTTT	Bureau of Patents, Trademarks and Technology Transfer
BSMBD	Bureau of Small and Medium Business Development
BSP	Bangko Sentral ng Pilipinas
BSU	Benguet State University
BTRCP	Bureau of Trade Regulation and Consumer Protection
CBFM	Community-Based Forest Management
CBS	Corrugated Bamboo Sheet
CCIP	Chamber of Cottage Industries of the Philippines
CDA	Cooperative Development Authority
CDPEAP	Christmas Decor Producers and Exporters Association of the Philippines
CENRO	Community Environment and Natural Resources Office(r).
CEPT	Common Effective Preferential Tariff
CFIF	Cebu Furniture Industries Foundation
CFIP	Chamber of Furniture Industries of the Philippines
CFP	Community Forestry Program
CITC	Cottage Industry and Technology Center
cm	Centimeter
CNFPO	Certificate of Non-timber Forest Products Origin
COD	Cash-on-delivery
DA	Department of Agriculture
DAO	Department Administrative Order
DAR	Department of Agrarian Reform
DBP	Development Bank of the Philippines

DECS	Department of Education Culture and Sports
DENR	Department of Environment and Natural Resources
DFA	Department of Foreign Affairs
DOLE	Department of Labor and Employment
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
EBF	Environmental Bamboo Foundation
ECCP	European Chamber of Commerce of the Philippine
EEC	European Economic Community
ERDB	Ecosystem Research and Development Bureau
ERDS	Ecosystem Research and Development Sector
FAO	Food and Agriculture Organization
FOB	Free on Board
FORI	Forest Research Institute
FPRDI	Forest Products Research and Development Institute
FRI	Forest Resources Inventory
ft	Foot
FTSC	Foreign Trade Service Corporation
GATT/WTO	General Agreement on Tariff and Trade/World Trade Organization
GFSME	Guarantee Fund for Small and Medium Scale Enterprises
GO	Government Organization
HPSD	High Pressure Sap Displacement
IBA	International Bamboo Association
IBF	International Bamboo Foundation
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IFMA	Iloilo Furniture Manufacturers' Association
IFMAg	Industrial Forest Management Agreement
IFP	Industrial Forest Management
IFPP	Industrial Forest Plantation Program
IGLF	Industrial Guarantee and Loan Fund
IMMPC	Iloilo Manufacturers' Multi-purpose Cooperative
INBAR	International Network for Bamboo and Rattan
IPB	Institute of Plant Breeding
IPGRI	International Plant Genetic Resources Institute
IRB	Integrated Rural Bamboo
IRR	Internal Rate of Return
ISF	Integrated Social Forestry
ITP	Industrial Tree Plantation
IUFRO	International Union of Forestry Research Organizations
LBP	Land Bank of the Philippines
LGC	Local Government Code
LGU	Local Government Unit

lm	Lineal meter
m	Meter
MAO	Municipal Agricultural Office(r)
MISO	Management Information Service Office
mm	Millimeter
MMSU	Mariano Marcos State University
MPFD	Master Plan for Forestry Development
MSU	Mindanao State University
NACIDA	National Cottage Industry Development Authority
NCR	National Capital Region
NEDA	National Economic and Development Authority
NGO	Non-Government Organization
NIMTC	National Industrial Manpower Training Council
NPV	Net Present Value
NSCB	National Statistics Coordination Board
NSO	National Statistics Office
NVSIT	Nueva Viscaya State Institute of Technology
OSIS	One Stop Information Shop
PCARRD	Philippine Council for Agriculture and Natural Resources Research and Development
PCCI	Philippine Chamber of Commerce and Industries
PCHI	Philippine Chamber of Handicraft Industries
PD	Presidential Decree
PDC	Philippine Development Corporation
PDDCP	Product Development and Design Center of the Philippines
PFS	Philippine Forestry Statistics
PhilExport	Confederation of Filipino Exporters Foundation
PHRDC	Postharvest Research and Development Center
PIA	Philippine Information Agency
PICOP	Paper Industrial Corporation of the Philippines
PNAC	Palawan National Agricultural College
PO	Peoples Organization
PROSEA	Plant Resources of Southeast Asia
PSPC	Panay State Polytechnic College
RA	Republic Act
RISE	Research Information Series on Ecosystem
SBGFC	Small Business Guarantee and Financing Corporation
SCUs	State College and Universities
SMEs	Small and Medium Enterprises
SUBCONEX	Subcontractors Exchange Program
TAPI	Technology Assistance and Promotion Institute
TCA	Tarlac College of Agriculture
TESDA	Technical Education and Skills Development Authority
TLRC	Technical Education and Skills Development Authority

ULFD	Urban Livelihood Financing Program
UNCTAD	United Nations Center for Trade and Development
UNDP	United Nations Development Program
UPCF	University of the Philippines College of Forestry
UPLB	University of the Philippines Los Baños
VISCA	Visaya State College of Agriculture

1.0 BACKGROUND

In line with the goals of the Philippines 2000 to raise the economic status of the country into a "Newly Industrialized Country (NIC)", an export-led and growth-centered industrialization strategy has been promoted all over the country. Consistent with this thrust is the promotion of cottage, small and medium industries, particularly those that exhibit strong export potential and demonstrate greater labor absorption capacity. The potential of bamboo as a major raw material for the production and manufacturing of products intended for the export market and domestic uses provides a very promising prospect for development. In addition to its economic significance, the socio-cultural and ecological functions of bamboo are well recognized, thus providing a greater justification for the need to identify strategic directions that would ensure the long-term development of the bamboo industry.

However, it is a fact that bamboo has not been given the proper attention it deserves. It is within this context that the Department of Trade and Industry - Cottage Industry Technology Center (DTI-CITC) has proposed a project intended to formulate a comprehensive Master Plan for the Development of Bamboo as a Renewable and Sustainable Resource. The Master Plan is envisioned to provide the overall development framework, direction, specific programs/projects and other forms of interventions for the sustainable development of the bamboo industry. Funding for this project is sourced out from United States Agency for International Development (USAID) through the National Economic and Development Authority - Technical Resources Project (NEDA-TRP).

Appendix Table 1.1. List of firms surveyed, April 1997

NO.	NAME OF COMPANY	RESOURCE PERSON	ADDRESS	TYPE OF ENTERPRISE
1		Mrs Mendel Doctor	414 Penthouse II Quezon Ave., Q.C.	Propagator
2	Sabali Resource Co.	Aurello R. Ramirez	12909 Villa Adelina, Los Baños Laguna	Prapagator
3		Tomas Aquino	Laoac, Pangasinan	Propagator
4		Dante Fernandez	Sta Barbara, Pangasinan	Propagator
5	Nepa Q-Mart Industries	Mario Bacarra	127 Ermin Garcia St., Cubao, Q.C.	Propagator
6		Raul Maluloy-ad	Cebu	Propagator
7	Pioneer Bamboo Industrial Corporation	Johnny Yung	759 General Luis St., Kaybiga, Kalookan City	Manufacturer/Exporter
8	Cane and Bamboo Arts and Articrafts	Francisco P. Fernandez	2766 Daan Hari St., United Parañaque I MM	Manufacturer/Exporter
9	Abebros Companies, Inc.	Paul Abejuela	29 Kanlaon St. Mandaluyong City	Manufacturer/Exporter
10	Reunion Furnishing	Guillermo Rodriguez		Manufacturer/Exporter
11	CTC	Banny Pancho	Patubig, Marilao, Bulacan	Manufacturer/Exporter
12	Silahis Arts and Artifacts	Robert F. Lane	2353 Sunrise St. Concorde, Tambo Parañaque	Manufacturer/Exporter
13	Kates Arts and Crafts	Kate Achumbre	Poblacion, Liloan, Cebu	Manufacturer
14	Castilex	Lorie Boquieren	Cebu	Manufacturer
15	Pader Handicraft	Jerry Pader	Manaoag, Pangasinan	Manufacturer
16	Articrafts	Rilanda Famoso	Poblacion, Liloan, Cebu	Manufacturer
17	Bernans Handicraft	Nancy Catalan	Poblacion, Liloan, Cebu	Manufacturer
18		Felix Pilar	Calamba, Laguna	Manufacturer
19		Carling Aquino	San Carlos City, Pangasinan	Manufacturer
20		Boy Ocumen	San Carlos City, Pangasinan	Manufacturer
21		Salvador Pranada	Manaoag, Apngasinan	Manufacturer
22	Marquez Handicraft	Jimmy Marquez	Sta Barbarra, Pangasinan	Manufacturer
23	Cainta Bamboo Furniture	Veronica Olitin	San Roque, Cainta, Rizal	Manufacturer
24	Orient International Trading Corporation	Isagani C. Atienza	43 Esteban St., Mandaue City	Trader/Exporter
25	Saffy Handicraft	Josie Soriano	2594 Lamayan, Sta Ana MM	Trader/Exporter
26	AKR Handicraft	Teofilo De Guzman	Manaoag, Pangasinan	Trader
27	Dismaya Handicraft	Alfredo Dismaya	Manaoag, Pangasinan	Trader
28	JJ Enterprise	Maryjane Mungaya	Los Baños, Laguna	Trader
29		Rodrigo Aquino	Manaoag, Pangasinan	Trader
30		Mila Agsalud	Uradaneta, Pangasinan	Trader
31	Mendoza Handicraft	Rosevida Mendoza	Manaoag, Pangasinan	Trader
32		Erlinda Tumanan	San Carlos City, Pangasinan	Trader
33	Sagun Handicraft	Leonardo Sagun	Manaoag, Pangasinan	Trader

2.0 PROJECT OBJECTIVES AND EXPECTED OUTPUT

The Project aims to pursue the following objectives:

- Formulate a Master Plan that would set the framework and strategies for the promotion and development of the bamboo industry;
- Provide a program for the establishment of a pilot integrated bamboo propagation and production scheme; and
- Conduct a Bamboo National Conference that will provide the venue for a comprehensive assessment of the strategic directions and strategies for the development of the bamboo industry including information exchange on the potentials of bamboo.

The expected outputs of the Project are therefore as follows:

- Master Plan for the bamboo industry
- Model integrated bamboo propagation and agro-industrial production village
- National Bamboo Conference/Workshop

3.0 METHODOLOGY

3.1 Master Plan Preparation

3.1.1 The Process

Figure 3.1 depicts the general procedure adopted in the master planning for bamboo. It consists of four major steps:

Situational analysis or industry assessment;
Formulation of development framework;
Identification of development scenarios and growth targets; and
Preparation of the agenda for action

The process has a number of characteristics. First, it is sequential and orderly; second, it is cyclical in nature; third, it is iterative; fourth, it is holistic, comprehensive and multidisciplinary; and fifth, it is participatory and consultative.

The process went through a series of steps where one leads to the next until the final Master Plan was prepared. This involved determining (a) where we are in terms of the present situation of the industry; (b) where we want to go in terms of vision, goals and objectives for the industry; and (c) how do we get there in terms of a plan of action for achieving these objectives and the desired state of the industry. The cyclical nature of the process means that the various aspects and concerns of the industry addressed during the situational analysis are also the targets of interventions and recommendations comprising the Master Plan.

The outputs from the four steps underwent various iterations and revisions as additional information and fresh insights became available. The preparation of the Plan took into consideration the holistic, comprehensive and multidisciplinary nature of the industry in terms of (a) the various stages involved in the production, processing and manufacturing of bamboo products; (b) the demand and supply sides; (c) the input and output markets; (d) the policy and institutional environment under which the industry operates; (e) the industry weaknesses, threats, strengths, and opportunities; and (e) the required expertise for addressing all these concerns.

The Master Plan preparation was made as participatory and consultative as possible through the following:

(a) The first consultative workshop held last 13 March 1997 during the initial stage of the project as part of the scoping process. This was attended by the entire Study Team, senior officials of CITC, representatives of OIDCI, FPRDI Director and his staff, and industry leaders from Sambali Foundation, In-Hand Abra Foundation, Community Management Institute, SAMCO Enterprises, Mañosa and Associates, and In-Tech Dev. This consultation provided information on the various issues and concerns of the bamboo industry and allowed a fruitful interaction between the industry leaders and Study Team. Inputs from this workshop provided

directions to the Study Team for the rest of the master planning activities. The highlights of this workshop are presented in Appendix A covering the names of the participants and the issues raised.

(b) The second consultative workshop held last 26 June 1997 which was attended not only by the industry leaders but also by representatives of various agencies and institutions which presently cover bamboo and are expected to be more greatly involved in the implementation of the Master Plan. The workshop provided opportunity to the Study Team to present to a larger body the highlights of their findings and the initial draft of the development framework and strategic directions comprising the Master Plan. Thus it allowed further consultation and more importantly, validation of the initial draft of the Master Plan. Through the active discussions during the workshops, more inputs were generated towards improvement of the draft Plan. Appendix B presents the highlights of the participants' inputs.

(c) The third consultative workshop which is the Second National Bamboo Conference held last 1-2 August 1997 in Lingayen, Pangasinan. This was the final stage of the consultation process where participants also included government leaders at the national and local levels. The conference provided opportunity for a more productive interaction among all industry sectors and stakeholders, thus ensuring that all concerns are incorporated in the Master Plan. Inputs from the conference participants were used in the finalization of the Plan. The highlights of this conference are presented in Appendix C.

3.1.2 Major Tasks Undertaken

The above discussion already provides some of the major activities undertaken. The chronological ordering of the various activities is as follows:

(a) Collection of primary and secondary data

Secondary data were based on existing documents/materials and time-series information available in various data collecting agencies. Documents include workshop papers, research publications and other reports available at CITC, ERDB, FPRDI, PCARRD and UPLB. A listing of the CITC materials is presented in Appendix D. Time series data such a trade and market statistics were sourced from DTI and NSO. Institutional and policy information were collected from relevant agencies such as DTI, BOI, DENR and others.

Recent materials include the First National Bamboo Conference papers (August 1996), the CEM-UPLB/ERDB/FPRDI Bamboo and Rattan Seminar/Workshop papers (June 1996), a research report entitled "The Bamboo Sector in the Cordillera and Western Visayas: An Analysis of the Production-to-Consumption System" by Rivera *et al* (1996), and the research report of the UP Visayas College of Management entitled "Productivity Assessment of the Bamboo-Using Industry in Region VI" (1996). Additional information came from the various publications of the International Network for Bamboo and Rattan (INBAR). Still others were sourced via the Internet.

Primary data were collected to complement and validate secondary information. Aside from those collected from industry leader during the workshops, data were generated from a field survey of bamboo enterprises conducted last April 1996. The survey covered a total of 33 firms broken down as follows: 17 manufacturers of various bamboo products 6 of whom are exporters, 10 traders engaged in buy-and sell activities, and 6 propagators. The sample was initially based from the 1996 Buyers Guide list of bamboo enterprises but replacements were made later due to closure of some firms and unavailability of the respondents at the time of survey. The survey areas included Metro Manila, Cebu, Pangasinan and Laguna. The list of the surveyed firms is presented in Appendix Table 1.1. Field visits were also conducted in Laguna for the "Kawayan: Yaman Laguna" project and Iloilo and Davao for the bamboo plantations of DENR. Likewise, the plyboard processing and bamboo flattening operations in Iloilo were visited.

(b) Analysis of data and assessment of issues, problems/constraints, threats, and strengths of the industry as well as the opportunities which can be explored for the development of the bamboo industry. This industry assessment covered the following major areas: bamboo resources and raw material production, processing and utilization, domestic marketing and international trade, and policy and institutional environment.

(c) Formulation of the development framework encompassing the vision for the bamboo industry, goals and objectives, and strategic directions for the industry. This was based from the initial assessment of the industry with inputs from the industry leaders during the first consultative workshop.

(d) Identification of development targets and growth scenarios relative to the vision, goals and objectives. This involved making demand and supply projections for the next 10 years based on current and future uses and export levels of bamboo products, and plantation development programs of DENR including planting efforts of the private sector. This provided indications of expected deficits in the raw material supply and the extent of plantation development needed to address this problem.

(e) Preparation of the agenda for action which consist of the specific programs and strategies that are needed in order to achieve the industry objectives. These specific programs comprise the "Master Plan" which were presented in terms of specific activities and their objectives, expected output and impact, indicative cost, and agencies/institutions expected to be involved in implementation.

(f) Validation of the Master Plan. This was done in two phases: the first was through the consultative workshop held last 26 June 1997 and the second was during the National Bamboo Conference held last 1-2 August 1997.

(g) Finalization of the Master Plan. This is the last stage of the process where all inputs gathered from previous activities were incorporated to revise earlier drafts of the Master Plan.

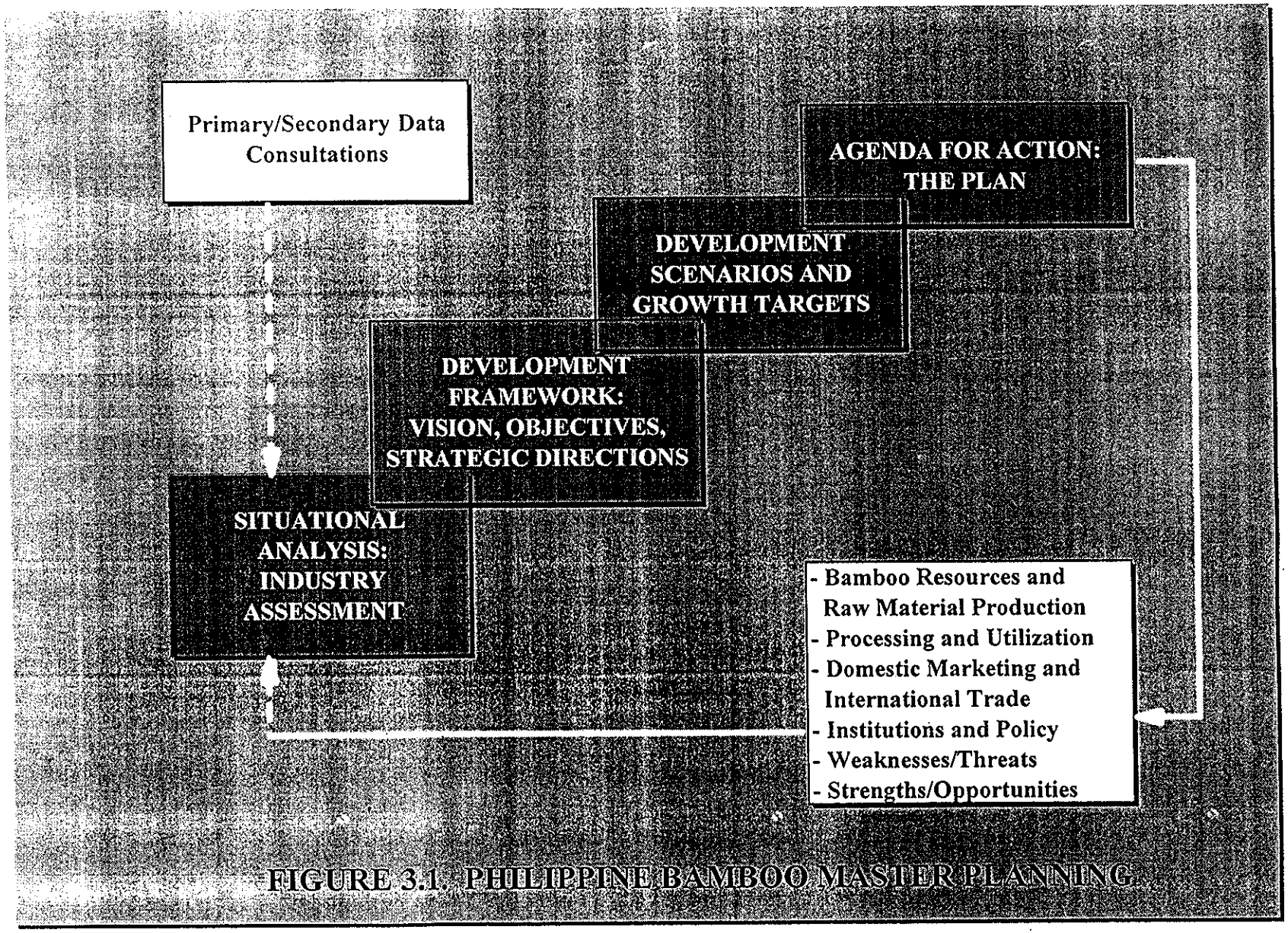

FIGURE 3.1. PHILIPPINE BAMBOO MASTER PLANNING

4.0 INDUSTRY ASSESSMENT

4.1 Bamboo Resources

4.1.1 Bamboo Species

There are 110 bamboo genera recorded in the world consisting of approximately 1200 species. These are distributed between the 46° North latitude and 47° South latitude and thrive from sea level to as high as 4,000 meters above sea level (m.a.s.l.) in elevation (Widjaja 1989). The knowledge on bamboo identification is normally based on the botanical collection of bamboo specimens that are deposited in the different herbaria in the world. However, because of the complexity of the bamboo itself, there is a relatively poor representation in the different existing herbaria. The rarity of flowering in bamboo has further contributed to the difficulty of taxonomic study in bamboo.

In the Philippines, taxonomic collection of bamboo was started as early as the 18th century by Blanco and was deposited in the Philippine National Herbarium. Unfortunately, these were burnt during the Second World War. While some duplicate specimens can still be found in other herbaria outside the country, many of these specimens which were then available have not been distributed to other recognized herbaria. From then on, various accounts of the number of species of bamboos have been made by various taxonomists. According to PCARRD (1990), Brown and Fisher (1920) reported 8 genera and 30 species, 17 of which are erect and 13 are climbing bamboos. Merrill (1923) enumerated 8 genera, 24 species and 1 variety, whereas Sharma (1982) reported 12 genera consisting of 49 species 30 of which are erect and 19 climbing.

In 1996, Rojo made a comprehensive annotated historical review of various literature and works on the identification and introduction of the different bamboo species in the country published by various authors beginning as early as 1837 with the work of Blanco in his "Flora de Filipinos" up to the most recent works of Schlegel and Tangan in 1994 and PROSEA in 1995. Based on this review, there are at least 7 major documentations/reports on the Philippine bamboo done which are taxonomically recognized and published. A matrix of the number of Philippine bamboos taxonomically recognized and/or published by various authors as summarized by Rojo in 1996 is presented in Table 4.1.1.

In the same work, Rojo made an updated accounting of the different bamboo species in the Philippines as of 1996. He identified a total of 62 bamboo species found growing in the Philippines. This most recent listing of 62 existing bamboos in the country is 15 species more than the highest previously recorded of 47 taxa in the consolidation initiated by PCARRD in 1991.

This dramatic increase in the total number of bamboo species found in the country was attributed by Rojo to the effort of the ERDB which has embarked on the establishment of bamboo introduction areas or bambuseta through its ERDB-DENR-UNDP/FAO Bamboo Research and Development Project initiated in early 1987. These living collections of different bamboo species, both endemic and exotic, are located in the Philippine Bambusetum in Baguio City and in the Bambuseta found in ERDB Experimental Station in Los Baños, Laguna and Nabunturan, Davao del Norte. Out of this total number of bamboo species thriving in the country, 21 are endemic/native to the country of which 8 are classified as erect and 13 as climbing bamboos. At present, of the 8 erect bamboos identified, only a few of them are considered economically important while the rest may be considered as potentially important only because of their limited volume. Appendix Table 4.1.1 enumerates the scientific names, common names, habits and origins of the different bamboo species found in the Philippines as recorded by Rojo (1996). He further identified the different existing and traditional uses as well as the potential uses of each bamboo species. Appendix Table 4.1.2 presents the important Philippine bamboo species identified by PROSEA in 1994.

4.1.1.1 Economic and Potential Uses of Different Bamboo Species

> *"There are bamboo tiles for shelter, bamboo hats for shading, bamboo paper for writing, bamboo rafts for carrying, bamboo skin for clothing, bamboo shoes for wearing, bamboo shoots for eating, and bamboo fuels for fire."* [Sung Dynasty (1312 A.D.) Su Dongpa]

This description of bamboo as an important material made as early as the 13th century perhaps fittingly illustrates the multifarious uses of bamboo owing to its flexibility and the numerous practical uses that it offers. Based on the 1975 report on housing and construction, bamboo constitutes 26 % of the entire dwelling units in the country (Philippine Yearbook 1975). Thus, bamboo came to be known as the "poor man's lumber". Today however, this moniker is no longer true since bamboo is now considered by many enthusiasts the world over as the "green gold".

Tagarino (1990) in his work on the socio-economic aspect of bamboo which was commissioned by the ERDB-DENR-UNDP Bamboo Research and Development Project (PHI/85/008) categorized the various specific uses of bamboo according to 7 areas of utilization (Table 4.1.2). These are as follows: (1) construction and infrastructure, (2) handicraft and furniture industries, (3) agricultural industries, (4) industrial purposes, (5) food and food processing, (6) musical instruments, and (7) landscaping and ornamental purposes.

On the other hand, the MPFD (1990) under its non-wood forest based industries component enumerated 5 categories of bamboo-based industries, namely: (1) furniture and handicraft manufacture, (2) props for the banana industry, (3) poles for fishpen industry, (4) boat outrigger, and (5) construction. The PDC in 1983 made a detailed listing of the specific uses of 8 common bamboo species in the Philippines (Tagarino 1990).

Table 4.1.3 shows the list of specific uses of the common bamboos in the Philippines done by PDC as modified to reflect revision of scientific names and to include the official common and local names. Added in the list are two other important bamboo species which are widely cultivated in the provinces of Davao and Surigao in Mindanao for banana props and light construction.

The list of uses of bamboo cited above does not include the utilization of bamboo as raw material for other high value products such as "plyboo" bamboo tiles, corrugated bamboo for roofing materials, bamboo boards and other novelty items recently developed as a result of technological advancement. Most of the technologies are currently available especially those that were developed by FPRDI.

Not to be overemphasized is the ecological importance of bamboo being a great potential crop in rehabilitating the country's large tracts of denuded land. Bamboo's wide range of adaptability to adverse edaphic and climatic conditions makes it ideal for reforesting about 2 million hectares (ha) of barren areas and grasslands of the country. Being fast growing and with a massive root system, bamboo is effective for controlling soil erosion and stabilizing riverbanks and other embankments. It has been proven that some bamboos can thrive on water- logged areas, thus restoring the productive potential of the said area.

It is perhaps worthwhile to note the A to Z of bamboo uses from David Farrelly's "The Book of Bamboo." (INBAR 1995-1996). The list of some general uses of bamboo in alphabetical order is given in Appendix Table 4.1.3.

4.1.1.2 Extent and Distribution of Bamboo in the Philippines.

Total hectarage planted to bamboo has decreased from 200,000 ha based on 1910 resource inventory to only about 7,294 ha in 1978 (PCARRD 1984), a decline of 192,702 ha or 97% over a 65-year period. This is approximately almost 300 ha of area planted to bamboo lost yearly over the said period. Statistics (PFS 1970-1994) also revealed that bamboo pole production from forest land has drastically decreased by almost 80% from a high of 1.79 million poles in 1979 to 0.392 million in 1994, a period of about 15 years.

In the absence of detailed and more reliable data during the period covered, the statistics cited above is perhaps the only existing and officially accepted historical data on the extent of bamboo production area in the country. Its usefulness, however, as basis for planning and management of the bamboo resources is quite limited. The total area stated could not provide the basis for necessary estimate of possible sources of bamboo poles since it does not make mention of the stocking or density per ha. Moreover, species classification was not categorized in the report. The MPFD (1990) report indicated that the area covered by bamboo would be much greater than that reported in 1978. The assumption was based on the relatively more recent survey of some erect bamboos in selected provinces in the Philippines conducted by Virtucio *et al.* in 1983 or 5 years later. Based on this report, Tagarino (1994) surmised that since the result

of the survey covering only 9 provinces showed that the area covered with bamboo is about 4,980 ha, then, if this is extrapolated to the country's 73 provinces, the area would be much larger. This attempt to estimate the bamboo stand based on the extrapolation is quite simplistic and straightforward and may result to overestimation since the provinces identified in the survey are known to be places where there are relatively abundant bamboo stands compared with other provinces not included in the survey. Summary of the survey conducted by Virtucio, *et al.* (1994) is presented in Table 4.1.4.

This survey provides better information of the characteristics of the bamboo area in the country as it gives the approximate stocking and standing poles providing the number of clumps contained in a hectare and the number of culms per clump. Its deficiency, however, is that it only covers one species which is *kauayan tinik* (*Bambusa blumeana*). On the other hand, the RP-German FRI conducted in 1988 reported the total number of bamboo resources found inside the dipterocarp forest. This time, the bamboo poles are expressed in lineal meters (lm) without giving estimates of actual area covered or the number of clumps. Table 4.1.5 shows the inventory of bamboo resources found in the dipterocarp forest (RP-German FRI 1989) as modified by MPFD (1990) and Rojo (1996) to provide estimates of the number of culms based on the average length of culm of each species.

Based on the table, there are about 10,730.0 million lm of bamboos found inside the dipterocarp forests for all species identified or an estimated equivalent of 413.6 million standing bamboo poles or culms. From this figure, the total number of culms/poles for erect bamboos (*anos, bayog, bolo, buho, kauayan kiling*) is only 205.5 million. On per clump basis, it could be estimated to range from about 4.1 to 6.8 million clumps based on the average number of 30 to 50 culms per clump. In terms of aggregate area, this will cover approximately 20,500 to 34,000 ha if the stocking density is about 200 clumps per ha. Based on the report, the bamboos inside the dipterocarp forest are mainly concentrated in Regions 2, 4 and 8.

Recognizing the importance of the information on the actual extent and distribution of bamboo in the Philippines, the DENR, as early as 1990, through it field operation office issued instruction (DENR Memorandum dated July 19, 1990 issued by the then Undersecretary for Field Operation, USEC Victor O. Ramos, now DENR Secretary) to its field units to provide data on bamboo inventory in their specific regions down to field level. The information would include area planted to bamboo, species, spacing and other relevant information. However, due to some technical, financial and time constraints, a thorough and complete enumeration was not realized. A result of that effort based on the partial data submitted by the DENR regional office is presented in Table 4.1.6.

At present, this effort is being continuously carried out by some of the DENR Regional Offices to update their regional information on bamboo resources. Likewise, similar surveys are being initiated by other agencies and offices. Tables 4.1.7, 4.1.8 and 4.1.9 show partial data based on some of the recent surveys of bamboo production areas in Regions 1, 3 and 4, respectively. The detailed information for Region 4 is presented in Appendix Table 4.1.4.

Uriarte and Maligalig (1992) also noted that in terms of location and ownership, 23% of the bamboo stands in Ilocos Norte, 8% in Ilocos Sur, 11% in La Union and 35% in Pangasinan are located in private lands. On the average, about 80% is within public lands. The management, protection and disposal of bamboo in public lands are, however, difficult to ascertain. The corresponding forest charges reported are too low to reflect the actual volume harvested.

The difficulty encountered in the inventory of bamboo resources in the country can be attributed to various reasons. First, bamboo stands in the forest, unlike the trees are generally found in small patches and sparsely distributed over the vast forest where estimate of aggregate area is quite difficult. Second, about 75% of the bamboo stands are found in the lowland (Virtucio as cited by Bennagen 1991). These are also sparsely distributed throughout the countryside in either "backyard type" of planting or mostly along the river banks. Lastly, it was only recently that bamboo planting has become a part of the total plantation development effort especially by private sector and that sizable and contiguous areas planted to bamboo have become significant areawise and volumewise.

While in the past bamboo production area would only refer to bamboos naturally growing in the forest and in "natural stands" in private lands (the latter providing the bulk of needs), today, bamboo plantations have become one of the dependable sources of raw materials for some segments of the bamboo industry. Table 4.1.10 provides an updated listing of existing private bamboo plantations in the country with the corresponding hectarage, ownership, species and specific location. Private bamboo plantations have a total area of 3,040 ha.

Malvas (1995) reported that in 1986, the DENR has started its pilot bamboo plantation projects establishing some 1,346 ha as of 1995 in 41 sites located in 5 regions. Table 4.1.11 shows the list and locations of DENR bamboo plantation projects under its (a) regular planting program, (b) contract reforestation program through the ENR Forestry Sector Loan Program for which some 890.8 ha have been planted, and (c) DENR Research Pilot Plantations. Thus, the total hectarage of government bamboo plantations is 2,293 ha.

4.1.1.3 Estimated bamboo resource availability and culm/pole production

Based on the information from the various sources and the current available updated data as presented above, the total available bamboo resource in terms of area covered and the annual estimated available bamboo poles (matured culms) for harvesting and utilization were analyzed and recomputed in Table 4.1.12 according to the nature of origin or source.

The values of the estimated area covered by bamboos in the forestlands were based on the data of the RP-German FRI in 1988 for bamboos found in the dipterocarp forests and on the number of culms/poles as estimated by the MPFD (1990) and Rojo (1996), computed at the assumed stocking density of 200 clumps per ha with 30 to 50 culms per clump.

For the government and private bamboo plantations, the hectarage was based on actual existing recorded plantation area and the surveys conducted. For the area of bamboo in "natural stand", the figures from the survey of erect bamboos conducted by Virtucio *et al.* in 1988 were updated to include 10 more provinces making a total of 19 provinces represented. While this figure results to underestimation of the actual hectarage of bamboo in the "natural stand" since 54 more provinces were not represented, the procedure will compensate for whatever overestimation may have occurred as a result of assumptions made on the stocking densities, the possible double counting of some areas reported and the assumed projected productivity of 5 harvestable culms/poles per clump per year.

The computation showed that there is at least a total of about 39,211 to 52,711 ha of production area for erect bamboos in the country with expected production of approximately 29 to 52 million harvestable poles or culms per year. Of the total expected production, about 65 to 68% will come from the forestlands, 22 to 25% from the "natural stands", 5 to 5.5% from the private plantations and 3 to 4 % from government plantations.

In terms of bamboo species, *buho* (*S. lumampao)* constitutes the majority of expected production amounting to about 64% followed by *kauayan tinik (B. blumeana)* at about 16%. *anos (S. lima)* comprised about 10% of the total expected production with *laak (B. sp. 2)* at about 9%, and *kauayan kiling (B. vulgaris)* at 1.5%. *bayog (B sp 1)* and *bolo (G. levis)* only contribute about 1% of the total production. Other species such as giant bamboo *(D. asper)* and *kayali (B. alter)* have insignificant contribution of only less than 1% to the expected yield. It must be noted that *buho* and *anos* will come from forestlands while production of *K. tinik* will come from both existing "natural stands" and established plantations. *Laak*, on the other hand, will come entirely from established plantations.

4.1.2 Bamboo Production and Management Techniques

4.1.2.1 Nursery Technology

Propagation Techniques

Generally bamboos could be propagated by either sexual (reproductive) or asexual (vegetative) means.

<u>*Reproductive propagation*</u> - propagation method of bamboo by the use of seed. This is, however, not popularly practiced in the country due to the scarcity of bamboo seeds brought about by the irregularity and rarity of flowering of most common bamboo species in the country except for some species like *buho* (*Schizostachyum lumampao*) which are gregariously flowering. Reports also indicated that even if the seeds are available, they are mostly infertile and viability is very low such as those studied in *kauayan tinik* (*Bambusa blumeana*).

Vegetative or asexual propagation - propagation of bamboo that makes use of different parts of bamboo plants as propagation material.

There are several methods of bamboo vegetative propagation. ERDB-DENR/FAO /UNDP (1994) describes three methods: (1) clump division, (2) offset or basal stem division and (3) culm cutting. PCARRD (1991), on the other hand, specified 4 methods of vegetative propagation, namely; (1) offset, (2) culm cutting, (3) branch cutting, and (4) tissue culture. Descriptions of the different vegetative propagation methods as provided by various authors are summarized as follows:

- Basal Culm Division or Offset - This method makes use of the rhizomes and the portion of the culms. It is commonly used in the monopodial or non-clump forming bamboos. It can be applied to some sympodial bamboo species with loose clumps such as *anos (S. lima)* and *buho (S.lumampao)* because these are difficult to propagate by either culm or branch cutting.

- Culm Cutting - This uses segments of culm (cuttings) bearing buds or fascicles of branches. Cuttings are extensively used to propagate bamboo of the genera *Bambusa, Dendrocalamus and Gigantochloa.*

- Branch Cutting - This method is an alternative method of propagating rhizomatous branch-producing bamboos like *kauayan tinik* (*B. blumeana*), *bayog* (*D. asper) kauayan kiling*, (*B. vulgaris*) and other similar varieties.

- Branch Marcot Culm Cutting - This method is similar to culm cutting method, however, it induces first the rooting of branches by marcotage, before the culm is cut into one-node pieces for planting.

- Tissue Culture - It is a biotechnology which involves the development of new plant in artificial medium in aseptic conditions from plant tissues.

- Airponics- It is a method of accelerating the growth of plants in oxygen-rich environment without soil (Maravilla 1996). The plant root zone is suspended in a growing chamber and intermittently pulse misted with a nutrient solution. Propagation of bamboo through this method is still very new and in fact the only one of its kind in Asia. The facility for airponics plant propagation system (APPS) is located at Sta. Barbara, Iloilo.

In the Philippines, the most prevalent method of propagating common commercial bamboo species (i.e. *bayog, kauayan tinik, kauayan kiling, bolo, laak and kayali*) is basically by culm cutting with some procedural variations as may be found practical and effective by individual propagator. Branch cutting and branch marcotting- culm cutting have been employed for propagation of giant bamboo and *bayog*, respectively (Gigare *et al.* 1992 and Alfonso D.

1990). Appendix Table 4.1.5 and 4.1.6 show the detailed procedure for giant bamboo clonal propagation and branch marcotage, respectively. Offset method is found to be effective in propagating *buho* where culm cutting is not so successful. Study on the use of tissue culture in bamboo propagation has been carried out for various species in the past year. Tissue culture derived plants of *Dendrocalamus strictus* and *Schizostachyum lumampao* have been successfully produced and seedlings had been trial planted which are now vigorously growing in the field (Zamora and Gruezo 1992). Maravilla (1996) reported that branch cutting of giant bamboo has been successfully propagated through APPS.

As previously stated, there are procedural variations in the propagation by culm cutting as practiced by various growers /practitioner. Prominent among them are by: Malab *et al.* (1996, refer to Appendix Table 4.1.7), Caasi (1996, refer to Appendix Table 4.1.8), Alfonso (1990), ERDB-DENR/UNDP/FAO (1992), and other variations such the "whole length culm" method of propagation of *laak* by ERDS-DENR XI. Generally, however the steps in propagation by culm cutting involves the following steps:

1. Selection of planting stocks
   (a) Choose planting stock from good and healthy clumps.
   (b) Select appropriate age of culm suited for propagation since it varies from species to species. Generally, the culm age ranges form 1 to 2 years old. For *kauayan tinik*, a culm is about this age when branch sheaths are still attached to it and the culm sheath on the top portion of the culm has just fallen off. PCARRD (1991) provided the list of recommended ages of culm for propagation, the number of nodes and portion of culm utilizable for different Philippine bamboos (Table 4.1.13).

2. Planting stock preparation
   (a) Cut and remove the selected culm (well developed and fresh buds) from the mother clump with a sharp bolo or saw to avoid splitting .
   (b) Remove the branches from the selected culm leaving one or two nodes intact.
   (c) Determine the usable portion of the culm (about 2/3 to 3/4 usually about 24 nodes for *k. tinik*). If the source of planting stock is far from the planting site, haul the planting material immediately to the nursery. Avoid unnecessary exposure of planting material to the heat. If necessary, cover the planting material to keep them fresh.
   (d) Cut the culm/pole into segments (1-node or 2-node cuttings) 2 to 3 inches below each node or nodes as propagule. These propagules may be directly potted in potting bags or rooted in beds ("misting beds" or "incubation" beds) or directly planted in the field.

Some bamboo propagators employ direct planting of cuttings in potting bags. Others prefer to root the propagules in beds. In the latter, the propagules or the cuttings are laid tightly together in nursery bed with the node covered with sand leaving the upper portion of the cutting

and branch exposed. River sand is usually used as substrate of the rooting bed. Another practice involves having the beds kept covered with a layer of clear plastic to retain moisture. Sterilization of both propagules and rooting bed is done with the use of fungicide. The step-by-step procedures of propagation using the "misting beds" by Malab *et al.* (1996) and the "incubation method" by Caasi (1996) are found in Appendix Tables 4.1.6 and 4.1.7, respectively.

3. Potting
   (a) Twenty to 25 days after rooting, transfer the potted propagules in potting bags. A black polyethylene bag with an appropriate size (about 16"X 20" X 0.0003) is recommended.
   (b) Use pulverized top soil with high organic matter as potting medium.
   (c) Fill about 1/3 of the plastic bags with the soil.
   (d) Place the rooted bamboo cutting vertically in the center of the bag and fill up the remaining portion with the potting media.
   (e) Compact the soil in the plastic moderately.
   (f) Water the newly potted cutting. The open node should be also be filled with water.
   (g) The newly potted cuttings should be placed in a shade area for about one month.

   Note: Direct potting of cutting material generally involves the same potting procedure except that propagules are not yet rooted.

Nursery Cultural Practices and Care

1. Check the potted propagules daily to maintain moisture all the time.
2. Apply appropriate fungicide to prevent diseases.
3. Apply complete fertilizer in each potted propagules (about 20 g of 14-14-14 NPK fertilizer).
4. Prune the roots extending beyond the bottom of the bag to avoid permanent penetration in the to the soil.

4.1.2.2 Plantation Development Technology

Plantation Establishment

Site Requirement - The growth and development of bamboo depends primarily on water, sunlight and nutrients and other growth requirements. These requirements for growth may vary from one bamboo species to another. Below are some important site requirements for bamboo plantation development (PCARRD 1992, Malvas 1995, Hoang *et al.* 1992, and MPFD 1990).

1. Latitude
   Except for the "sasa" group of bamboos, others grow naturally within 40 degrees on either side of the equator, particularly in the Tropic of Capricorn on the southern side and in the Tropic of Cancer on the northern side of the equator. The Philippines

is located at 4^0 31' to $21^0$21' north of the equator. The climatic conditions obtaining in the country favor the growth and development of *Bambusa, Dendrocalamus and Schizostachyum*. They are widely found from North to South of the country.

2. Altitude

   Bamboos can grow from about the sea level to as high as elevation as 2,800 to 3,200 m.a.s.l. depending upon the species. *Dendrocalamus, Bambusa* and *Schizostachyum* grow well in lowlands. *Phyllostachys aurea* grows well in Baguio which has an elevation of 1,500 m.a.s.l.

3. Temperature

   Temperature is affected by elevation. Bamboos can grow in places where the temperature ranges from 8.8^0 C to 36^0C. However, some bamboo species grow and develop better in certain temperature range. For example, *B. blumeana,* and *B. vulgaris* have better performance in warm area with temperature range of 29^0C to 32^0C, whereas *G. levis, B. oldhamii* and *D. latifflorus* grow well in cool areas.

4. Rainfall

   The total rainfall which is the amount of rainfall measured in millimeter (mm) per year and rainfall distribution which is the number of rainy months per year are important parameters which should be considered in bamboo plantation development. A very close correlation between shoot growth and precipitation has been established. Moisture is the most important factor that affects growth and development of bamboos. When the moisture is limited as in the dry season, bamboo adopts by shedding their leaves. At the onset of the rainy season, leaves emerge and within a few weeks, the crown is full of leaves against bamboos found along creeks and rivers which are green throughout the year due to continuous moisture.

5. Soil

   Bamboos can thrive in a wide range of soil types but they grow best in well-drained sandy loam and clay loam soils. Loam soil provides good drainage and aeration. A soil pH of about 5.0-6.0 is most suitable for bamboo. Saline soils along salty or brackish waters are not suitable for bamboos.

Lantican *et al.* (1985) enumerated some site requirements and geographical distribution of some commercially important bamboo species in the Philippines (Table 4.1.14).

Site Preparation. The Bamboo Farming Manual published by ERDB-DENR/ UNDP/FAO (1994), PCARRD (1989), Piñol *et al.* (1991), Lapis *et al.* (1987), Hoang (1991), and Malab *et al.* (1996) describes the various steps in preparation of planting site for bamboo as follows.

(1) Sketching or mapping and delineation of area. It is important to sketch the main features of the planting site to assess access to water sources and determine the location, size and form of the plantation.

(2) Staking. The four corners of the plantation site should be marked with long poles. If the site is too large, it should be divided into smaller compartments preferably 100m X 100m section.

(3) Field layout. Field layout can be facilitated by establishing two pairs of base lines running perpendicular to one another (located along the boundaries of the planting site). The base lines are then delineated in order to make staking easy. Location of stakes depends on planting distance. The recommended spacing for most commercial bamboo species like *kauayan tinik, bayog* and other large clump and culm bamboo is from 7 X 7m to 10 X 10m. For medium clump size bamboos like *laak and boho*, the practice spacing is 4 X 5m. For riverbank and embankment stabilization, closer spacing of 5 X 5m or denser planted in quincunx system is suggested.

(4) Clearing. Clear the area of weeds and unwanted vegetation. Depending on vegetation sites, area could be completely cleared or stripped cleared where a 1 meter wide strip is brushed from the center of the strip. For riverbank or hillside planting, spot clearing is recommended for least soil disturbance.

(5) Planting hole preparation. Prepare the planting hole in advance. The planting hole should be wide and deep enough to accommodate the propagules either rooted or directly planted. The suggested dimension of planting hole is about 50 cm wide and 40 cm deep. When digging the hole, the topsoil should be separated from the subsoil. Dug loose the bottom surface of the hole to improve drainage and allow deeper root penetration..

Transport of planting Stock

(1) When nursery raised propagules are ready for planting (about 4 to 6 months after potting), harden the plants before transporting for outplanting. About 1 week before transporting the plants, watering should be reduced. This will minimize damage to root system during extraction and conveyance.

(2) Load and unload potted propagules carefully to avoid damage especially to the roots and new shoots.

(3) If possible, plant the propagules immediately after hauling them from the hardening bed to the planting site.

Planting technique

Planting of bamboo in plantation can be done either by direct planting of cuttings or by outplanting the nursery-raised propagules.

A. Outplanting the nursery-raised propagules

1. Loosen the soil in previously prepared planting hole.

2. Cut and carefully remove the plastic bag without breaking the balled soil and damaging the roots and shoot of propagules.
3. Lay down the propagules vertically in the hole with the soil intact.
4.. Cover the plant with well pulverized top soil.
5. Gently compress the soil around the newly planted plants
6. Water and mulch the plant

B. Direct Planting of Culm Cuttings

Direct planting of culm cutting is employed when excessive rainfall is assured throughout the year or appropriate irrigation is made. Caution, however, should be exercised in using this method if a relatively large plantation is to be established especially if source of planting stock is not readily available in the immediate vicinity.

Selection and preparation of planting for direct planting follows the same procedure as that of the nursery-raised cuttings, except that the cuttings are directly planted without the benefit of potting. The planting procedure is similar with that of nursery-raised propagules except that cutting may be laid in either horizontal, vertical or slanting position. For horizontal planting, lay the cuttings horizontally with buds sideways in the planting hole. Fill up the holes with 10 cm top soil to cover the cuttings.

Plantation Maintenance and Silvicultural Treatment

(1) Fertilization. While bamboo could grow in some adverse conditions, it is sometimes necessary to apply fertilizer to provide the plants with the kind and amount of nutrient necessary for optimum growth. This activity becomes indispensable especially when the areas most likely available for bamboo plantation development are very poor and marginal. Fertilization is usually done at planting time and every 3 to 4 months thereafter. The amount of fertilizer recommended is about 200 to 300 g of complete fertilizer. If soil fertility analysis of the area is available the amount of nitrogen, phosphorous and potassium may vary in proportion. Organic fertilizer such as cow dung and chicken manure is also recommended for plant growth development. Fertilizer should be applied in rainy season. Small amount of fertilizer per application but at closer interval is preferred than applying more fertilizer but at less frequency.

(2) Watering. If rainfall becomes irregular, it is sometimes essential to water the plantation especially in the first few months after planting if the plants show signs of wilting.

(3) Mulching. Covering the hills and the plant with grasses and other organic materials is very helpful to reduce moisture loss from soil and from the plant. This operation which is usually overlooked provides a more favorable growth development and reduces possible mortality due to heat stress.

(4) Replacement of mortality. Plants that have died should be replaced as soon as possible. If the replacement is not carried soon enough replanted plants will be suppressed by older plants and hence growth will be stunted in the long run.

(5) Weeding and brushing. Regular weeding and brushing should be conducted especially during the first two years of plantation establishment to eliminate competition for light, water and nutrient from other vegetation such as shrubs and grasses especially *cogon* (*Imperata cylindica*).

(6) Thinning. Three years after planting, it is important to thin all 3-year old and dead culms. The damage and defective culms are also removed. This will provide more growing space for new shoots and facilitate management of the clumps and the plantation as a whole.

(7) Pruning. In a well managed plantation, pruning of lower branch of the culms is recommended . This is especially done to branchy species like *kauayan tinik* and other similar species to provide access to the clump during fertilization and harvesting.

(8) Protection. As in any other plantations, bamboo should be protected from animal hazard, pest and diseases and especially from fire to which bamboo plantations are very susceptible during dry months.

(a) *Protection from fire.* Fire can be prevented by establishing firebreaks along the boundaries and compartment of plantations especially during dry months. A 10 - 20 m wide strip cleared of grasses and other flammable materials should be established along these areas. If possible, planting of fast growing fire resistant species is recommended.

(b) *Protection from animals*. If grazing animals like cattle, carabao and goat are prevalent in area, the plantation should be protected by fencing its perimeter.

(c) *Protection from pest and disease*. Rats usually damage young bamboo shoots and young culms. Termites destroy roots and lower parts of the culm. Other bamboo pests are cottony cushion mealy bug, bamboo scale, locust, leaf roller, tussick moth, and aphids. Bamboo diseases include tar spot, leafspot, leaf rust, culm blight and other physiological diseases. Commercial rodenticide, insecticide and fungicide can be used to control these pests and diseases. However, none of these has been reported to be in a widespread proportion to affect bamboo growth and development so as to pose a very serious problem.

Bamboo Harvesting Systems/ Method

Harvesting is considered as one of the principal activities in bamboo production system. Knowledge of the different aspects of bamboo harvesting operation is of great importance because harvesting is the culmination of all production efforts. Accurate information of the interrelationship of the different activities could provide a means of measuring the efficiency of the harvesting operation. This is important because bamboo clump productivity is also influenced by the harvesting system. For bamboo, there are two (2) known methods or systems of harvesting as practiced in the country:

1. Selective cutting - This system is the most common and the traditional practice of cutting commercial bamboo species in the country. In this system, only the selected culms or poles of some specific age are harvested.
2. Clear-cut or the blanket method - In this method, all the poles/culms regardless of age are totally cut leaving only the very young culms and the shoots. This system, however, is practiced in the country in a very limited area and for specific purpose only. This method of harvesting is known to be applied for harvesting *laak* species (*Bambusa Sp.2*) in Davao to be used for banana propping.

Some Considerations in Harvesting Bamboo

There are some important considerations to be observed for efficient bamboo harvesting system:

1. Culm Age - The age of the culm should be the primary consideration in bamboo harvesting. The strength, durability and other physico-mechanical properties of bamboo culm is a function of its age. Generally, for most of the commercial bamboo species, harvesting age for construction purposes is between 3-5 years old.
2. Cutting time/Season - It is best to conduct bamboo harvesting during the dry season when the culms are lowest in terms of starch content level making it less susceptible to powder post beetle attack when used in service. There is also no new shoot emergence during this time and therefore, shoot damage is avoided.
3. Cutting Height - Cutting of harvestable culms/poles should be done as close as possible to the ground preferably right after the first node for maximum pole utilization and growing space management. When the uncut portion (stumps) accumulates, it results to overcrowding occupying the growing space of new emerging shoots. It also creates additional difficulty in the next harvest.
4. Distribution - If possible, culms to be harvested should be uniformly distributed within the clump periphery. This allows even spacing of the culms to be left and eventually of the new shoots that will emerge.

Harvesting Treatment for Old Unmanaged Bamboo Clumps

Most of the existing bamboo stands in the country have become very dense and congested through the years due to inappropriate harvesting practice and virtual absence of management. This resulted in reduced pole production and poor quality of harvested culms. These bamboo stands can be reinvigorated and improved in terms of the quantity and quality of poles produced through silvicultural treatments. Heeling-up of the soil occupied by the clumps and application of fertilizer can improve stand productivity. Treatment of the stand by thinning/cleaning can also improve the productivity. There are two (2) known methods of thinning old clumps. These are the horse shoe and the cross pattern methods. The general procedure is as follows:

1. Open the clump on the side opposite to where the maximum production of new culm is noted.
2. Remove all over mature and defective culms in the interior of the clump.

3. From the periphery, cut old culms but leave enough number of healthy culms to support the young culms.

Plantation Management Regime

Sustained production of good quality poles over time should be the measure of a well managed bamboo stand. The optimum utilization of bamboo is influenced by clump age and productivity as affected by management/practices.

Study showed (Sinohin *et al.* 1990) that different species of bamboo and their components have different total chlorophyll content. These results indicate that the growth of young immature culm largely depends on the reserve nutrient from the mother culm and the carbohydrates produced during photosynthesis. Among the species, *S. lumampao* is the most dependent followed by *Bambusa sp.* and *B. vulgaris*. The least dependent are *D. latiflorus, D. asper* and *B. blumeana*. This implies that the intensity and frequency of harvesting bamboo should be regulated for sustained pole production. Therefore, over cutting of mature culms should be avoided especially those that are adjacent to new emerging and elongating shoots for at least a year. This will allow the shoots to fully establish its root system and manufacture its own food.

Moderate thinning and cutting only poles that are 3 years old and above every two years is the optimum prescription for managing natural stand of *buho (S. lumamapao)* (Virtucio and Tomboc 1990). For *K. tinik (B. blumeana)* natural stands, the optimum harvesting prescription is the application of light thinning and harvesting only the poles that are 4 years old and above every 2 two years (Virtucio *et al.* 1992). For *laak* (*Bambusa sp. 2*) plantation, the most dominant species used for banana propping, the best cropping treatment that produces the most number of culms per clump is harvesting all the 3-year old and defective culms and 50% of the 2-year old culms if planted in the flatland and harvesting all 2- and 3-year old culms including the defective culms if planted in hillyland and to be harvested at 2 years interval (Manipula *et al.* 1995).

Except for *laak*, appropriate harvesting regimes for other commercially important bamboo species in plantation have not been established as of the present although a comprehensive study on the effect of the different harvesting intensity, cutting age and cycle for 7 major species is now being conducted by the DENR through ERDB in six (6) regions throughout the country. The data collection which is being done in about 57-ha established pilot plantations of different species of known ages planted under different site conditions was started about 3 years ago but requires a longer observation period for more conclusive result on the appropriate harvesting of the major species being studied.

With these scientific information to be obtained and to be complemented with the findings of Virtucio *et al.* (1990) on the effect of culm age on pulp yield and physico-mechanical properties of six important bamboo species, an optimum harvesting and management system for different bamboo species can be developed. Physico-mechanical properties and pulp yield of bamboo vary among species, their culm age, and portion of the culm.

Growth and Yield

Growth and yield prediction is indispensable for an effective production planning and a necessary basic item for optimal decision making in management (Revilla 1974). It provides information on area allocation, cutting schedules and for the purpose of business projection. One of the basic data required for growth and yield estimates for bamboo is the age of the stand or clumps. Unfortunately, almost all of the existing bamboo stands in the country are of unknown ages which have made the estimation of yield difficult since clump productivity is observed to be affected by age. In spite of this shortcoming, PDC (1983), as cited by Tagarino (1990), reported productivity estimates of some bamboo species in the Philippines (Table 4.1.15).

Recently, however, with the proliferation of bamboo plantations, monitoring of exact ages of clumps becomes possible. So far, the only existing data on bamboo growth and development is the report by Virtucio (1996) on growth performance of eight bamboo species in the established plantations in the different sites/regions in the country for a period of five years (Table 4.1.16).

4.1.2.3 Analysis of Bamboo Propagation and Production Technologies

In 1992, Hoanh *et al.* in their bamboo production manual, made a comparative assessment of the different methods of bamboo propagation based on various activities involved from the collection of planting stock to determine the effect of the operation on the productivity of the mother clumps where planting materials are sourced out (Table 4.1.17). The analysis shows that culm cutting method provides a general overall advantage than the other methods since, while the ease of operation is almost comparable it takes a shorter time for the newly planted propagule from culm cutting to attain full clump and culm development. Rhizome or offset method may provide faster clump development, however, it is destructive to the mother clumps thus reducing its potential production unlike in the culm cutting where emergence of new shoots is enhanced. Not included in the comparative assessment is the planting stock production by tissue culture and airponics production system which have potential for mass production of bamboo planting stocks. Economics of production or costing on a planting stock or seedling basis is not also included in the analysis.

4.1.2.4 Financial Analysis of Bamboo Plantation Development

The cost of establishing bamboo plantations varies from one species to another, the method of planting and the condition of the area to be developed. PCARRD estimated that the cost of plantation on a per ha basis is about P24,000 in 1991. The Bamboo Farming Manual (ERDB 1995) estimated that the cost of establishing a hectare of bamboo (*kauayan tinik*) is about P24,498 based on 1993 daily wage. Caasi (1997) gave an estimate of P18,000 to P22,000 per hectare depending on the accessibility of the plantation area.

For bamboo planting stock production, Malab (1996) indicated a cost of P13.00 per seedling while Caasi (1997) provided an estimate of P10.00 per seedling for *laak*. Alfonso's

costing for ready-to-plant potted *K. tinik* is P50.00. Potted branch cutting of G. bamboo sells at P50.00 per pot in Duenas, Iloilo.

Uriarte and Piñol (1994) conducted financial analysis on bamboo plantation development assuming that the farmer has all the resources needed to develop and manage the plantation either from borrowings or from their own funds. Findings indicated that there are four major activity components that account for the total cost, namely: nursery operation, plantation establishment, protection and maintenance, and harvesting and hauling. The total cost is estimated at P36,000 per ha based on the following assumptions:

Assumptions:	
Area	1 hectare
Species	*Kauayan tinik*
Spacing	7 x 7 meters (210 hills/ha)
Site	Cogonal/grassland/brushland
Planting stock	Nursery rooted, 2-node culm cutting
Cutting age	3 years and older
Cutting schedule	Annual
Planning period	10 years
First commercial harvest	6th year after planting
Farm gate price	P50.00 (high quality); P40.00 (average quality) and P30.00 (low quality)*
Discount rate	10% real interest rate
Tax rate	5% of gross sales of product
Land rent	P100/ ha./year

*(High quality culms are those that are straight , 10 meters or longer; average quality are those that a shorter than 10 meters but not shorter than 8 meters and relatively straight; low quality are those of smaller and shorter culms and usually crooked.

Analysis showed that 50% of total cost is incurred in the first year with minimal expenditures in succeeding years before commercial harvest. On the 6th year, where the first commercial harvest starts and onwards all cash flows are positive (Table 4.1.18).

The cash flow schedules indicate the advantage of bamboo propagation over other crops. This projection could be even extended up to 25 to 50 years or more considering the productive life cycle of bamboo such as *kauayan tinik* as long as appropriate management regime is observed.

Analysis based on profitability indicators (NPV, BCR and IRR) revealed that a one-ha bamboo farm module hurdle the 3 tests, having an NPV of P50,612, BCR of 1.82 and IRR of

31%, greater than the assumed discount rate of 10% or the opportunity cost of the capital invested. Results of further test using the discount rate of 25% to account for inflation still indicate a positive NPV at P7,050 and BCR of 1.20. Although lower, the indication is that the bamboo farmer is still capable of getting positive stable returns if money is invested in bamboo plantation (Appendix Table 4.1.9).

Sensitivity analysis which is used to systematically test the potential earning capacity of the project if actual events differ from initial assumptions made showed that increase in cost by 10% resulted to decrease in NPV by 14% or from a value of P50,612 to P44,415 or a loss of P6,197. In terms of BCR, the value is reduced from 1.82% to 1.65%. On the other hand reduction in price of bamboo poles by 10% and leaving all other assumptions constant resulted to a drop in NPV by P11,071 or from the previous value of P50,612 to P39,541. This indicates that the decrease in price by 10% directly affects the new value by 28%. It is therefore, concluded that profitability is more sensitive to a change in the price of bamboo poles than to the change in production cost by more than two times.

4.2 Processing and Utilization

Following is an assessment of the more important subsectors of the bamboo industry. These are: (a) construction and infrastructure, (b) handicraft and furniture, (c) agricultural industries, (d) industrial purposes, and (e) food and food processing. Assessment is in terms of basic properties and technologies, the manufacturing process, and the equipment and materials used.

4.2.1 Furniture

Bamboo as a furniture material has evidently generated renewed interest with the sprouting of bamboo handicraft and furniture manufacturers in many places. Registered bamboo firms are located mostly in Metro Manila, Pangasinan, Cebu, Iloilo and Bacolod. Enterprising individuals or groups are now also in existence in Rizal, Laguna, Batangas, Cagayan, Isabela, Quirino and other provinces. Product lines include sala and dining sets, beds with headboards, rocking chairs, television/VHS stands, lampshades, bookshelves, corner display racks and many others, a far cry from furniture items traditionally made from bamboo like benches or "*bangko*" and light beds or "*papag*". The transformation of what used to be looked upon as lowly material into attractive, even costly furniture that caters even to sophisticated tastes of urban consumers once more showcases the versatility of bamboo and the imagination, creativeness and technology behind its use. Table 4.2.1 shows the common product lines of bamboo furniture items processed in Metro Manila, Cebu, Laguna and Pangasinan.

With wood and rattan becoming increasingly scarce and expensive, the shift to bamboo for modern day furniture is a welcome step. However, the use of bamboo should be tempered

with appropriate technical know-how to maintain its commercial value and sustain bamboo furniture making in the country.

4.2.1.1 Basic Properties and Technologies

Out of the 62 reported bamboo species in the Philippines, only eight (8) species are currently of high economic importance in furniture manufacture, namely: *kauayan-tinik* (*Bambusa blumeana*), *kauayan-kiling* (*B. vulgaris*), *bayog* (*Bambusa sp 1.*), *botong* (*Dendrocalamus latiflorus*), *buho* (*Schizostachyum lumampao*), *anos* (*S. lima*), giant bamboo (*D. aspera*), and *bolo* (*Gigantocloa levis*).

Kauayan tinik, kauayan kiling, bayog and *botong* are the most popularly used species in the bamboo furniture industry. Generally, *kauayan tinik* and *bayog* are commonly used and preferred species. They are best suited for furniture since both are durable enough to withstand the various processes of construction. The large culms, thick walls and prominent nodes, particularly of the *kauayan tinik*, make good qualities most appropriate for plug insertion, a concept utilized in furniture construction. Materials for furniture products are preferably mature culms, about 3-5 years old or more.

Procurement of Bamboo. Bamboos (*kauayan tinik* and *bayog*) are procured in different forms: the butt portion from 1.5 to 3.0 meters long, the middle or top portion, and the small diameter culms (about 2.5 to 4.0 cm). The butts are used for furniture legs, the small-diameter as furniture braces, and the middle or top portions are made into slats for the seat and back rest proper of chairs and table tops.

Bamboo is delivered or picked up from the source. At times, processors do their own harvesting to be sure that the bamboo they are getting are of right quality. In practice, however, manufacturers generally do not make specifications as to length, diameter or age of bamboo. They just place their orders for raw materials which are then delivered by jeeploads. When raw materials are picked-up, the buyers usually select from the stack of bamboo culms in the buying site. Those who do their own harvesting scrape a portion of the culm to see if the inside is pinkish in color, an indication that it is mature.

Storage of Bamboo Culms. The storage practice is under shed (in work area) while others leave the bamboo culms in the open through rain or sunshine. Actually, since production is based mainly on orders, the need for raw materials is immediate so these are processed shortly after procurement. The storage period depends on the processing rate. The raw materials are either left lying on the ground or standing against trees or walls of houses or shed.

Ideally, harvested culms which will not be used for some time should be stored properly. The quality of bamboo can be kept intact even after a year of storing if good storage practices are observed. Bamboo should be stored away from direct sunlight and rain to avoid brittleness and any alternation in surface color.

Leaning the bamboo poles against the walls of the storeroom is preferred than stacking them in a pile. If piling is to be done, it is best to keep the pile at least a foot from the ground to avoid dew formation. Change the arrangement of poles once in a while if to be piled for a long period. Too dense piles should be avoided to prevent moisture formation and surface scratches. Partially damaged materials caused by molds or insect infection should be treated immediately and stored separately.

Drying/Seasoning. Seasoning or drying is very important in the processing of bamboo for furniture.

Two methods of drying are practiced by processors: sun and air drying. Sundrying is unknowingly resorted to when the culms are left in the open. Direct exposure to sunlight normally causes splitting, warping and other seasoning defects.

In air drying, the material is less subject to drying defects such as splits, checks and collapse. Some manufacturers leave the culms standing against tree to prevent direct exposure to sunlight and effect air drying but they are also exposed to rain. Even where culms are kept indoor, air drying is not efficiently done as they are just piled horizontally on the ground without provision for proper aeration. Proper piling of bamboo culms was described above under Storage

Another method of drying is by kiln drying. It takes about 9 days to kiln dry bamboo as against 4 or more weeks in air drying. However, the use of kiln dryers is recommended only in large scale operations.

Preservation/Treatment. Most bamboo species are susceptible to biological and physical deterioration especially when harvested young. Producers and exporters of bamboo furniture employ different means to prevent or check the attack of powderpost beetles. Solignum and malathion are most commonly used insecticides.

Solignum can be applied by spraying, brushing or wiping on the surface of the assembled furniture. Malathion can be applied in the same manner. Injection directly into insect holes on the base or legs of furniture items using a syringe is sometimes resorted to. However, injection does not ensure complete protection against beetle attack due to the branching nature of tunnels made by insects.

However, only about 17% of the bamboo enterprises surveyed in Metro Manila, Cebu and Pangasinan practice/apply chemical treatment (Table 4.2.2). In Region VI, the practices commonly applied prior to use include the following in order of importance: spraying insecticide, drying, using gas, soaking in salty water, boiling, brushing, and cleaning.

4.2.1.2 Manufacturing Process

Modern day furniture construction does not require the use of nails to join furniture parts together any longer. Pegs and dowels, which are pieces of accurately shaped wood, are used instead as wooden fittings to join bamboo furniture parts.

Constructing the desired piece of furniture requires careful studying taking note of details specifically the type of joints to be used. A piece of furniture is made of primary components, which include the legs or posts; and secondary components such as the arms, seat frames and back rest frames. Generally, secondary components should be smaller by 1/2 inch in diameter than major components.

Following is a basic procedure to follow in bamboo furniture construction:

- Carefully study the desired design and select the proper materials.
- Measure the bamboo using either a caliper or diameter gauge.
- Cut the bamboo into the required sizes; straighten the curves by scraping and sanding the internodes.
- Measure and mark the portions to be bored and bore the holes using a hole saw with the right diameter. To bore a series of holes along a straight line, use a boring jig.
- Taper the ends of the secondary components with a disc sander in a wood lathe and fit them into the major components. Make the necessary adjustments.
- Scrape, sand and assemble all parts and insert the wooden plugs into all open ends.
- Glue may be applied to reinforce plugs.
- Perform final scraping and sanding in preparation for finishing.

For most manufacturers/processors, the flow of raw materials after the furniture design has been determined until these are converted into finished products. The following processes are involved:

Cutting to sizes. Bamboo culms are cut to desired sizes according to furniture parts using a handsaw.

Scraping. This involves the shaving or scraping of the bamboo rind with manually operated tools such as a bolo, a scythe or a fabricated scraper. The last one is actually a curved blade about 2.5 cm wide with handles on both ends. Majority is quite at ease with a bolo for scraping off the outermost covering of the bamboo culm. An adult worker can scrape a 64.7 cm long piece of culm in approximately five minutes with a bolo.

Splitting. To make slats for the seats and back rest of chairs and table tops, the culm is split with the use of a bolo into 1.0 cm width or more. The slats are hardly straight and of

uniform width because of the presence of nodes and absence of a precise splitting tools.

Boring and Jointing. In assembling furniture pieces, components are joined together using either housed joints or butt tongued joints. In house joints, one component is inserted into a hole made in the other, the size of which corresponds to the circumference of the male component. The most widely used jointing system is the chuck and bore joint, where the vertical member is bored and horizontal member is turned and tapered to fit it, the subsequent joints being both glued and doweled.

Boring of holes is made either solely with the use of gouges or with an electric drill and followed through with gouges. In the latter case, small holes are first mechanically drilled along the circumference of the intended hole size. Then gouges or carved chisels of varying width are used to chisel off portions until the desired (marked) hole size is attained. In butt tongued joints, instead of inserting one component into another, they are just laid at right angles to each other but there are holes at the joint into which a piece of wood is inserted and goes through both components to hold them together.

Doweling. This is a major technique used extensively in bamboo furniture production to connect, where possible, all components, e.g., front, side and back legs to rail. Dowel holes are drilled using electric hand drill which is adjustable or using carved chisel. They can be arranged in accordance with the profile or shape of the component being drilled. The dowel or spigots can be turned by using sharp knife in accordance with the diameter of the drilled holes into which they are expected to fit.

Binding. Binding adds more beauty and design besides strengthening the joints. Various types of materials may be used for binding such as leather, raw hide, parchment and the most popular is split rattan. Split rattan must be scraped prior to use so that subsequent staining and lacquering will have proper adhesion.

Assembly. Frame of chairs are assembled manually using a frame press and the joints are glued and doweled. Slats are binded one after the other to form back rest and seats. Nailing is still a common practice among many manufacturers.

Finishing. Although the scraping of components will have been carried out prior to sub and final assembly, some additional cleaning up is necessary at this stage. The surface preparation for finish coats consists of sanding, cleaning the sanded surface and application of sanding sealer, as the case may be. Sanding should be carried out by always going along the grain using #180 aluminum oxide abrasive papers and/or 180 silicon carbide. The use of very coarse abrasive paper will scratch the surface and marks will be visible when lacquered or stained. The manufacturers are not very concerned with abrasive grit size. Most settle for just one coarse and one fine grit which they gauge visually. The sanded surface is cleaned by wiping with wet cloth. Then the furniture is sun-dried. Others apply sanding sealer before applying the finish coat, accordingly to improve finish quality and save on top coat. They do this even when

no stain is applied so apparently, the sanding sealer serves as a base coat. One to two coats of sanding sealer are applied followed with slight sanding using grit 320. They are cleaned and top coat is applied depending on the choice of customers.

Topcoats used are Valspar clear varnish, plastic clear varnish, mahogany-colored varnish, clear lacquer, and enamel paint. These are all applied by brushing or spraying. To give a decorative touch to the finished products, some manufacturers singe the nodal portions of the culms with a blow torch before applications of clear finish coat.

4.2.1.3 Other Raw Materials Used

Split rattan. This comes in two types: the clean strips that need little scraping and the coarse strips that need more scraping to clean or smoothen them.

Black plastic strips. These are used by some manufacturers instead of split rattan.

Filler and Glue. Weldwood, epoxy and wood filler ("masilla") are all used for filling in oversized holes in ill-fitting joints. These also serve as bonding materials in joints.

Varnish. Valspar or plastic varnish either clear or in mahogany color (when stained finish is desired by buyers) are used as topcoating for the furniture. Sometimes, tinting colors are mixed into the varnish for a desired coloring of the furniture.

Treating Chemical. The chemical preparations used against powder post beetles are aldrite, solignum, malathion, common table salt and a combination of salt and detergent. Soaking in plain water is also resorted to.

Sanding Sealer. Some manufacturers apply sanding sealer prior to application of topcoat for better finish quality.

Sandpaper. This is either paper or cloth backed and come either as cut-to-size pieces or continuous panels purchased by yard. The grit size range from 80 to 200.

Steel nails. Most manufacturers still use wooden shoe nails to hold the slats for the chair seat and back rest instead of tying these with rattan or plastic strips.

4.2.1.4 Equipment/Tools/Gadgets Used

Table 4.2.3 presents the list of tools, machines and other equipment used for bamboo handicraft and furniture production. The possible sources of tools and equipment are listed in Appendix Table 4.2.1. Most bamboo furniture processors use tools/gadgets/equipment for the various operations as follows:

Operation	Equipment/Tool/Gadget
Cutting to sizes	Crosscut handsaw
Scraping and removing nodes	Any one of the following: bolo, scythe, knife, fabricated scraper
Splitting	Bolo and mallet
Boring	Electric drill or gouge (carved chisel)
Sanding	Disc sander or sanding paper
Smoothening culm edges	File
Finish application	Brush or spray
Decorative scorching	Blow torch

The common facilities, tools and equipment used by small and medium bamboo enterprises in Metro Manila, Cebu, Laguna, and Pangasinan, including their prices are presented in Table 4.2.4.

4.2.2 Handicraft (Bamboocraft)

Majority of the country's regions are engaged in bamboo handicraft production outranking wood and rattan crafts. Readily available than wood, bamboo is crafted into various household items/commercial articles for both local and foreign markets. Among the common items include trays, lampshades, fancy baskets, brooches, napkin rings, pen holder, jewelry boxes, flower vases. Table 4.2.1 also shows the product lines for the gifts, toys, and housewares in Metro Manila, Cebu, Laguna and Pangasinan. For Region VI, the most important bamboo products include furniture, construction/building materials, handicraft, novelties, earrings and trophies, religious items, and utensil handles.

4.2.2.1 Basic and Technological Properties

Bamboo species commonly utilized for handicraft manufacture *include kauayan tinik, kauayan kiling, bayog, buho, bikal*, giant bamboo and *bolo*. Large culms, thick walls, long internode are among the important properties. Younger culms are desirable and freshly cut bamboos are preferred to ensure easy splitting and to make fine splitting possible. The material should produce bamboo strips that are durable, flexible and can withstand the different processes of interlacing when weaving. Dried bamboos are rough and brittle producing inferior quality handicraft products.

4.2.2.2 Manufacturing Process Flow

The general steps in handicraft manufacture are as follows (PHRDC 1987 and PCARRD 1984) :

Raw Material (Bamboo culm) → Cutting → Scraping → Splitting → Slitting → Slicing → Sizing → Shaving → Chamfering → Dyeing → Weaving → Chemical→ Treatment → Drying → Finishing

Cutting. Cutting is done either with an ordinary handsaw or a Japanese razor. Poles are measured to desired lengths and cut crosswise. The circular saw pole cutter is another device ideally used for mass production.

Scraping. This involves removing the outer skin of the bamboo. An ordinary bolo may be used. However, it is more convenient to use the drawback or scraper. The curved blade of the drawback should be in contact with a larger surface area during each stroke to make scraping more convenient. A bamboo scraping machine can do the job more efficiently.

Splitting. Poles are divided into several pieces called bamboo splits during splitting. An ordinary bolo may be used but a hand splitter can do the job more effectively. This device is especially designed to produce several bamboo splits in one operation. The number of splits produced depends on the number of blades attached to the splitter. For mass operation, a splitting machine may be used if available.

Slitting. This involves cutting the splits along lines parallel to the radius of the bamboo pole to produce narrow pieces. A bolo may be used but a cleaver knife can produce bamboo slits much faster and easier. This tool, which is shorter than ordinary bolo, is handy and convenient to use. It gives more force during the operation since it is thicker and heavier. If a slitting machine is available, bamboo slits can be produced faster.

Slicing. Slicing is cutting thinner bamboo splits along lines perpendicular to the radius of the bamboo pole. An ordinary kitchen knife or bolo can be used but a cleaver knife is preferred for the operation. A bamboo slicing machine can also be used to do the job more efficiently.

Sizing. This is the production of flat strips (sliced or slitted) with uniform width. A double bladed Japanese knife which is handy and easy to use is recommended for this process. For faster and more accurate production of uniform flat strips, a sizing device which has two adjustable blades produces the desired size of all strips passing through the device.

Shaving/Stripping. Producing bamboo flat strips with uniform thickness (sliced or slitted) is called shaving or stripping. An ordinary kitchen knife may be used but a short Japanese knife is more handy and convenient. If available, a shaving device with an adjustable blade facilitates the operation. The distance between the blade and the metal surface determines the thickness of the processed strips.

Chamfering. This involves the removal of sharp edges of bamboo flat strips to enhance workability while interlacing the flat strips into the desired form. Removing the sharp and rough edges of flat strips also improves the appearance of woven products by giving it a neat and trim look. An ordinary kitchen knife may be used but a device called a chamfering knife can do the job more efficiently. This knife has sharp ridges similar to the handsaw and is best recommended for this process.

Dyeing. This involves soaking the strips for a few minutes in a boiling dye solutions prepared by dissolving 1 tbsp of dye for every 20 l of water.

Weaving. Considered an important phase in bamboocraft production, weaving involves interfacing processed bamboo strands to form desired patterns. There are several designs or patterns for weaving named according to their shapes; however, the three (3) basic types are the cross, hexagonal and netting patterns. Table 4.2.5 shows the variations or designs derived from these basic patterns.

The cross pattern is a simple and most frequently used in bamboocraft weaving. Vertical and horizontal bamboo spokes set across each other are woven alternately forming a cross. The cross-diagonal, double cross and open square are variations of the cross pattern.

The hexagonal pattern is considered the simplest and cheapest among the basic patterns. It is commonly used for various basket products. Variations such as the double hexagon, blinded hexagonal, hexagonal cornflower, variant hexagonal, blind hemp leaf, and triangle pattern are derived from the basic hexagonal pattern.

The netting pattern is a popular design slightly similar to the cross pattern. It is used for basket trunks, table plate, table mats, handbags, bookshelves, ceiling covering and other products.

Chemical Treatment. The products are dipped or brushed with a mixture of equal amounts of Solignum and thinner to prevent attack of "*bok-bok*" or drywood termites.

Drying. To keep the products from becoming brittle, they are sun-dried for an hour or less.

Finishing. Depending on product lines, they may be applied with finishes (brushing or spraying) such as varnish or lacquer to enhance their quality or beauty.

4.2.2.3 Tools, Equipment and Machineries

The list of hand tools, machineries and other equipment for bamboo handicraft and furniture production is presented in Table 4.2.3.

For handicraft, the basic hand tools include the following:

Bow saw. A 2 cm-bladed saw with a jagged edge attached to a wooden handle. Used for cutting materials crosswise to avoid cracks and removing unwanted branches.

Cleaver knife. A double-edged knife with a flat tip. Used for splitting and slitting small pieces of bamboo materials.

Shaving knife. A sharp knife with a broad blade attached to a long wooden handle. Used to produce sliced or slitted bamboo flat strips of the same thickness.

Sizing knife. A pair of short-bladed knives with very pointed tips. Used for producing bamboo strips of the same width.

Chamfering knife. A knife with a jagged sharp blade attached to a wooden handle. The teeth at the edge become finer towards the tip of the blade. The tip is flat and unpointed. Used for removing sharp edges of bamboo flat strips.

Drawback. This tool has a curved flat blade slightly broad at the center and narrow at both ends. Each end of the blade has a wooden handle. Used for scraping the outer skin of the bamboo materials.

Bamboo Hand Splitter. An iron wheel with sharp blades radiating from the center and having two long iron handles extending horizontally at the wheel's circumference. Used for splitting bamboo poles.

Sharpening Tools. The quality of the finished product depends to a great extent on using sharp tools. It is ideal that the edges of cutting tools are checked regularly.

Scissor. A cutting instrument having two blades whose cutting edges slide past each other. Used for cutting bamboo weaving sheets.

Spokes/Weaves Setter. A piece of metal device with pointed tips used to set the weaving strips in desired distances.

Electric Bending Iron. An iron rod with a 4-sided tip attached to a wooden handle. Used for bending flat bamboo materials to be used as frames for bases or borders of bamboocrafts.

Bamboo Slicing Machine. Ideal for producing thin bamboo splits to as low as 0.05 mm. The thickness of materials fed into the machine should not exceed 7 mm and a width of about 30 mm.

Bamboo Splitting Machine. This machine splits bamboo culms into several pieces of equal measurements.

4.2.3 Construction Materials

4.2.3.1 Basic and Technological Properties

Bamboo is one of the oldest and chief building materials in rural areas and villages throughout the world's tropical and sub-tropical regions. In the Philippines, a greater portion of the local populace particularly those living in the countryside still depend on bamboos as the primary material for the construction of low-cost houses. Bamboo construction is popular for several reasons: (a) the material is plentiful, (b) the villager can build his own house with simple tools, (c) there is a surviving tradition of skills and methods adequate for construction, and (d) the bamboo house is easily built, easily prepared, well ventilated, sturdy and earthquake resistant.

However, the physical characteristics of bamboos make it difficult to process and fabricate mechanically. The variation in dimensions, the crookedness of the culms, the non-uniformity of the internodes, and the unevenness of taper all contribute to the difficulties encountered in construction.

However, about 8 bamboo species have been studied (Espiloy and Espiloy 1992; Espiloy and Sasondoncillo, 1976, 1978; Espiloy and Robillos, 1985; Espiloy *et al.* 1985, 1995; and Espiloy 1982) for its strength properties, namely: *kauayan tinik, kauayan kiling, bayog, bolo, buho*, giant bamboo, *laak and kayali*. There years of age is the most appropriate time to harvest bamboo for furniture making and general construction work. Several solutions to the emerging construction problems have evolved from centuries of practical experience, that it is not easy to revolutionize the present mode of use of bamboo as a construction material. On the other hand, it is necessary to reorient old methods to modern ones, thereby bringing into focus newer products of technology such as application of glue and preservatives to bamboo mats thus producing bamboo matboards for wallings (Espiloy *et al.* 1995) and roofing (Carandang 1995).

Our society today is fast-paced and continuous in growth and movement. Also, our country has been beset with numerous natural calamities that create the need for emergency shelters. For this reason, it is appropriate for structures to have the flexibility to adapt to man's changing needs and activities. This flexibility may be achieved through the use of a basic unit upon which modules can be added and subtracted as the needs arise and this is the development of modular construction/building systems (Peralta 1996).

In a recent survey conducted by Lopez (1997) in Bula, Camarines Sur, about 95% of the rural part of the municipality use bamboo in practically all aspects of their life. For construction

purposes, most of the houses are constructed of bamboo ("sawali" or split), and roofs of *nipa* have bamboo trusses and purlins;

- posts are of bamboo;
- doors and windows, walls and floors;
- stairs and bridges;
- cooking area ("*dapag*" in Bicol);
- sink and rack area ("*batalan*" or "*banggerahan*" in Bicol;
- gates and fences;
- scaffolding and construction skeleton (form);
- animal pens (pig pens, dog house, chicken and duck houses)
- greenhouses and vegetable trellises;
- outhouses, bodegas, and garages; and
- covers for copra cookers ("*agonan*" in Bicol)

In a survey conducted by Aliño (1989) in Central Visayas comprising Cebu, Bohol, Negros Oriental and Siquijor, about 48% of the households interviewed used bamboo as construction materials for their dwellings. Every dwelling used up about 24 bamboo poles. For every repair, every dwelling used up about 18 bamboo poles. Of these bamboo users, about 88% purchased the bamboo used, the rest were "home produced". Some households reported using bamboo splits; others bought bamboo poles. Bamboo splits were converted into bamboo pole equivalent based on the assumed ratio of 40 sticks: 1 pole.

Based from the 1997 survey, the product lines for the construction industry include packaged "*bahay-kubo*", "*sawali*" sheets, bamboo roof (shingles), bamboo spokes (sizes 26", 24", 22", 18" and 12") and bamboo splits. Bamboo products with market potentials for construction purposes are "*sawali*" and architectural components which the enterprise plans to produce in the future.

4.2.3.2 Manufacturing Process

(a) Bamboo Processing

Bamboo has to undergo a number of processing operations before they could be made into different products. Some of these operations are common for most of the products.

Figure 4.2.1 shows that, after felling, the branches are removed, and cut to required lengths. If required, starch and gummy substances are removed from bamboo at the initial stages itself. Then a primary processing step like splitting or bending or flattening is carried out depending on the end product. For certain products, the bamboo components are passed through secondary processing step like bleaching or dyeing. The articles are finally finished.

(b) Manufacture of Selected Bamboo Product

Bamboo Parquet Block

In studies at FPRDI, three bamboo species were used for bamboo parquet block. These are *kauayan tinik, bayog* and giant bamboo. The bamboo parquet block is a composite material made up of wood veneers and bamboo slats. The preparation of the slats consists of splitting the bamboo into one-inch width or more but not exceeding two inches, after boiling the bamboo in water for 2 hours. Wood veneer has a core thickness of 60% to 70% of the total thickness of the composite and dried to 8 - 10% moisture content.

Gluing consists of spreading the core with synthetic resin such as urea, melamine or phenolic at 35-40 lbs/1000-ft^2 and hot pressed at 250°F and specific pressure of 175 psi.

Bamboo Particleboard

Bamboo and ipil-ipil wood are converted into particles and mixed by the following proportions:

bamboo particles (%)	wood particles (%)
100	0
70	30
50	50
30	70

Gluing is done at 4 resin content levels of urea formaldehyde and mat forming at 340°F and pressed for 7 minutes.

Resin-bonded Bamboo Mat

Fresh or green bamboo culms are converted into slivers, 300 mm long, 10 mm wide and 1.0 mm thick taken from long internodes, and hand-woven into bamboo mat (sawali) 300 x 300 mm in size. *Kauayan tinik* and *botong* bamboo species are used. Urea formaldehyde is used as the adhesive with glue spread of 141 g/m^2 and hot pressed at 20 kg/cm^2 specific pressure and pressing time of 2 minutes.

Based on the properties of the bamboo boards produced, *botong* species was found better than *kauayan-tinik*.

Corrugated Bamboo Sheet (CBS)

Kauayan tinik and *kauayan kiling* bamboo culms are converted into slivers. The steps involved in the manufacture of CBS are as follows:

- separation of internodal segments
- splitting into 14 mm wide strips
- sizing of slivers into 0.50 mm to 1 mm thick
- weaving of slivers into mats of 40 cm x 40 cm

- air-drying of woven mats to about 10% to 15% moisture content
- application of phenol resorcinol formaldehyde adhesives
- hot pressing of glued mats in the fabricated corrugated mold.

Bamboo Plyboard

The product is a pre-painted panel board made basically out of waste plastics, rice hull ash and bamboo. It has versatile usage in the construction industry inasmuch as it can be used for flooring, exterior and interior walling, furniture making, ceiling and roofing. It has basically bamboo slats as its structural element and utilizes a unique emulsion produced from waste plastics and rice hull ash to serve as binder under Patent Number 7484. The surface coating emulsion used for painting the plyboards is under Patent Number 7343. The following are the basic steps involved in the manufacture of the product:

1. Production of waste plastic binder emulsion.
2. Production of surface coating emulsion
3. Preparation of bamboo slats (cleaning, cutting, splitting and planing)
4. Forming of plyboards (assembly of bamboo structural matter and binding with emulsion)
5. Drying
6. Edging/Trimming
7. Painting
8. Stocking

Equipment and machinery for plyboard manufacture are as follows: hammer mill, splitter, planer, assembly beds, trimmer/edger, mixing trough, paint application, and conveyor.

Bamboo Scaffolding

Bamboo poles lashed together have been in use as scaffolding from ancient times. They are admirably suited for the purpose because of their strength, resilience and shape. Bamboo scaffolding is still used extensively in Asia, Africa and Latin America to support the various operations of building, painting and repair of even multistoried structures. The platforms on which masons stand while working and building materials are also kept, often consisting of bamboo culms laid side by side and lashed to supporting members. When lifting devices are not used in building construction, ramps constructed from bamboo often serve for vertical transport of materials. Bamboo scaffolding is also erected against dwellings to support bamboo matting for protection against the sun and rain during summer.

4.2.3.3 Tools, Equipment and Machineries

Tools and equipment used in the primary processing of bamboo prior to the manufacture of selected bamboo products as housing components (wallings, roofings, sidings and floorings) are: cutter, splitter, sizer, planer and trimmer. Cold/hot press machine is used in the lamination of bamboo boards for wallings and roofing.

4.2.4 Basketry

In Region I, the basket making industry is distinctly separated from handicrafts because a lot of people are specializing in *kaing* and *kaping* (*biladan ng bihon*) making. About 3 towns in Pangasinan are exclusively producing these two product lines. The annual bamboo requirement of the 611 basket makers is about 97,760 culms. Specific demands has wide range implications to the supply side because of the variation exhibited by the different species in terms of production cost, field performance, site adaptability, growth and yield, and farm gate prices. The species prevalent in the area are *kauayan-tinik, bayog, kauayan kiling* and *buho*. Some basket weavers do not have records on what bamboo materials or species they use.

The 1997 survey conducted in Metro Manila, Cebu and Pangasinan showed that the product lines of the basket making industry are hampers (set of 2 and 3), planter's basket (set of 3), picnic baskets, waste baskets and round baskets. In the survey of Uriarte and Maligalig (1992) in Region I, the product lines are basket, *kaing, kaping ("bilaran ng bihon")*, *bilao* and hamper .

4.2.5 Fishing and Agriculture

In Region I, *talaba* cultivators and fishpen operators are the 2 major bamboo consumers for this industry. The annual culm requirement of the 135 *talaba* cultivators is 13,500 *bayog* poles and the 8 fishpen operators need 25,500 *kauayan tinik* culms per year.

Kauayan tinik, *bolo* and *buho* are the species extensively used in the fishing industry. Bamboos used in the fishing industry are not treated with preservatives. Their prolonged immersion in water has a preservative effect on the culms. Bamboo use in the fishing industry include rafts, traps/coral, fishpens, boat outriggers, fish shelters, stakes and fishing rods.

In Bula, Camarines Sur, bamboo is also used as banca stabilizers (Lopez 1997).

Bamboo poles are used as props to support fruit-bearing bananas. Two 2-1/2-4 meter culms are dug slightly into the ground and crossed to support a fruit-bearing banana plant. The species used as props in the banana industry are: *kauayan-tinik*, *bolo*, *botong*, *laak* and *kayali*. The same principles and procedure in the drying and preservation of bamboos for housing and other constructions apply in the drying and preservation of bamboos to be used as banana props.

4.2.6 Food

The young shoots or "*labong*" is a nutritious vegetable and palatable to most Filipinos. *Kauayan tinik* and *botong* are the most common commercial species utilized for food. However, there are no reliable figures to indicate the volume of bamboo shoot production and its

distribution among regions since in most cases many of the shoots are harvested by the farmers as they come out, then consumed at home or sold in the market. The young shoots are washed carefully, sliced and boiled before they are used. The nutritive value and proximate chemical composition of some Philippine bamboo species are shown in Appendix Tables 4.2.2 and 4.2.3.

There is no bamboo shoot canning factory in the country. All canned shoots in the market are imported either from Thailand or China. Nonetheless, canning of bamboo shoots can be done in the country.

Throughout Southeast Asia, bamboo shoots are eaten fresh, pickled or dried. A number of local dishes can be prepared with bamboo shoots, namely: *lumpiang sariwa*, *labong* relish, *atsarang labong*, *ginataang labong*, *labong* with black beans or tausi, *dinengdeng na labong* and *adobong labong*.

4.2.7 Pulp and Paper Industry

Bamboo is an important raw material for pulp and paper manufacture. In the late 1960s, bamboo was used by BPPMI for the production of quality printing and writing paper. BPPMI applied the kraft or sulfate process in producing the bamboo pulp. After a number of years of operation, the company shifted to logging residues coming from Mindanao due to the depletion of bamboo in Bataan and nearby areas. In 1993, a small paper factory based on bamboo was put up in a Barangay in Calamba, Laguna. Bamboo is chipped and then soaked in a mild caustic soda solution for about a week at ambient atmosphere. The treated chips are then refined in a disk refiner to produce pulp. Bamboo pulp is processed into "incense paper" for export to Taiwan. India is utilizing commercial quantities of bamboos for pulp and paper production. Bangladesh, Thailand, Indonesia, Japan and Taiwan are also utilizing bamboo but in much lesser quantities.

4.2.7.1 Basic Properties and Technologies

Researches conducted by the FPRDI have shown the suitability of some Philippine bamboos for pulp and paper manufacture although the papers produced were of slightly lower quality than paper made from wood. Local bamboo species that have been utilized for paper manufacture are:

Anos [*Schizostachyum lima* (Blanco) Merr.]
Bayog [*Bambusa sp. 1*]
Bikal [*S. diffusum* (Blanco) Merr.]
Buho [*Gigantochloa levis* (Blanco) Merr.]
Giant bamboo [*Dendrocalamus asper*]
India bamboo [*Bambusa arundinaceae* Wild.]
Kauayan-china [*B. multiplex* (lour.) Rawusch]
Kauayan kiling [*B. vulgaris* Schrad.]

Kauayan tinik [*B. blumeana* Schultes f.]
Pole-vault bamboo [*Phyllostachys nigra* Munro]
Spineless India bamboo [*B. tulda* Roxb.]
Yellow bamboo [*B. vulgaris* Schrad. var. striata (Lodd.) Gamble]

Fiber morphology. The fiber dimensions and derived values of some Philippine bamboo species are shown in Table 4.2.6. The derived values used with hardwoods and softwoods such as slenderness ratios, flexibility ratios, and Runkel ratios may not be applicable to bamboos. Generally, fiber lengths of bamboos (1.45-3.78 mm) are comparatively longer than those of the hardwoods. The fibers are less promising for papermaking based on their Runkel ratio values (1.33-8.00) which should be equal to or less than 1 for acceptable paper making materials. Moreover, the fibers are stiff, so that sheets have lower density and over-all strength. Bamboo fibers are high in tearing resistance but low in tensile strength, based on their slenderness ratios (73:199) and flexibility coefficients (11-43).

Chemical composition. Table 4.2.7 lists the proximate chemical composition of some Philippine bamboos.

4.2.7.2 Pulp and Paper Making Process

Preparation. First, the culms are prepared for pulping. Two devices are used:

Crushers. Bamboo crushers are similar to those used in sugar mills. the culms are split and broken by feeding them through pairs of rolls with progressively narrowing clearances and grooves.

Chippers. Modern high speed bamboo chippers with 5-10 knives like those used for pulpwood are being used in recently established mills. Some chippers have provisions for holding the culms against the chipper knives.

In some mills, a combination of crushers and chippers are used. First, the culms are lightly crushed and then chipped. Then the chips are screened and the fines discarded. The oversized pieces are reduced to their proper size by passing them through hammermills, disintegrators, and other similar devices. The screened pieces go into the bins, silos, or direct into the digesters.

The crusher produces subdivided pieces which are very easily penetrated by cooking liquor. However, the bulk of pieces produced by crushers is greater than that of an equal weight of chips produced by chippers. The material produced by the chippers contains less fines and the chip are of more uniform length (1-1 1/2 cm) than those produced by the crushers. The crushed material consists of irregular-sized pieces, some of which are as long as 5 in. Due to the high silica content of bamboos, the knives quickly lose their sharpness. Therefore, frequent regrinding or replacement of the chipper knives is required.

Pulping Methods. The sulfate and sulfite processes are employed in pulping bamboo. While the soda process may also be applied in pulping bamboo, the pulp produced is inferior in quality in most respects to pulp produced by the sulfate process. Mechanical grinding, neutral sulfite, cold soda, semi-chemical pulping, and continuous kraft digestion experiments have been done with bamboo, but these are not practiced on a commercial scale as yet.

Sulfate or kraft process. This process makes use of caustic soda and sodium sulfide in the cooking liquor. It produces pulp with exceptional strength, unbleached. This dark-colored pulp is used in the manufacture of wrapping and bag papers and linerboards for fiber boxes. To produce lighter-colored paper from this pulp, this is subjected to multi-stage bleaching.

This process makes it generally possible to pulp mixtures of various species. A chemical recovery system facilitates recovery of the chemicals in spent liquor for reuse, and to generate steam during recovery. Without recovery, the cost of chemicals in the soda and sulfate processes would be excessive. Recovery also greatly reduces the waste-disposal problem.

The sulfate method is the most widely used bamboo pulping process because it readily produces acceptable pulp from mixtures of various species. The pulp is stronger than that produced by other processes and the chemical recovery system is efficient and reliable.

There are two methods of sulfate digestion: the fractional or two-stage method and the single-stage method.

The pulp obtained by fractional method is easily bleached by a single hypochlorite treatment. However, the modern two-stage method includes the following variations: (1) in the first stage, 203% active alkali as sodium oxide and a cooking time of 2-4 hours at 142-150°C are used; and (2) in the second stage, 12-13% active alkali as sodium oxide and a cooking time of 44.5 hours at 162-170°C are used.

Utilizing less complex single-stage cooking methods to produce bleachable pulps is now possible as there are modern multi-stage bleaching processes. The single-stage sulfate method takes 45 hours at 165-173°C with 15-16% active alkali as sodium oxide. The sulfidity of the cooking liquors used for both single-and two stage digestions varies from 10% to 25%.

A study at FPRDI showed that some Philippine bamboo species such as bolo (*Gigantochloa levis*), *buho* (*Schizostachyum lumampao*), giant bamboo (*Gigantochloa aspera*), *kauayan-kiling* (*Bambusa vulgaris*), *kauayan-tinik* (*Bambusa blumeana*) and yellow bamboo (*Bambusa vulgaris* var. striata) respond well to the kraft or sulfate method of pulping. The results of the study are shown in Table 4.2.8.

The above species had a higher range of ash and silica contents than the other Asian species, but had lower lignin contents than the Indian species. The Philippine bamboos were easily digested with 15% NaOH and 5% Na_2S at 170°C for 3 hours. Bleachable pulps with

permanganate numbers ranging from 13.048.0% were obtained. In general, the bamboos studied yielded pulp with higher tearing resistance but lower folding endurance, bursting strength, and tensile strength than foreign softwood kraft pulps and Philippine hardwood kraft pulps. The relative rigidity and moderate length of the bamboo fibers were associated with the strength differences between the bamboo and other pulps.

Sulfite or acid process. The cooking liquor in the sulfite process consists of a mixture of calcium, magnesium, or ammonium bisulfite and sulfurous acid. The resulting pulp is relatively light colored and easier bleached than pulp produced by the sulfate process. It is strong enough to make newsprint, magazine paper, greaseproof, glassine and fine papers. The sulfite process is also employed in the production of dissolving pulps, such as those that are used in the manufacture of rayon and cellulose films of various kinds.

One disadvantage of employing the sulfite process in pulping bamboo is that each species must be cooked separately as different digestion conditions are required for each. Consequently, more labor is required in handling each species separately in stacking, chipping, etc. The cooking time is a lot longer (12.5-20.5 hours) than the time required by the sulfate process. Another factor which has hindered its wider use has been the absence of a chemical recovery system in the process. The application of a modern recovery system may make this process competitive with the sulfate process.

Cold caustic soda semi-chemical pulping. In this process, the chips are soaked in caustic soda solution at normal atmospheric pressure and temperature for a few hours. Then they are fiberized in disc mills. The pulp is yellowish. Among it uses are in making newsprint, toweling, corrugating, and insulating papers and building boards. Pulp for both high-and low-density hardboards can be produced by this method.

This process is relatively simpler than other semi-chemical processes. Recently this method has been shortened by the use of hydrostatic pressure, which effects quick chemical impregnation of the chips, in a few seconds or minutes instead of hours.

Bleaching. Sulfate pulps cooked in two stages are bleached in the mills by two hypochlorite treatments; they are washed after each treatment. The chlorine consumption ranges from 7-10%.

Multi-stage bleaching is used for pulps produced by the sulfide process and those cooked in a single stage. The stages involved are: Chlorination, caustic extraction, and one or more stages of hypochlorite treatment. Every stage is followed by washing. Chlorine consumption varies from 6-8%.

Papermaking. Bamboo papermaking uses essentially the same procedure used in making paper from other fibrous materials. Bleached sulfate and sulfite bamboo pulps, either alone or in combination with other pulps, are used for making a wide variety of writing, printing, and

wrapping papers, newsprint, and paperboards. Unbleached bamboo pulp is used for making paperboards, wrapping and bag papers.

Several types of paper were produced by the FPRDI from *kauayan tinik* sulfate pulp. Experiment bond paper from the bleached pulp had better strength, brightness and capacity than commercial bond paper and they exceeded the US Federal Specifications. Experimental airmail bond paper from bleached pulp had better strength properties than that made from imported commercial bleached sulfite pulp. Onion skin from the bleached pulp was comparable to commercial onion skin and also exceeded the bursting strength requirements of the U. S. Federal Specifications for manifold paper. Offset book paper from the bleached pulp was comparable to commercial offset bookpaper in most properties and also met the US Federal Specifications for uncoated book paper.

The *kauayan kiling* experimental bag and wrapping papers produced from sulfate pulp exhibited higher tearing resistance but lower burst, fold and tensile strengths than commercial papers tested at FPRDI. However, when better adhesives such as starch, guar gum and locust-bean gum were incorporated in pulp furnishes, its burst, folds and tensile strengths were considerably improved. The strength properties of the papers made from pulp reinforced with adhesives were superior to those of the commercial papers tested, and exceeded the U.S. Federal Specifications.

The wrapping papers made from *buho*, giant bamboo, *kauayan kiling* and *kauayan-tinik* sulfate pulps were deficient in burst strength but sufficient in tear strength for Grade A and B kraft wrapping papers. Blending up to 40% giant bamboo kraft with hardwood sulfate pulps improved its tearing resistance, but at the same time lowered the burst and tensile strengths.

Good quality newsprint was made from combinations of bamboos and hardwoods. This was particularly observed in a papermaking stock consisting of a combination of 80% unbleached gubas neutral sodium sulfite chemi-mechanical (NSSCM) pulp and 20% bleached *buho* sulfate pulp, or the combination of 85% unbleached gubas cold-soda pulp and 15% bleached *kauayan kiling* sulfate pulp.

PICOP formerly Bislig Industries, Inc. in search for a source of long fiber pulps established in its forest concession in Bislig, Surigao del Sur, an experimental bamboo plantation in sites other than along river banks and creeks.

According to Chinte (1965), a ton of bamboo from the 3-4 year old plantation contained from 86 to 190 green culms or from 216 to 337 air-dry culms. At 40 percent pulp mill utilization some 540 to 843 culms of dry-air bamboo will be necessary to produce a ton of pulp.

The annual yield of air-dry bamboo per hectare of 3 to 4 years old plantation was found to be 5,991 to 6,900 kg for *kauayan kiling*; 1,261 to 1,735 kg for *kauayan dilaw* and 663 to 1,068 kg for giant bamboo. At 40 percent pulp mill utilization, the corresponding pulp production

figures are: 2.396 to 2.760 tons for *kauayan kiling*; 0.504 to 0.694 ton for *kauayan dilaw* and 0.265 to 0.427 ton for giant bamboo.

4.3 Market Environment

4.3.1. Philippine Market

4.3.1.1 Market Participants

Who are they?

The bamboo market consists of buyers, sellers and other market intermediaries involved in the production, trade and consumption of products classified as raw/construction materials and end/finished products. These market participants are engaged in exchange (buy and sell), physical (transport, processing, storage) and other facilitating (grading, standardization, promotions, providing price and market information, financing) activities necessary to make products available to users in the appropriate form, time and place.

The participants in the bamboo market are as follows:

(a) licensees or permittees allowed to establish/maintain plantations for poles, shoots, and/or planting materials and/or harvest bamboo in public/forest lands;
(b) owners of natural stands or plantations in private lands for poles, shoots and/or planting materials;
(c) gatherers of bamboo hired by permittees or private land owners;
(d) producers of intermediate products such as splits, woven products such as sawali, plyboo, other floor and wall boards;
(e) manufacturers of finished products such as furniture, handicrafts, other gifts and housewares;
(f) traders including cooperatives, agents, wholesalers, retailers, exporters and importers of raw materials like poles, stumps and shoots, intermediate products in (d) and finished products in (e);
(g) in-house (or subcontractors) and factory workers
(h) consumers/end-users such as households, builders, fishpen operators, and others; and
(i) service sector such as input suppliers, machine fabricators, financiers, transporters, and providers of market and price information.

They are not mutually exclusive such that a market participant may be involved in various activities in varying extent. An extreme case is one who is simply a permit holder or one engaged in a full vertically integrated operation, that is, from sourcing and production of raw materials to exporting or retailing of finished products to end-users.

Full accounting of the total number of market participants is not possible because of (a) proliferation of small unregistered firms and those engaged in informal market transactions, (b) firms also handle non-bamboo materials and products and may be listed under non-bamboo firms and (c) the dynamic nature of the market where conditions prompt participants to shift to other products and/or other economic activities.

Different sources indicate the importance of the bamboo industry considering their number and extent of economic activities engaged in. Table 4.3.1 shows the estimates available from various sources. It is estimated that direct participants could exceed more than 50,000 if workers which comprise a significant number are included. The most recent list indicates 171 bamboo-based firms excluding workers and small unregistered firms.

Characteristics of market participants

The bamboo firms included in the 1996 listing are located mostly in Metro Manila; other parts of Luzon particularly Pangasinan; and the Visayas primarily Cebu, Iloilo and Bacolod (Table 4.3.2). Very few are in Mindanao. Majority are managed as corporations and single proprietorship. Of those reporting, very few were established in recent years indicative of the considerable business experience of most firms. Manufacturers and exporters dominate the registered firms but it should be noted that a few are engaged in propagation and even architectural and artistic work for bamboo. Limited data on employment suggest that most firms have 50 workers or less with some firms having more than 100 the highest at 700 workers.

Based on a recent survey of bamboo participants in the Cordilleras and Western Visayas, some of their socio-economic characteristics are presented in Table 4.3.3. All have gone to school with majority of the workers having attended the secondary and vocational levels. The number of household members involved in bamboo activities is as many as 4 for gatherers and 7 for traders, practically all household members. Workers include both males and females with most of them depending on bamboo activities as primary income source. However, except for traders and manufacturers, annual income from bamboo is quite low, averaging less than P5,000 for gatherers, P5,000-10,000 for raw material producers and furniture workers and P10,000-15,000 for raw material traders and handicraft workers.

Roles, functions and interrelationships

Ideally, each market participant must perform his function properly avoiding activities that are unnecessary in order to keep costs at a minimum. Oftentimes, specialization is essential but in some cases, integration of activities leads to scale economies. Thus, a gatherer may not be involved in manufacturing activities considering resource constraints but he must be able to respond readily to the pole requirements of the manufacturers. However, a plantation owner may go into handicraft or furniture manufacturing if management, financial and labor resources and markets are readily available. Otherwise, he may be better off being a supplier of the raw material to a city-based manufacturer or the community's construction needs for bamboo.

Table 4.3.4 describes the roles and functions of the market participants based in Abra, Iloilo and Negros Occidental. Producers and manufacturers are engaged in actual production of raw materials and finished products, respectively, while traders including cooperatives link sellers to buyers from different geographical locations and in the process perform important functions of transporting, storage and even financing. Workers support the highly labor-intensive manufacturing business.

4.3.1.2 Bamboo Products and Uses

Product description

Generally, bamboo products are classified as primary (poles, shoots and stumps), secondary or semi-processed (*sawali*, splits, sticks, boards), and finished products (handicraft, furniture and ready-to-cook/eat shoots). Primary and secondary products are inputs for various industries including housing, fishing, agriculture and manufacturing while finished products are directly channelled to end-users in both domestic and export markets for direct consumption. These are described below.

Primary products

(a) Poles - The most common shapes utilizing the full culm is usually tapered from the butt to the tip.

(b) Shoots - This is the emerging portion of the rhizome that becomes the culm/pole, a number of bamboo shoots are edible.

(c) Stumps - This is the portion of the bamboo plant/clump left after harvesting.

Secondary products

(a) Sawali - Bamboo mats are made by plaiting splits. The matting is used for interior walls, partitions, ceilings, doors and windows and for exterior walls. Mats are produced in a variety of shapes and patterns. The strips are generally woven by hand although small machines have been used with some success. Sawali board consists of woven bamboo matting glued together in much the same way as plies of wood in plywood.

(b) Splits - The term "split" is used for any shape smaller than a quarter of the culm. Generally, splits are not used as building components but are woven into mats or made into lashing. Splits are made from quarters by dividing the quarter radially or longitudinally.

(c) Boards - Bamboo boards are commonly used for flooring, walls, and even roofing. A board consists of culm that has been cut and unfolded until it is almost flat.

Finished products

(a) Furniture - Furniture made of bamboo includes sala set, dining tables, corner and center tables, cabinets, beds, lounging chairs, sofa beds and rocking chairs.

(b) Handicraft - These are non-traditional products made of indigenous raw materials like wood, rattan, bamboo, buri, abaca, and handwoven fibers. Products of the handicraft industry include trays, brooches, pen holders, wall decor, boxes, decorative baskets, vases, fans and fancy items.

(c) Processed foods - Bamboo shoots throughout Southeast Asia are eaten fresh, pickled or dried. Processed bamboo shoots from various producing countries are being exported to more than 20 countries including the Philippines. Japan imports a large quantity of canned or dried shoots from Mainland China and Taiwan. A number of dishes can be prepared with bamboo shoots such as: *lumpiang sariwa*, *labong* relish, *atsarang labong*, *labong* with black beans and *adobong labong*.

Table 4.3.2 shows the various products handled by the bamboo-based firms. The major products are furniture, and gifts and housewares. The latter includes a wide range of handcrafted items. As specified in the Buyers' Guide for each firm, they include baskets, woven native deco, novelties, wall deco, variety gift items, lampshades, trays, planters, Christmas decors, toys, hampers, bathroom accessories, fish traps, bags, magazine racks, wall cabinets, torches, fashion accessories, chopsticks, rough paper, carts, carriages, placemats, sawali, curtains, spice racks, sticks, trunks, flutes and whistles, fans, card letter holders, umbrella stands, flower vases, mirror frames, attaché cases, toy chest, handpainted birds on driftwood and bamboo twigs, and art pieces.

The different product lines of the bamboo enterprises interviewed during the 1997 survey are shown in Table 4.2.1. One firm in Metro Manila manufactures paper using bamboo as raw material. The 1996 study on bamboo in Region VI reported that the most frequently manufactured products are ranked in order of importance as follows: furniture, novelties, handicrafts, earrings and trophies, and religious items and utensils.

Market segmentation

Bamboo products are channelled to both domestic and export markets. Export-oriented products are largely furniture and handicraft of high quality with limited volumes of raw materials such as poles and sawali. The 1997 survey shows that 3/4 of the firms sell to the domestic market, the rest to the export market. Similarly, the 1996 Region VI survey reported that majority (80%) of the respondents have the domestic market as primary outlet for their products, the rest serve the export market.

The domestic market is quite segmented in terms of furniture and handicraft such that export-quality products are directed to high-end markets such as hotels, restaurants, condominiums, and residential houses while lower quality ones commanding lower prices are available to low and medium income consumers. At present, there is a small market for plyboo and other wall and floor boards for expensive housing but due to their prohibitive costs, demand for these products has remained negligible. The large demand for housing continues to be that of rural households in combination with other low-cost construction materials.

4.3.1.3 Trends in Supply and Availability of Raw Materials

Comparative supply estimates from various sources

The total bamboo supply consists of domestic production and imports. Domestic production comes from natural stands and plantations in both public and private lands. Comparatively, plantations are still limited and the dominant source remains to be the natural stands. Earlier reports indicate that more than 75% of the bamboo resources are in A&D lands which include private lands (PFS, various years and Virtucio 1991 as cited by Bennagen 1991). These are usually of backyard scale.

There are no estimates of total bamboo production or harvest in the Philippines. The only estimates are those of DENR as reported in the PFS which as mentioned comprises a relatively small proportion of supply since these represent harvest only from public forests. Furthermore, there is often underreporting of forest products harvest. Table 4.3.5 shows bamboo harvest from public forests from 1970 to 1995 together with the number of licensees and AAC. The latest reported number of licensees is 17 in 1992 with AAC of 240,000 pieces. Harvest reports have been quite erratic with highest at 1.77 million pieces in 1979 and lowest at 123,000 pieces in 1972. The trend is clearly declining from 1990 with 984,000 pieces to only 307,000 pieces in 1995.

Imports of poles

Philippine imports of bamboo poles are not significant, the highest at 109 tons in 1994 and 59 tons in 1995 (Table 4.3.6). During the 1981-1995 period, imported poles totalled 231 tons averaging only about 15 tons per year. Assuming 6 kg per pole, this amounts to only 2,500 poles per year. Annual import value averaged US$10,000 the highest during the 1993-1995 period with range of 39 to 58 tons per year. Sources of pole imports include 9 countries in Asia with about 79% coming from Korea, Taiwan and Hongkong (Table 4.3.7). The rest came from China, Thailand, Japan, Vietnam, Indonesia and Singapore. For 1995, poles were imported from Thailand, China, and Hongkong.

3.3.1.4 Trends in Demand

Demand estimates by type of users

The major industry users of bamboo are furniture and handicraft, housing, utilities for fishpens and agriculture, food, and pulp and paper. At present, the latter is negligible.

Intraregional analysis of the demand for and supply of bamboo in Regions 1 and 7 showed that there exists an immense deficit of raw materials to fully assure continuous operation of industries that are currently in place. This wide discrepancy will continue to dwell upon and even worsen in the coming years if no concerted effort is initiated and directed towards bamboo resource-based expansion through plantation development. Production from natural sources has suffered considerably from over-exploitation, conversion of land to other uses and expansion of built-up areas to accommodate the swelling population and other infrastructure.

The annual bamboo production data included in the PFS provide insufficient basis for planning and managing this valuable resource and in establishing relationship with bamboo-based industries because the procedure for collecting data lacks comprehensiveness to include annual harvest flows. Quantity presented was principally based on transported materials and did not indicate the harvests' origin. An example is in Region IV where a considerable number of bamboo culms were recorded as production of the Region when in fact these materials originated from Northern and Central Luzon delivered to Rizal and Laguna fishpen operators.

Demand for bamboo is principally governed by the type of product(s) or end-use(s) the buyer intends to use the material. The choice of a particular species, therefore, is dependent on its physical, mechanical and chemical properties. The mensurational attributes are likewise important as characterized by the size of culm (diameter and height), culm wall thickness, node interval, straightness and taper of the culm. Example is *kauayan tinik*, the priority species for the furniture industry while *bayog* is demanded in talaba culture.

On the other hand, *buho* is sought after by the weaving industry to make *sawali*. The specificity of the industry on species choice and preferential alternatives compels segregation by industry. This is vital in relating the species needs of a particular user. Specific demands has wide ranging implications for the supply side because of the variation exhibited by the different species in terms of production cost, field performance, site adaptability, growth and yield and farm gate prices.

The 1997 survey indicates that 60% of the manufacturers use *kauayan tinik*. Other species being used are *buho, bayog, botong,* and black bamboo. In Region VI, *kauayan tinik* is the primary species used by the surveyed bamboo enterprises.

Demand in agricultural sector

Rivera and Austria (1996) have identified about 24 banana plantations in Mindanao needing bamboo as propping materials with annual requirements of about 10 million poles. Eight of them, however, have their own bamboo plantations, 4 are using ipil-ipil, while 3 have overhead cable propping system. Others buy 4-4.5 m poles from suppliers at P4-7 per pole. The demand from the banana industry has declined in recent years due to contraction in banana output resulting from stiff competition in the world market.

The reported total area for the banana plantations in Davao is about 24,000 ha which would give about 24 million hills. If each hill requires 2 props, then there would be about 48 million props needed in one fruiting season. Since there are 3 fruiting seasons a year, there would be a total of 144 million props assuming one pole is used only once. However, a pole may last for 2 seasons or a need of 72 million props per year. Each bamboo culm can provide 2 props which means that the total bamboo culm requirement per year would be about 36 million. Breakage of the props does occur when the fruits are too heavy. This could run to about 5% of the total props, hence, the total requirement would be 37 million culms per year.

Big tomato plantations require bamboo sticks as propping materials. One is the Bukidnon Resources Commodities, Inc. (BCRI) which used to require 14 million sticks or 1.2 million poles yearly for its 3,000 ha tomato plantation. Due to some administrative and disease problems, however, BCRI has contracted its output and thus its demand for bamboo sticks.

Demand in the fishing industry

Uses of bamboo by the fishing industry are for the following: traps, fish cages, barriers, hook and line, spears, sea anchors, float traps, baskets for transporting fish, netting needles, poles for drying nets, poles for dip nets and boat outriggers. Fishpens in Laguna Lake are estimated to require 838,000 poles per year while those in Sampaloc Lake, Taal Lake and others need about 27,000 poles annually. The motorized and non-motorized bancas require annually about 340,000 poles for outriggers.

In Region I, *talaba* cultivators and fishpen operators are the 2 major bamboo users for the fishing industry. The annual requirements of the 135 *talaba* operators and 8 fishpen operators are 13,500 and 12,000 culms, respectively, or a total of 25,500 culms per year.

Demand for Furniture and Handicraft Manufacture

In Region 1, the consumption estimate for the furniture industry was based on the coefficient of utilization of each product under this category. The average material requirements for each item produced and average monthly production are shown in Table 4.3.8. On the average, pole requirement is highest at 130 poles per month. For handicraft and basketry, this is 30 and 29 poles per month.

Estimation for the handicraft industry has basically the same approach with that of the furniture industry. The basket making industry was distinctly separated from handicraft because a lot of people in Region I are specializing in *kaing* and *kapig* (*bilaran ng bihon*) making. About 3 towns in Pangasinan are exclusively producing these 2 product lines.

Demand for Construction

According to Uriarte and Maligalig (1992), estimate of bamboo consumption in Region I was extrapolated from the census statistics of NSO and NEDA. From a population of 3,642,000 in 1992, 77% is rural or a total of 2,804,340 inhabitants. At an average of 10 household members per dwelling unit, about 280,434 rural houses are built in Region I. Assuming that 15% (conservative estimate) of rural houses are completely or partially built of light materials, about 42,065 households are involved. Further assuming that each household consumes 5 culms per year, the annual requirement for this sector is estimated to reach 210,325 culms.

At the regional level in Central Visayas, Table 4.3.9 shows that about 48% of the households interviewed (Aliño 1992) used bamboo as construction materials for dwelling. Every dwelling used up about 24 bamboo poles. For every repair, every dwelling used up about 18 bamboo poles. Of these bamboo users, about 88% purchased the bamboo used, the rest were home-produced. Sources of household demand for bamboo can be classified as those originating from repair or replacement and those for new construction.

The demand for bamboo in the Central Visayas region was projected to increase from 2.2 million poles in 1990 to about 3.2 million poles in 2015 (Table 4.3.10). To meet this expected increasing demand, the required hectarage devoted for bamboo production would be 2,322 ha in 1990 and 3,397 ha in 2015 (Aliño 1992).

Aggregate demand for bamboo

At the national level, demand estimates were prepared by the MPFD (1990) commissioned by DENR. The MPFD demand projection was up to the year 2015 and considered the different uses (Table 4.3.11). These are for banana props, fishpens, banca outriggers, furniture, handicraft, construction and panel boards. For the year 2000, using low and high estimates, the country's demand for poles could reach 78.62 and 87.69 million culms, respectively. Considering the different factors that could affect demand such as increase in demand for construction, preservative treatment of banana props that could reduce demand, growth in furniture and handicraft manufacturing as a result of better export prospects, and the introduction of bamboo panel boards, demand for bamboo could reach 113 to 133 million culms by the year 2015. If the estimated harvestable culms of 21 million (MPFD 1990) will not be augmented through plantation development, large supply deficits are expected. Even if demand is grossly overestimated, the figures reveal some shortage in bamboo supply.

For Ilocos Region, estimates were based on 4 species (*kauayan tinik, bayog, kauayan kiling and buho*) which are most demanded by the bamboo-based industries in the region. Results show that there is tremendous local shortage of bamboo if sourcing is confined within the region since it can provide only 32% of the requirements for *K. tinik,* 36% for *bayog,* 49% for *K. kiling* and 59% for *buho.*

Exports of poles, other raw materials and finished products

Philippine exports of bamboo consist of baskets and basketware, furniture and poles in that order of importance. Over the 1981-1995 period, total exports were valued at US$ 247 million or an annual average of US$ 16.49 million (Table 4.3.12).

Bamboo exports are predominantly baskets and basketware comprising 92.47%, followed by furniture with 7.41%, and then poles with a share of less than 1%. As export volume and value for baskets and basketware are lumped together for all materials such as reed, raffia, rattan, bamboo and the like, the share of bamboo was estimated at 20% based on personal communications with NSO personnel.

During the 15-year period, handicraft export rose from US$9.24 million in 1981 to US$22.77 million in 1995 or an annual growth rate of 10.08%. Furniture export was from US$ 961,000 to US$ 1.51 million reflecting a growth rate of 5.84% per year. Pole export was negligible at US$ 1,000 in 1981 increasing to US$ 22,000 in 1995. However, annual export during the last 3 years was lower than in the early 1990s when total exports rose to US$ 26.07 million in 1992. Furniture export peaked at US$ 1.93 million in 1991. The highest export for baskets and basketware was in 1992 at US$ 24.22 million.

The most recent report indicates that some 510 kg of bamboo shoots were exported in 1995 valued at US$ 2,119 (Table 4.3.13). Some limited volume of woven bamboo strip (sawali) has been exported. Other bamboo products exported include chandeliers, other electric ceilings and lighting fittings, electric lamps, electric tables, desk, bedside or floor-standing lamps and torches.

Philippine bamboo furniture exports are destined to more than 20 countries (Table 4.3.14). The USA is the single biggest market capturing about 1/3 of the total export. Other major buyers include Spain, France, Australia, Italy and Netherlands. Similarly, country buyers for the other bamboo products are highly diversified. By type of product exported, the destination countries are shown in Table 4.3.15. Toward expanding exports, this list can be used to improve marketing strategies in specific countries.

4.3.1.5 Product Flow and Distribution Channels

General bamboo production to consumption system

Bamboo production occurs in two stages; first is for the raw material and second is for the finished product. Various stages of processing may occur in between where a bamboo product is produced not for direct consumption but as an input to various industries like fishing, agriculture, and construction. Examples of these are poles and splits for fishpens, and plyboo, sawali and other panel boards for housing. Examples of directly consumable finished products are furniture and handicraft.

From the production point to consumption point, different activities, market participants and institutions are involved. From the farm or forest where bamboo is harvested, it undergoes primary and subsequent stages of processing according to the required final use of bamboo. Since services are performed on the product, costs are incurred and a price structure is formed such that the price of the final product reflects the cost of the bamboo resource and the services provided including payment to those who performed such services. An efficient system is where there is a continuous interaction between producers and consumers with the former producing that which the latter requires at the lowest possible cost.

The production point is that wherein bamboo becomes ready for first sale. It may be the farm or forest or stockyard where the poles or splits are prepared for sale to the first buyer. The consumption point is that of final sale. The production system could be extensive as when it is harvested in natural stands in the forest or backyard with little management input or it could be intensive as in a well managed bamboo plantation whether in public or private lands. Similarly, the production system for intermediate or finished products could be extensive or intensive. Production of lower quality products for household use is generally extensive moving toward a more intensive system as more resources and inputs are used under a well defined management structure to produce high quality products for higher end markets.

Production of raw materials in the Philippines is primarily an extensive system since the bulk of bamboo comes from natural stands where no replanting is done. As some plantations have already been established, a small proportion of bamboo are produced under an intensive system. Bamboos produced under both systems may find their way to various points in the distribution channel where further processing or production takes place either in extensive or intensive system. Manufacturing of handicraft or furniture items among export-oriented firms is primarily an intensive production system characterized by task specialization, high degree of mechanization, large output, and well established marketing strategy and network.

Geographical product flow

Generally, bamboo flows from sources/supply areas to demand/consumption areas. The study of Virtucio (1984) identified 9 provinces with abundant bamboo resources comprising the

major supply points. These are Ilocos Norte, Ilocos Sur, Pangasinan and Tarlac in Luzon; Aklan, Antique, Capiz and Iloilo in Visayas; and Davao del Norte in Mindanao. The growing areas are mostly privately-owned except in Davao del Norte. On the other hand, the major demand areas for the furniture and handicraft industry are Metro Manila, Pangasinan, Pampanga, Abra and Baguio in Luzon and Cebu, Iloilo and Bacolod in Visayas. The banana plantations in Mindanao and fishpens in Southern Tagalog also comprise the major demand areas.

Where end users are present in a bamboo producing province, bamboo is largely consumed within that province. Otherwise, it is transported to other provinces where it is demanded for various uses. For example, Figure 4.3.1 shows that bamboo poles in Pampanga, Laguna and Rizal are all used within these provinces where demand by furniture and handicraft and fishing industry is high. However, in Bataan, 85% of the poles are sold outside the province. In Pangasinan, about 1/3 of the poles also go out despite the presence of many handicraft and furniture makers due to the large supply of bamboo in the province. For Metro Manila, all bamboo requirements come from different supply points.

Product flow through various market channels

Many different channels exist for bamboo raw materials and products ranging from short, simple channels to longer, more complex ones characterized by many intermediaries performing multiple and sometimes duplicatory services.

Figure 4.3.2 shows bamboo coming from two sources, natural stands and plantation. It can go directly to the user as in the case of a farmer selling bamboo to his neighbor who uses it for building his house or it can pass through a number of hands where it can be transformed into a piece of furniture or handicraft by the manufacturer and then finally transported via a trader to the final user either in the domestic or foreign market. Generally, the longer the channel, the higher is the cost incurred due to participation of more intermediaries and the physical distance between the source and final destination. The CITC survey revealed that about half of the 72 bamboo enterprises interviewed obtain their bamboo poles from natural stand in their own backyard and/or nearby forest while the rest primarily source their poles from local traders (Navera 1996). For finished products, 60% of the firms sell directly to households; the rest to exporters and other manufacturers. The latter perform additional processing or finishing before products are finally sold to higher level markets.

By geographical location, Figures 4.3.3, 4.3.4 and 4.3.5 present the various market channels involved for raw materials and selected finished products such as bamboo poles, mat, sala set, mirror frames, etc. in Iloilo, Negros Occidental, and Abra. They also show the various services rendered by the different market intermediaries involved in the distribution channels.

4.3.1.6 Price Structure

Domestic and export price trends

Average prices of bamboo based from DENR forestry statistics for Metro Manila show a generally upward trend, from only P4.50 per piece in 1970 to a high of P60.70 in 1989 (Table 4.3.16). Thereafter, recorded prices are averages for various regions but similarly follow a rising trend, from P31.80 in 1991 to P45.33 in 1993, and finally to P68.86 in 1995. Such growth in prices is indicative not only of inflationary pressure but possibly also of the relative scarcity of bamboo in recent years. In 1996, Navera reported a selling price of P100-150 per pole for good quality *kawayan tinik* in Metro Manila.

Table 4.3.17 shows the unit prices in US $ of bamboo products exported by the Philippines to various countries for the 1981-1995 period. Pole prices are highly variable and do not exhibit any systematic pattern. The lowest price is US$429 per ton in 1987, the highest is US$2,857 in 1984. For baskets/basketware, export prices are increasing from US$1.08 per piece in 1991 to US$1.36 in 1995 with average growth rate of 6.18% per year. Export prices of furniture similarly exhibit a rising trend with annual growth rate of 7.39% although some annual fluctuations are observable. From US$16.55 per piece in 1987, price steadily rose to US$39.43 in 1991, then declined and rose again reaching US$35.95 in 1995.

Prices by product type and quality

At given market level, bamboo prices differ by species and quality, the latter differentiated by diameter size and length. The study by Maligalig and Saguin (1990) reported different grades of bamboo poles traded in the various provinces covered. For example, in Pangasinan, the various grades according to diameter size include *primera* (10 cm and above), *segunda* (8 cm) and *tercera* (5 cm). In some cases, poles are traded assorted or unclassified while in others, classification is simply small or big. The same survey revealed that for Batangas, the grading system is as follows: *over Caltex size* (10 cm and above), *Caltex size* (10 cm), *Coke family/beer size* (8 cm), *Pop size* (5 cm), and *battery/reject size* (<5 cm); while for Camarines Sur, poles are classified as A, B or C.

The 1995 survey by Rivera *et al.* revealed price differentials associated with various grades of bamboo, i.e., higher grades command better prices and lower grades command lower prices. The surveyed prices in pesos per pole at the producer's and trader's levels are as follows:

Type	Producer	Trader
Class A (10-15 ft)	25.00	45.00
Class B (6-9 ft)	14.00	31.67
Class C (4-5 ft)	6.00	11.33
Poser (1000's)	100.00	120.00
Split (6 ft, 50's)	28.12	46.62
Split (8 ft, 50's)	47.50	67.50

By species, reported average prices by DENR for 1995 are P68.86 per piece for *kawayan tinik*, P31.46 for *bayog*, P12.33 for *boho*, and P4.00 for *bolo*. Diameter sizes and lengths for these species, however, are not reported in the statistics.

For finished products, prices also differ by product type and quality. Export quality products generally sell at higher prices than lower quality ones which are usually directed to the domestic market. Average prices (pesos per set or piece) for 1995 for some bamboo furniture and handicraft items at the manufacturer's and retailer's levels are as follows:

Type	Manufacturer	Retailer
Sala set	1,995	3,034
Dining set	1,254	3,034
Single bed	228	354
Double bed	329	455
Table lampshade	121	303
Standing lampshade	243	607
Bookshelf	202	440
Rocking chair	177	329
Hamper	40	60
Pineapple jar (set of 3)	180	350
Market basket	20	30
Bag (small)	65	90
Hat (big)	45	55
Mirror frame (with accessories)	120	130
(without accessories)	115	125
Bamboo mats (sawali)	330	450
Ceiling material (*kisame*)	33	45
Palay storage (*tabungos*)	400	450

The average selling prices of bamboo products sold by the enterprises interviewed in 1997 are shown in Table 4.3.18. Although there are cases of no reports, generally, there are profits earned in the manufacture and sale of these products.

Prices by market level and value addition

Prices generally increase from lower level (farm or forestgate) to higher level (manufacturer or retail) market. This is due to value addition associated with services (transport, storage, processing, etc.) performed and profit or mark-up of market intermediaries. This is revealed in prices shown above where, for a given product type and quality, prices are higher at the trader's than at the producer's level. Similarly, furniture items at the retail level are priced higher than at the manufacturer's level.

Navera (1996) reported the following typical price (pesos per pole) structure for a good quality *kawayan tinik:*

Raw material source	Town trader	Furniture/handicraft manufacturer
Forest/mountain - 15-20		
Lowland plantation-25-30	45-55	60-85 (nearby province/city)
		100-150 (Metro Manila)

Thus, the price differential could be as low as P20 per pole between the producer's/ gatherer's and town trader's levels to as high as P95 between the town trader's and Metro Manila manufacturer's levels. The price differentials are primarily due to the cost of cutting, handling, transportation and profit although it was not possible to determine the respective shares of these items from the given data.

The recent survey of Rivera *et al.* (1996), however, showed the respective shares of the market participants (both cost and profit) involved in the production and sale of some selected finished products. Below is shown the value addition occurring through the market chain from the production point to the consumption point. The distribution of the final product value among those involved in making the product available to the consumer is also shown. The cost and profit structure differs across products but generally, greater value occurs at the manufacturing stage due to inputs used (cost) and profit margin.

	Sofa		Palay storage		Single bed	
	P	%	P	%	P	%
Gatherer	20	8	-	-	-	-
Producer cost	48	19	25	6	10	7
profit	30	12	100	25	20	13
Manufacturer cost	105	42	270	68	30	20
profit	47	19	5	1	90	60
Product value	250	100	400	100	150	100

Price setting/determination for raw materials and finished products

Several factors affect pole prices (Navera 1996). These include species, quality in terms of pole size in length and diameter and presence/absence of discoloration or stains and pests and fungi, maturity, distance from source, cost of labor for cutting and handling, government regulations, and profit margin. These factors were also reported by the bamboo enterprises interviewed in 1997 (Table 4.3.19). Since bamboo is mostly delivered to manufacturers, transport cost is a major factor affecting raw material price. Effects of some of the other factors have already been discussed above.

Poles which are 3-year old are considered mature and suitable for manufacturing furniture and handicraft. Less mature poles are more susceptible to pest infestation and would result to

products of shorter useful life. Delays in securing cutting and transport permits usually increases cost not only due to direct payments made to local officials but also in terms of cost associated with delayed deliveries to users.

For poles, Rivera *et al.* (1996) also observed the following factors as affecting prices: size and quality, supply and demand, prevailing price in the community, cost and season of the year.

For finished products, price determinants include quality and cost of raw materials used, design, workmanship/craftsmanship, process used in raw material treatment for pests and fungi, and technology used in processing/manufacturing. Majority of the firms surveyed in 1997 considered their production and transport cost and profit margin in pricing their products. At least 3 firms and 1 firm reported design and quality, respectively, as major price determinants (Table 4.3.19).

4.3.1.7 Areas of Market Competitiveness

Product diversification

Although bamboo has numerous uses in the Philippines, most of these are traditionally in agriculture, fishing industry, construction materials for rural housing, bamboo shoots in raw form, and furniture and handicraft. The uses for pulp and paper and construction materials such as bamboo parquet block, bamboo particleboard, resin-bonded bamboo mat and corrugated bamboo sheets and other laminated products where significant value addition is possible have not been fully explored and production has not reached commercial scale. The exception is when bamboo was used by the now defunct Bataan Pulp and Paper Co. as raw material for pulp and paper production and by the plyboo factory in Abra which eventually closed also reportedly due to lack of raw materials. As shown in the 1997 survey, there is one firm in Metro Manila that manufactures paper using up to about 12,000 poles per month producing 3,000 bundles of paper per month. For bamboo shoots, there is not a single canning factory in the Philippines and all canned bamboo shoots are imported from China and Thailand (Sta. Ana 1996).

In contrast, China and India have gone much ahead in pulp and paper production using bamboo while China has dominated the world market in the export of all forms of bamboo products: fresh, watered, dried and tinned forms of bamboo shoot; poles and leaves; handmade paper; weave products; carved products; furniture; and many others.

Philippine bamboo exports has largely been furniture and handicraft, although *sawali,* and bamboo shoots have recently been included. The latest statistics include 11 bamboo export categories which are as follows:

PSCC: 0566907	Bamboo shoots, prepared or preserved otherwise than by vinegar or acetic acid, frozen
PSCC: 2923100	Bamboos

PSCC: 8131107	Chandeliers and other electric ceiling and wall lighting fittings (excluding those of a kind used for lighting public open spaces or thoroughfares), of bamboo
PSCC: 8131307	Electric table, desk, bedside or floor standing lamps, of bamboo
PSCC: 8131507	Electric lamps and lighting fittings, n.e.s., of bamboo
PSCC: 8131704	Bamboo torches
PSCC: 8211301	Seats of bamboo
PSCC: 8217902	Furniture of bamboo
PSCC: 8997101	Baskets and basketware containers of all kinds, of vegetable plaiting materials (e.g. of bamboo, rattan, reed, rushes, osier, raffia, dyed cereal straw and lime bark)
PSCC: 8997102	Handbags, wallets, purses and similar articles, of vegetable plaiting materials (e.g. of bamboo, rattan, reed, rushes, raffia, osier, dyed cereal straw and lime bark)
PSCC: 8997902	Woven bamboo strip (*sawali*)

Thus, aside from limited product categories (as compared to China), designs appear limited for these categories. Recent visits in Camarines Sur indicate that the bamboo products can be described as having traditional design and of poor quality. This is due to the fact that the technology and skills needed to design and manufacture export-quality furniture, gifts and houseware products remain undeveloped. In Brgy. Pawili, Bula, it was reported that design has not improved since the furniture industry was started and there is very limited manpower for executing different designs derived from magazines and display centers. In order to improve competitiveness, the Phillippines needs to diversify into a wide range of products and designs acceptable to the changing needs of consumers.

Product quality

The upward trend in bamboo export of the country may indicate that Philippine bamboo products are increasingly becoming acceptable in the international market. Recent statistics point to growing market diversification as indicated by the increasing number of country destinations for Philippine bamboo products as shown below:

Export Category	Number of Country Destinations
PSCC: 0566907	1
PSCC: 2923100	17
PSCC: 8131107	2
PSCC: 8131307	3
PSCC: 8131507	17
PSCC: 8131704	36
PSCC: 8211301	35
PSCC: 8217902	20
PSCC: 8997101	20 + others (unspecified)

PSCC: 8997102	20 + others (unspecified)
PSCC: 8997902	2

If Philippine products are acceptable to these countries qualitywise, greater effort is needed to increase sales volume in these existing markets. Perhaps other forms of competitiveness may be explored such as greater reliability of supply, lower cost/price, and facility in import procedures in the Philippines.

In the domestic market, bamboo products face stiff competition in furniture items in the high-end market against those made of wood, rattan and imported furniture and in the low-end market against the cheaper, stackable, lighter plastic furniture (e.g. monobloc). In construction, competition is with concrete materials since bamboo has been traditionally viewed as low-cost and non-durable materials. In both cases, bamboo is considered "*bukbukin*" and will not last long. For Filipinos, durability is an important consideration in purchasing furniture and house construction, hence bamboo does not fare very well vis-a-vis its competitor products. For housewares, bamboo has to compete with plastic and aluminum-made materials.

Based on the 1997 survey, 11 out of the 16 bamboo manufacturers and 5 out of 10 traders reported having experienced rejection of their products (Table 4.3.20). These rejects have been attributed to the following:

Reason for rejects	Number reporting
Immature/Overmature bamboo	2
Water damaged	1
"Bokbok"	2
Poor construction	2
Crack	4
Color variation	1
Raw material treatment	4

It was also reported that firms have to incur additional cost for sanding due to uneven sizes of poles. Moreover, the incidence of molds during rainy season requires additional treatment.

Promotions

Except for relatively large bamboo enterprises catering to the medium and high end markets, promotional efforts such as participation in exhibits and fairs and displays in shopping malls are quite limited. Such activities are usually sponsored by trade associations and

74

government agencies like DTI but small enterprises are not always able to participate due to cost involved, lack of information or not having the "competitive" products for display. Micro enterprises usually would display their products in their stores along highways where they are readily visible to passers-by. Unfortunately, some are displayed in open areas where the sun or rain could damage the products. This situation contributes to deterioration of product quality and even projects an image of low quality cheap furniture items. This poor image of the product does not stimulate and create demand in the face of rising incomes and purchasing power of consumers. As incomes rise, consumers tend to prefer good quality even expensive products.

Table 4.3.21 shows the various promotional methods employed by the surveyed bamboo firms include exhibits and advertisement, mostly by the small and medium-sized firms, price discounts, credit terms, free samples and display primarily in retail outlets. At least 11 manufacturers think that such promotional methods can help improve sales in domestic and international markets.

Pricing

It was shown earlier that comparatively pole prices are higher in the Philippines than in China and India. Although there was no comparison of quality, this may indicate the relative demand and supply situations in these countries. Where bamboo is relatively abundant, price is expected to be lower as in the case of China and India. Thus, assuming that pole quality is the same, poles from the Philippines will not be competitive in the world market with those of China and India.

The high price of poles is translated in terms of high production cost and therefore high prices at which bamboo products must be sold. This is quite evident in plyboo production where the limited scale of production (scale diseconomies) due to inadequate raw material supply and limited technology application make plyboo a very expensive housing component, about P6,000 per square meter. Thus, it cannot compete with plywood which costs at most P1,200 for marine plywood of 3/4" thickness, 4' x 8' board. Ordinary plywood, lawanit and particle boards are even cheaper. Imported cement boards are also currently available and much cheaper than plyboo.

The cheaper bamboo furniture appears competitive with similar quality of rattan furniture in terms of price. However, bamboo furniture as they are presently available is heavier and appears to occupy a bigger space than rattan furniture which is relatively light and could easily be moved. Specific items such as chair appears less competitive with the stackable, lighter and cheaper plastic chairs which is becoming popular due to advertising and other forms of product promotion.

Following are the costs of production (P/piece) for bamboo laminated table, chair, and floor tile being piloted at CITC. They are considered of good quality and treatment of raw materials is being done. Being on a pilot scale, per unit cost is expected to be high and may not be directly comparable with competing products already available in the market. If these and

similar products will be considered for large scale production, promotional strategies are needed in order to capture a portion of the market which is already in the hands of existing products. One barrier that new entrants will have to deal with is the advantage that established producers have in terms of their products being already accepted by consumers. New products will have to possess new attributes that will appeal to consumers (other than price) in order to effectively compete with existing products.

Cost Item	Floor board 3/4"x2'x4'	Clerical table 48"x18"x28"	Chair
Raw material	544.00	906.42	511.66
Finishing	52.85	302.00	275.00
Power cost	19.69	36.68	23.51
Labor	200.00	1,000.00	700.00
Overhead	244.36	673.53	453.05
Total	1,058.90	2,918.63	1,963.22

Aesthetics and environmental value

If the quality of bamboo products can be improved, demand can be increased if the bamboo's aesthetic and social value can be enhanced. This attribute would seem to contribute to demand creation given the growing environmental consciousness and the existence of a niche market that puts a high value to the natural look of bamboo products in contrast to the non-natural look of plastic and other synthetic made products. In the domestic market, the demand for "*bahay-kubo*" is growing not only as an add-on to residential houses but as part of the architectural design of resorts, restaurants and gardens. DENR and LGUs are promoting bamboo plantations not only for livelihood but even initially for environmental reasons as it is being done in Laguna where all 17 river banks are programmed to be planted with bamboo.

The efforts of international organizations like INBAR, the Environmental Bamboo Foundation, the International Bamboo Foundation and the various bamboo societies worldwide to promote the sustainable development of bamboo resources and trade are anchored on ecological considerations and socio-economic-cultural life of dependent communities. The Philippines can take advantage of this development in the international community by similarly highlighting the environmental, aesthetic and social attributes of bamboo in its promotional efforts.

4.3.1.8 Perceptions of Bamboo Enterprises

Raw material supply

During the March 14 workshop, the general consensus is that there is shortage of bamboo for large scale industrial use such as for plyboo and other boards for construction purposes.

Earlier analysis also show projected deficits in Region 1, Central Visayas, and the country as a whole based on 1990 MPFD report.

The 1997 survey indicates majority (58%) of the bamboo enterprises perceive that raw material supply is insufficient and that 9% need assistance in sourcing them. Specifically, this was reported by 9 out of 18 manufacturers, 8 out of 11 traders and 2 out of 3 propagators (Table 4.3.22). By scale of operation, 79% of the small to medium enterprises and 59% of the micro and cottage enterprises reported the raw material supply problem, thus more of the relatively larger enterprises feel the problem.

In contrast, majority (70%) of the Region VI bamboo manufacturers who were interviewed in 1996 perceived that there is no shortage of bamboo. The remaining 30% felt that supply is insufficient and that *kauayan tinik* is the most difficult to find.

These varying results indicate that demand-supply situations differ across locations which calls for more detailed interregional analysis to determine the appropriate flow of bamboo, that is, from surplus to deficit areas.

Demand for bamboo products

The 1990 MPFD report showed large demand relative to supply and this gap is expected to increase over time. It also seems that based on export figures, demand for Philippine bamboo products is also rising although moderately as compared to wood and rattan products.

More than half of the surveyed bamboo firms perceive that demand for bamboo products is sufficient and will remain so in the future. Except for one, all exporters said there is sufficient market demand. About 31% feel that demand is insufficient while 10% indicated they need assistance in marketing and creating demand for their products (Table 4.3.22).

When asked about which products have market potential aside from those that they are already producing, about one-half of the respondents could not identify any while the other half indicated the following: (a) furniture - sala set, bedroom set, cabinet, dresser, divider; (b) decorative items - display items, frames, paper products; (c) basketware - baskets; (d) housewares - placemats, chopsticks; and (e) construction - sawali, architectural components.

Competitiveness

Among the 61% who responded to the question of whether Philippine bamboo products are competitive with those of other countries, 55% answered affirmatively, 45% said otherwise, and 5% expressed needing assistance to improve competitiveness (Table 4.3.23). Those who think Philippine products are not price-competitive said that this is due to better quality of Philippine products while others feel that the low labor cost and cheaper raw materials in China

allow them to sell their products at lower prices. Majority (82%) also feel that their products are quite competitive with those sold by other producers/sellers in the domestic market.

Needed product quality improvements

When asked how the respondents would rate their products vis-a-vis other local producers, majority said that their products are of better or at least of the same quality, but not lower. When compared with products of other countries, 16 of the 18 who responded indicated Philippine products are of better quality, 1 said they are of similar quality while 1 said they are of lower quality. Other countries considered for comparison are China, Taiwan, Europe, Vietnam, Indonesia, Japan and Singapore.

However, majority of the surveyed firms indicated various forms of improvements needed to develop the bamboo industry and thus improve the country's competitiveness in the world market (Table 4.2.2). These are as follows: product development (50%); design (17%); finishing (17%) which was reported mostly by micro, cottage and small enterprises; and raw material treatment (16%).

4.3.2. World Market

4.3.2.1 World Trade of Bamboo

Bamboo and bamboo products traded

Bamboos are listed among the NWFPs traded internationally which have commercial significance (FAO 1995). They are classified under fibres and flosses together with rattan, raffia, cork, esparto, kapok and others. Major products traded are poles, leaves, handmade paper, handicraft, furniture, carved and woven products and shoots as food.

Major suppliers, main markets, trade value and market shares

The main origins of bamboo are Asian countries particularly China, Thailand, Malaysia, Myanmar, Rep. of Korea, Indonesia, Vietnam, the Philippines and Bangladesh while the main markets are France, Germany and the Netherlands (FAO 1995).

Total global revenues from bamboo and its products are estimated at US$4.5 billion (Liese 1988). An IDRC study in 1991 estimated annual harvest at about 20 million tons, about 80% of which is used locally in the respective producing countries. In China alone, indicators of bamboo production are 11.13 million tons of bamboo poles and branches and 1.27 million tons of shoots in 1993, 169 million pieces of bamboo tools in 1992, 132,000 tons of pulp in 1989, and

82.19 million handicraft and 215.99 million furniture items in 1988 (Pabuayon 1995 and Pabuayon and Espanto 1997).

In Vietnam, annual production averages about 200,000 tons half of which is for paper, the rest for other purposes including chopsticks, blinds, mats and boards (Do Dinh Sam 1994). In Thailand, bamboo production was estimated at 136,000 tons in 1992 and consumption at 147,000 tons (Kyokong 1994).

4.3.2.2 Bamboo Resources in Selected Countries

In this and the following sections, discussions focus on 4 countries (China, India, Nepal and the Philippines) where data are available. These are mostly taken from the Report "INBAR Bamboo and Rattan Database for Asia" (Pabuayon and Espanto 1997). Otherwise, sources of information are indicated.

Bamboo species and genera

China has the richest bamboo resources with more than 400 species and less than 40 genera (Table 4.3.24). India has 125 species and 23 genera; the Philippines, 62 species and 19 genera; and Nepal, 53 species and 11 genera.

Bamboos in China are of 3 types: monopodial, sympodial and mixed type, the monopodial being the major one. The main species is *Phyllostachys pubescens* comprising more than 70% of the total growing area and stock volume. India's bamboos include indigenous and exotic species with 11 considered major ones. Nepal has 15 primary species according to traditional uses while the Philippines has classified 21 endemic species of which 13 are climbers, 8 are erect, 7 of them considered commercially important.

FAO (1994) reported over 20 species of bamboo growing in Bangladesh's natural forests and village homesteads, 7 genera with 44 species in Malaysia only 12 of which are commercially utilized, 35 species in Indonesia, 4 bamboo species widely used in cottage industries in Sri Lanka, and 13 genera with more than 60 species in Thailand.

Growing area and geographical distribution

India has the highest bamboo area at 10.18 million ha, followed by China with 6.79 million ha. Nepal has 62,891 ha while the Philippines has reported 5,009 ha in 1984 which was for only 9 provinces (out of 75) and 200,000 ha reported in 1910. Updated estimates for the Philippines have been presented earlier.

As of 1993, 3.79 million ha or 56% of China's total bamboo area are under plantations which is 90% higher than that reported in 1950, indicative of aggressive plantation development effort. Total bamboo area in China is 2.95% of its total forest area. The 5 primary producing

provinces are Fujian, Hunan, Jiangxi, Zhejiang, and Guangdong which altogether have 70% of total plantation area.

The bamboo area of India is about 12.8% of its forest area and include the 1.11 million ha under plantations. Bamboo grows naturally throughout the country except in Jammu and Kashmir states. The 5 primary growing areas are Madhya Pradesh with more than 1/4 of total area and the largest plantations, Orissa, Maharashtra, Andra Pradesh and Karnataka.

In Nepal, bamboos are endemic to all 3 ecological zones: tarai or plains, midhills and mountains but more concentrated in the eastern development region with more than 1/3 of total area. In the Philippines, most bamboos are found in A&D lands, the erect ones usually along river banks and household backyards and the climbing types in forestlands.

Additionally, FAO (1994) reported the following bamboo hectarage for other countries as follows: 50,000 ha of bamboo plantations in East Java and South Sulawesi, 810,000 ha (5.5% of forest area) in Thailand, and 1,120,800 ha in Vietnam.

Stock volume and resource productivity

China leads all countries in available bamboo resources with 96.32 million tons excluding those in non-plantation areas which is 59% higher than the 1965 reported volume. India has 4.49 million tons, the Philippines with 2.48 million tons (excluding those in A&D lands) and Nepal with 194,964 tons. For the Philippines, the figures was based from the 413.6 million culms estimated from the RP-German FRI inventory in 1988 and assuming 6 kg/culm.

China's bamboo resources are dominated by the *Moso* species, about 78%. According to the 1978 RP-German FRI, *S. diffusum* and the locally-known *bikal-baboi* comprised more than 3/4 of all bamboo resources. At that time, there were 10.73 M lm found in the forestlands 60% of which are of >2 cm diameter class with the rest in the <2 cm diameter class. These were widely distributed but 68% were found in 5 regions; namely, Cagayan Valley, Southern Tagalog, Central Luzon, Eastern Visayas and Central Mindanao.

Productivity (yield per hectare) is highest for China at 25.41 tons/ha, followed by the Philippines at 6.44 tons/ha, then by Nepal and India at 3.10 tons/ha and 0.50 tons/ha, respectively. These were estimated from data on bamboo growing area and production (Pabuayon and Espanto 1997).

The bamboo resources in Vietnam are estimated at 5,665.6 million culms broken down as 5,590.2 million culms in natural stands and 75.4 million culms in plantations (FAO 1994). For Malaysia, the estimate is about 33.28 million tons (wet weight) distributed as 10.3 million tons in Peninsular Malaysia, 14.9 million tons in Sarawak and 8.1 million tons in Sabah. By forest type, 49% are found in virgin forests, the rest in logged-over forests.

Raw material production/harvest volume and value

Poles/culms

Production of poles is highest in China with 12.19 million tons (1995), followed by India with 803,866 tons (1993), then by Nepal and the Philippines with 18,463 tons (1995) and 3,167 tons (1995) (Table 4.3.25). The latter is considered underestimated due to underreporting and exclusion of those from A&D lands.

Generally, pole production shows an upward trend. Annual growth rates are 7.98% for China, 12.76% for India, 2.23% for Nepal and 31.62% for the Philippines. This trend implies the growing importance of bamboo in the national economies of these countries and its rising demand and uses. However, it also reflects the declining resource base particularly in countries where plantation development is minimal. Karki *et al* (1996) indicated that in Nepal, "the natural stands are suffering from uncontrolled exploitation, lack of any type of management, lack of plantation development schemes, unsustainable harvesting and outdated processing technology". For the Philippines, Bennagen (1991) noted that bamboo resources have been substantially depleted through the years based on production data and current accelerated efforts to establish plantations for augmenting raw material supply to bamboo-based industries. Similarly," bamboo production from natural forest in India is decreasing while the demand is increasing" (India Database 1995) indicative of strong pressure on the resource base.

Shoots, branches, tools and pulp

China's shoot production increased from 134,000 tons in 1980 to 1.27 million tons in 1993 indicating a growth rate of 20.23%/year or an annual average of 587,643 tons (Table 4.3.26). Other products in China include branches, tools and pulp. Their shares in total bamboo tonnage in 1993 are 5.10% for branches, 8.96% for shoots and 1.15% for pulp. The respective annual growth rates are 8.94%, 16.96% and 5.76%.

There are reports of shoot production in Nepal and in Thailand, Taiwan, India, Indonesia, the Philippines and other Asian countries although no quantitative estimates are presented.

Based on the latest available data, the total value of poles, branches and shoots produced in the 4 countries is about US$1.103 B. Expectedly, the largest share is for China at 94%. The rest is shared by India, 2.11%; Nepal, 0.24%; and the Philippines, 3.58%. It should be noted that the small shares of these countries may be due to inadequate quantitative information (Pabuayon and Espanto 1997). Moreover, the estimate is only for the 4 countries while those of others like Indonesia, Thailand, Bangladesh, Vietnam, Malaysia, etc. are excluded. As presented earlier, total global value of bamboo products could approach US$5 billion.

Based on the 1994 FAO report, bamboo production in Bangladesh was 92.62 million culms in 1987 and this has been increasing since 1976 when it was only 47.27 million tons. For Malaysia, the estimated annual production is 2 million sticks or 25,000 tons valued at

US$64,815. For Thailand, the estimated production (removal) from natural forests is 15.6 million culms in 1989 valued at US$12.14 million.

Production of finished products

Bamboo has numerous uses. The inventory of uses (A to Z) prepared by INBAR and the EBF based in Bali, Indonesia is presented earlier. For China alone, the significant bamboo products include (a) plybamboo such as mat plywood, curtain plywood, laminated board, concrete form, parquet floor board and plywood; (b) pulp and paper which uses about 1 million tons of bamboo annually; (c) food (shoots) and feed (leaves) with more than 90 bamboo shoot processing plants of different production scales in just one province; (d) handicraft (woven and carved) and furniture (tables, chairs, stools, tea tables, sofa, bed, cabinet, shelf); (e) bambooware such as daily use articles (chopsticks, summer sleeping mat, baskets, curtains), and agricultural production tools (carrying pole, rice basket, rice threshing machine, waterwheel, etc.). Handicraft and bambooware have numerous categories and styles with about 7,000-8,000 kinds of products (CAF/ITTO 1993).

As presented earlier, the uses of bamboo in the Philippines are also numerous. However, there is no pulp and paper production, while that of plyboo and other boards remains insignificant.

In India, the main uses are for pulp (35%), housing (20%), rural uses (20%), fuel (8.50%) and others such as furniture, mats, baskets, etc.(16.5%). New uses of bamboo include parquet (block), flooring, laminated bamboos, strips for aircraft, bamboo reinforced concrete, and artificially shaped bamboo for decorative items.

In Malaysia, the uses include toothpicks, chopsticks, furniture, musical instruments, shoots as food, blinds, paper, fences, bridges, baskets, *satay* sticks, and other handicraft items.

In Sri Lanka, bamboo is used in building, scaffolding, ladders, bridges, fences and numerous daily use articles like brushes, tool handles, toys, musical instruments, and basketware.

In Thailand, culms are used for house construction, scaffolding, props, ladders, fencing, containers, pipes, toys, musical instruments, furniture, wickerwork, partitions, house walls, fuel and raw material for pulp and paper making. Shoots in fresh and preserved form are a popular food item. The pulp and paper industry utilizes more than 5 million culms each year.

4.3.2.3 Bamboo Trade in Selected Countries

Market orientation

Most bamboos are sold and used in the domestic market but growing sales are made in the international market, indicative of the growing global bamboo trade. It is estimated that

Table 4.1.10. List of existing private bamboo plantations

LOCATION	OWNER	SPECIES	AREA(ha)
Luzon			
Isla Verde, Batangas City	Jose Ma. Pastor	*Kauayan Tinik*	50
Pililia Rizal	Alfonso Domingo	*Kauayan Tink*	20
Agno, Pangasinan	Doctor's Farm	*Kauayan Tinik*	5
Pangasinan	NEPA Q-Mart	*Bayog* and *Botong*	50
Coron Palawan	Francisco Fernada	*Kauayan tinik*	5
Del Monte, Bulacan	Sighn Bambusetum	*Kauayan Tinik*	20
Bula Camarines Sur	Mike Laya	*Kauayan Tinik* and *Kauayan* Buddha	3
Laguna	Various Private Group	*K. tinik*, Giant bamboo and 80% *Laak*	890 a/
Sub-total			**1043**
Visayas			
Murcia, Negros Occ.	R. Jalandoni	*Kauayan Tinik*	160
Murcia Negros Occ.	T.Trebol	*Kauayan Tinik*	20
Murcia Negros Occ.	N. L. Agustin Farms	*Kauayan Tinik*	30
Isabela Negros Occ.	R. Suatenco	*Kauayan Tinik*	5
La Castellana, Negros Occ.	Ferria Farms	*Kauayan Tinik*	14
Manapla Negros Occ.	Lamata Farms	*Kauayan Tinik*	14
Cadiz Negros Occ.	Mirasol	*Kauayan Tinik*	10
Victoria Negros Occ.	Maravilla Farms	*Kauayan Tinik*	10
Moises Padilla Negros Occ.	Feria Farms	*Kauayan Tinik*	7
Valladolid, Negros Occ.	Mayor Presbitero	*Kauayan Tinik*	2
Dingle, Iloilo	Hermontt Enterprise	*Kauayan Tinik*	8
Duenas, Iloilo	Paterno Larida	*Kauayan Tinik*	10
Anilao, Iloilo	Maravila Enterprise	Giant Bamboo	10
Guimaras	SMILE	Giant Bamboo	12
Sub-total			**312**
Mindanao			
Panabo, Davao N.	TADECO	Spiny, *Laak*, Lunas	140
Davao del Norte	Nest Farm	Spiny, *Laak*, Lunas	161
Panabo Davao N.	DAPECOL	Spiny, *Laak*, Lunas	303
Davao del Norte	WADECOR	Spiny, *Laak*, Lunas	80
Davao del Norte	F. S. Dizon & Sons Inc.	Spiny, *Laak*	110
Davao del Norte	AMS-FC Davao Norte.	Spiny, *Laak*	100
Davao del Norte	SFC, Davao Norte.	*Laak*	5
Davao	CFI, Agusan Norte	*Laak*	12
Davao del Norte	Davao Fruits Corp.	*Laak*	434
Davao del Norte	Twin River Plantation Inc.	*Laak*	132
Pandadan, Tagum D.N.	Caasi Farm	*Laak*	5
San Isidro Nabunturean D. N.	Caasi Farm	*Kayali*	10
Piang Village, T'boli S. Cot.	P.R. Virrey	*Laak*	2
Mati, Davao Oriental	Rabat	*Tini, botong*	5
Compostela, Montevista D.N.	CBMC	*Laak*	186
Sub Total			**1,685**
Grand Total			**3,040**

Sources: Virtucio and Rivera (1995), Pastor (1995), Alfonso (1995), Caasi (1994), Uriarte and Marquez C. (1995), Basada et al 1997, and Binoya 1997 consultant 1997

a/ Based on the 255,000 seedling planted as of February 1997 through Kawayan: Yaman Laguna Project by private individuals and organization at survival rate of 70% and 200 plants/ha

export sales comprised about 5% of total output value in India and from 17% to 29% in the case of China, the Philippines and Nepal.

Export composition, volume and value

For the 4 countries considered, the annual value of bamboo exports is US$297 million (Table 4.3.27). The respective shares are: 91.48% for China (US$271.81 million), 8.19% for the Philippines (US$24.31million), 0.21% for India (US$243,350) and 0.25% for Nepal (US$757,027). China's exports are primarily shoots, manufactured products, poles and leaves in that order of importance. Bamboo products comprise the bulk of India's exports while that of Nepal consists of poles only. Those of the Philippines are mainly baskets, basketware and furniture. For Malaysia, exports amounted to US$81,150 in 1988 increasing to US$176,474 in 1990 (FAO 1994).

China's exports are the most diversified including bamboo shoots in fresh, watered, dried and tinned forms, leaves, poles, handmade paper, furniture, comb, fan, carving and weave products. Exports of shoots, poles, leaves, poles and handmade paper totalled 206,990 tons in 1993 from only 41,394 tons in 1981 (Table 4.3.28). The annual growth rate in export of these products is 16.47%. Poles comprised 70.50% of total exports by weight, followed by shoots with share of 27.2%. Shoots are of four types: fresh, watered, dried and tinned, the latter being the most significant. Shoot exports grew at an annual rate of 18.39%-24.63%. Exports of leaves and handmade paper also show significant growth at 19.32% and 24.05%, respectively.

In value terms, China's exports rose from US$63.22 million in 1981 to US$271.81 million in 1993 reflecting an annual growth rate of 14.98% (Table 4.3.29). Valuewise, the exports are ranked as follows: weave products (US$116.31 million, 63.81%), shoots (US$130.02 million, 23.28%), poles (US$21.22 million, 9.68%), handmade paper (US$1.82 million, 1.09%) and others (US$2.44 million, 2.15%). All products registered positive annual growth rates the highest being for furniture (although small in absolute value), and shoots. The smallest growth is for weave products but this comprised the largest absolute value of exports.

For India, significant exports came mainly in the mid-1990s (Table 4.3.30). Most products are consumed domestically particularly pulp and paper for which 23 companies are reportedly operating with aggregate annual capacity of 1.57 million tons or 68,177 tons per company. For Nepal, bamboo export grew at more than 20% per year during the 1992-1994 period. Comparatively, the Philippines also exhibited positive growth rate in bamboo exports which are primarily baskets and basketware, although smaller at 9.25% per year.

Bamboo export (in US$ million) of 3 other countries were reported for the 1984-1988 period as follows (Manokaran 1990):

	Thailand	Taiwan	Hongkong
1984	4.43	137.30	37.10
1985	7.53	160.50	22.80
1986	8.45	192.70	29.70
1987	31.38	192.80	39.80
1988	20.10	182.40	47.30

For Thailand, it was reported that shoots export increased from 6,158 tons in 1983 to 67,065 tons in 1991 (Chat 1994). In 1992, bamboo shoots export was valued at around US$40 million. For Indonesia, export which is mostly chopsticks amounted to US$3.84 million. If these are considered and assuming that such export levels are maintained, export trade of the 7 countries is estimated to exceed US$500 million.

Export destinations

The major markets for China's raw bamboo exports are Hongkong, Japan, and European countries such as Netherlands, UK, and France. Woven products also go primarily to Hongkong (>50%), with some exported to Europe and USA. Japan is the biggest buyer of bamboo shoots (>60%) with other buyers comprising of Hongkong, Singapore and South Korea.

Nepal's sole foreign buyer of its poles is India. On the other hand, India has a number of buyers from the Middle East but it also sells to USA and Europe particularly Germany and Switzerland.

For the furniture export of the Philippines, close to 1/3 is absorbed by USA with moderate volume going to Spain, France and Australia. There are many other markets but trade volumes are rather small at present.

Thailand's bamboo shoot export goes mainly to Japan while other markets include USA, UK, Germany, Australia, the Netherlands, Canada, Saudi Arabia, Sweden, France and Korea.

Indonesia's export of chopsticks is channelled primarily to Japan (93%), the rest to Hongkong, South Korea, Singapore and Taiwan.

The main markets for Malaysia's bamboo in 1990 are Singapore (with market share of 30.2%), UAE (27.6%) and Taiwan (25.7%).

Import composition, volume, value and origins

Annual imports of bamboo products of the 4 countries is small at US$2.28 million. Despite being a major producer, China has recorded imports consisting of poles, weave products and tinned shoots amounting to US$2.07 million in 1993. By product type, the import shares for China are: 77.63% for poles, 21.95% for weave products, and 0.42% for tinned shoots.

India's imports consist mainly of poles and splits valued at US$114,310 and products worth US$62,930 for a total value of US$177,258 in 1995. The main source of imported poles is Singapore with some also coming from Malaysia, Indonesia and Hongkong. Its import from Nepal, however, is not recorded. Imported finished products come mainly from China with small volume from UK and Italy.

For the Philippines, pole imports amounted to US$1,200 in 1981 reaching US$58,000 in 1994. By volume, import was only 0.03-3.70 tons in earlier years but this increased to 27-109 tons in 1993-1995 period. Imported poles come primarily from other Asian countries such as Korea, Taiwan, Hongkong, China and Thailand.

Hongkong has also recorded imports of US$34.80 million in 1984 increasing to US$40.80 million in 1988 (Manokaran 1990). Since Hongkong has no resource base of its own, this import is the main source of its exportable products.

The highest recorded import of Thailand is 25,028 million baht in 1984 and this was down to 13,492 million baht in 1988 (FAO 1994).

The UNCTAD's Database recorded some US$37.56 million world's import of bamboo but there is no specification as to the type of bamboo products (FAO 1995). Bulk of imports was made by 3 main markets: EEC with US$12.57 million, USA with US$3.13 million and Japan with US$7.58 million, totalling US$23.28 million comprising 61.98% of total world import.

4.3.2.4 Projected Demand and Supplies in Selected Countries

Table 4.3.31 compares the projected demands and supplies in the 4 countries based on estimates made by Pabuayon and Espanto (1997). Demand and supply projections are based on individual country estimates using certain assumptions.

The aggregate demand of the 4 countries is expected to reach 16.55 million tons in year 2000, then to 18.78 million tons in 2005 and finally to 19.81 million tons in 2010. Ranking of the countries according to demand is as follows: China, India, Philippines and Nepal.

On the other hand, supplies is expected to reach 19.02 million tons in year 2000 rising to 24.72 million tons in 2005 and then to 29.67 million tons in 2010. These are rough estimates and do not consider economic factors such as input/output price structure, success or failure in reforestation or plantation development programs, technological developments and externalities like climatic/weather changes.

Projections show possible aggregate surpluses with bulk expected to come from China. Thus, based on past growth rates, China will need to develop its domestic market and/or seek more buyers abroad. Nepal also needs to expand its domestic consumption to absorb potential surpluses in the future. India and the Philippines are expected to face deficits unless

consumption slows down or greater efforts to augment supply are put in place. India's supply, however, may catch up with demand in year 2010. The deficits for the Philippines are expected to remain large considering the strong domestic market and rising export of finished products.

As presented, these scenarios apply only to the 4 countries, thus do not provide a picture for global bamboo situation, more so for other specific countries. For example, in Thailand, the availability and production of bamboo do not meet the demand, hence recommendations for augmenting supply have been forwarded (FAO 1994). Similarly, investment incentives in Malaysia for the establishment of plantations have been identified.

4.3.2.5 Price Structure in Selected Countries

Local prices of poles and products

Available prices in 1991-1993 for China, India and the Philippines standardized in US$ per pole show that pole prices in the Philippines are higher than in the two countries as shown below:

	China	India	Philippines
1991	0.61	0.64	1.14
1992	0.73	0.62	1.60
1993	0.79	0.55	1.68
Average	0.71	0.60	1.47

Although many factors affect price levels, the relative scarcity of poles in the Philippines may partly explain its higher price.

Table 4.3.32 shows the prices of the various bamboo products produced in China. Prices generally show a rising trend except for handmade paper. Poles are classified into large and small depending on diameter size with the price of large poles almost that of the small ones.

In India, bigger bamboos also command higher prices (for 1993) than smaller ones as indicated below:

Length (m)	Girth (cm)	US$ per pole
10	25-35	0.97
6	12-25	0.81
3-4	9-20	0.58

For the Philippines, price differentials by quality and market level have been discussed earlier. It is interesting to note that for a sala set, price (US$ per set) in the Philippines is higher than in Nepal which may be indicative not only of the respective demand and supply conditions in these countries but also of the quality of the product. The prices are:

	Philippines	Nepal
Manufacturer	75.20	44.10
Retailer	116.69	54.32

Unit export and import values

For poles, export unit value for China ranged from US$139 to US$231 per ton; for India, from US$190 to US$410 per ton; and for Nepal, from US$274 to US$312 per ton (Pabuayon and Espanto 1997). That for the Philippines is much higher and more variable ranging from US$463 to US$2,857 per ton. Since quality and other specifications are not indicated, the price differences are difficult to explain.

For China, export prices for shoots vary across different types. For 1993, the highest is for dried shoots as US$3,664 per ton, followed by fresh shoots at US$1,435 per ton, then by watered shoots at US$1,291 per ton, and finally by tinned shoots at US$1,153 per ton. For the Philippines, export prices of basket ranges from US$1.08 to US$1.36 per piece while for furniture, this is US$14.52 to US$39.43 per piece. In general, export prices for the 4 countries show increasing trends over time except for Nepal.

Comparatively, import prices are more variable than export prices. Import price for China ranged from US$107 in 1982 to US$2,925 per ton in 1993. For India, this ranged from US$77 in 1994 to US$2,005 per ton in 1995. For the Philippines, the range is US$124 in 1986 to US$2,000 per ton in 1995.

4.4 Institutional and Policy Environment

4.4.1 Bamboo Firms and Traders as Marketing Institutions

The market participants described earlier are themselves marketing institutions that play important roles in the production and distribution of bamboo products. Their performance is affected by other institutions like public and private organizations which may provide financial, technical, policy or other forms of support. They are likewise influenced by sectoral and general macroeconomic environment.

4.4.1.1 Asset size, ownership, and business experience

Based on the 1997 survey, the bamboo enterprises consisting of 17 manufacturers, 10 traders and 6 propagators are distributed according to asset as follows: micro (up to P150,000), 33%; cottage (over P150,000-P1.5 million), 18%; small (over P1.5 million-P15 million), 33%; and medium (over P15 million-P60 million), 9%; no answer, 7%. By ownership, 76% are single proprietorship, 3% are partnership and 21% are corporations. The 7 corporations are the relatively bigger firms (the small and medium based on asset). About 65% have been operating

for more than 5 years, the rest are relatively new with less than 5 years of operation or did not indicate their business experience. Most firms are producing diversified products using non-bamboo materials such as rattan, buri, and wood but almost 3/4 have bamboo as comprising 75-100% of their total sales.

Among those listed in the 1996/97 Buyers' Guide, more are listed as corporations which is not surprising since the this list includes the larger firms, many of whom are exporters (Table 4.3.2). Most of them are also operating longer than 5 years. The 1996 survey for Region VI also reveals that majority of the firms are single proprietors, with 13% corporations and 7% managed as cooperative and 63% have operated for more than 5 years with the rest having lesser business experience.

4.4.1.2 Manpower

Among those listed in the 1996/97 Buyers' Guide which reported their number of employees, 17% have less than 10, 51% have 11-50, while 32% have 51 to more than 100 workers. The latter are usually the corporations who operate continuously throughout the year to supply the needs of their importers.

About 56% of the firms surveyed in Region VI in 1996 have less than 10 employees, the rest have 10 or more. The least number of employees is 2, the highest is 85. As to tenure, half of the firms hire on contractual basis, 1/3 have regular/full-time employees, the rest hire on seasonal basis. All employees have attended school, most have finished at least high school education, indicative of their potential for skills improvement.

Similarly, the 1997 survey indicated more firms having less than 10 workers (42%). Those with more than 10 workers comprise 36% while others did not indicate their labor force.

The 1996 survey of Rivera, *et al*, reported that the labor force in the bamboo business is 65% male and 35% female which shows the extent of participation of women. For most of the workers, bamboo-related activities comprise the major source of income. It is interesting to note that in Region VI, the surveyed rank-and-file employees of bamboo enterprises are 75% female and 25% male. About 62% are within the age range of 14-30 years, the rest are 31 years old or older; while majority are either regular or contractual workers.

4.4.1.3 Tools, machines, equipment and supplies

The tools and equipment used by the surveyed firms including their acquisition cost are shown in Table 4.2.4. Comparatively, the larger firms who are also exporters have more advanced tools and equipment including dryer, compressor, drill, electric saw, electric sander, spray gun and compound machine for the paper manufacturer.

In Region VI, the reported tools, equipment and supplies are shown in Table 4.4.1. The tools used for cleaning, designing, carving, cutting; splitting, shaving, sizing, and refining include shaver, sizer, steel cutter, circular saw, knife, chisel, hammer, T-square, scraper, bamboo shaver, pair of scissors, pliers, and bolo. Machines and equipment are electric drill, blow torch, lathe machine, air compressor, spray gun, pressing machine, and drill press. Materials and supplies include shellac/varnish, bamboo strips, rattan strips, coco shells, sandpaper, nails, plastics, sodium peroxide, detergent powder, and linen cartolina.

4.4.1.4 Membership in associations

The survey in Region VI showed that 75% of the firms are not members of any bamboo association. The 25% who reported membership indicated that their associations are able to help in providing market and production information, organizing training and trade fairs, and lobbying for policy reforms in that order. Majority also said that there are no other organizations that help develop them except the 3 which were reported by 29% of the respondents. These are the PDC which provides financial assistance, the ADC which has a management information system and the AFFCW which also extends financial support.

4.4.1.5 Marketing practices

Buying of raw materials by manufacturers and bamboo products by traders are usually done on delivered basis although pick-up arrangement also exists (Table 4.3.19). In selling their products, manufacturers and traders also deliver to or have their products picked up by their buyers. Payment is mostly by COD but credit terms are also common among long-time trading partners. Price and quality largely determine the choice of source of raw materials among manufacturers. Additionally, product availability is another major factor reported by traders. Choice of market outlet is influenced by regularity and volume of purchase and payment terms.

4.4.2 Industry and Trade Associations

4.4.2.1 Names, addresses and contact persons

There are at least 5 local associations for bamboo listed in various sources. These include the Philippine Bamboo Society-Baguio Benguet Chapter, the Iloilo Furniture Manufacturers' Association (IFMA), the Iloilo Manufacturers' Multi-purpose Cooperative (IMMPC), the Aklan Furniture Makers Association, and the Cooperative in Davao composed of farmers engaged in planting and marketing of seedlings and poles for banana props.

The last one as reported by Mr. Caasi (personal communication) was established in 1989 but is now non-operational due to internal and marketing problems when the banana industry suffered from declining demand in the world market.

Contact person for IFMA is Ms. Glenda Dagdag, the president. For IMMPC, the contact person is Ms. Cecile Malta, the general manager.

There are about 8 industry associations which are of national or regional scope. However, information on the extent of membership of bamboo producers, manufacturers and exporters in these associations is not available. They are not necessarily for bamboo but for furniture, handicraft or exporters in general. These include the CFIP, PCHI, PCCI, PhilExport, ECCP, CFIF, CCIP and the CDPEAP. The contact persons for these associations are presented in Table 4.4.2.

4.4.2.2 Roles, functions and programs

IFMA is a non-stock, non-profit organization established in 1983 and is focusing on Bamboo Development Project which aims to complement existing wood furniture production, optimize use of widely available materials and skilled work force, and penetrate new markets. It works closely with the DTI Provincial Office in pursuing the project through the PDDCP which implemented design innovation and development activities for the bamboo-based furniture and accessories. The holding of fairs and exhibits where bamboo products are displayed and which serve as venue for linkaging manufacturers and potential buyers is among the activities undertaken together with IMMPC. Examples of such exhibits include the "Bahandi Sang Iloilo" (Treasures of Iloilo) held in November 1992 and Bamboo Development Project: Iloilo held in February 1993 which coincided with the Manila FAME Furniture and Furnishings Market Week. Both exhibits generated positive response and inquiries from foreign buyers. IFMA's plans include membership drive, a continuing education program to upgrade the knowledge and skills of workers and entrepreneurs, strengthened linkages with CFIP and DBP specifically to address the members' common needs for working capital, machinery and shop improvement.

IMMPC is a cooperative organized by IFMA for undertaking profit-making initiatives and has 19 members from 8 companies: A.D. Barvilla Enterprise, Elm and Oak Enterprises, Inc., Fanny's Rattan, FMC Enterprise, Iloilo Super Art Furniture Design, Libotaque Muebles De Narra, Noe's Upholstery Shop, and ROPAR Rattan-Wood and Bamboo Craft. Its focus is penetrating the export market through complementation and specialization among members.

The Philippine Bamboo Society-Baguio Benguet Chapter was organized in 1996 and supports the activities of the Philippine Bambusetum in Baguio (Tangan 1996). There are only 11 officers and members dominated by women with only one male member. Membership comes from government offices, NGOs, academe and private entities.

The functions and services provided by the 8 associations are also described in Table 4.4.2. Being primarily of national scope, they have large membership and some maintain regional or provincial chambers or offices. Overall, they undertake activities for the development and promotion of furniture and handicraft products (and other products) such as market linkaging, trade missions, information and technical services, and policy advocacy.

4.4.3 Research, Development and Training Agencies and Institutions

4.4.3.1 Academe

SCUs may undertake research activities in coordination with government and private institutions particularly in terms of funding and dissemination of research results. These include: UPLB, BSU, MMSU, NVSIT, TCA, PNAC, PSPC, VISCA and MSU. Funding may come through PCARRD or directly through local and international organizations such as FAO and IDRC.

4.4.3.2 Government

These include the CITC, ERDB, ERDS, FPRDI, TAPI, PCIERD and PCARRD.

CITC is the former NACIDA and is mandated to encourage and promote the establishment of micro, cottage and small enterprises and improve product quality and productivity towards global competitiveness for generating employment and livelihood opportunities.

ERDB and ERDS are both under the DENR and support the R&D activities of the forestry sector particularly in the technical, socio-economic and marketing aspects of the raw materials.

FPRDI is under the DOST and undertake R&D relating to technical, socio-economic, and marketing aspects of forest products particularly on postharvest and utilization. TAPI is also under the DOST and is responsible for technology commercialization and promotion. PCARRD is also under the DOST and is primarily responsible for R&D evaluation, monitoring, providing financial support, and promoting linkages among R&D institutions and individuals.

4.4.4 Other Supporting Agencies and Institutions

Many government institutions are mandated to provide services relating to production aspects, postharvest and utilization, trade, statistics, employment and labor relations, agrarian and land tenure, and cooperatives for the development and promotion of industries including bamboo. These are the DENR, DOST, DTI, NSO, NSCB, DOLE, and DAR.

Some of the institutions described earlier are under some of these departments. A major agency which has a number of bureaus and attached agencies which directly or indirectly affect the bamboo industry is the DTI. It is the primary coordinative, promotive, facilitative and coordinative arm for the country's trade, industry and investment activities.

Under DTI are various agencies whose functions are shown in Table 4.4.3. These are as follows: NIMTC, CITC, PDDCP, CITEM, BETP, BITR, SUBCONEX, BTRCP, BSMBD, BDTP, BPTTT, BPS, FTSC, PTTC, MISO, BIS and BOI.

4.4.5 International Organizations: Mandate and Activities

4.4.5.1 Bamboo associations/societies

Due to the importance of bamboo not only for the major producing countries in Asia but also for the major consuming countries of bamboo products in other parts of the world, several societies have been organized for its promotion and development. Those found via the Internet and have their own home page include the following: (a) the ABS which have various chapters including the Caribbean Chapter, Hawaii Chapter, Northeast Chapter, Northern California Chapter,. Pacific Northwest Chapter, Southeast Chapter, Southeast Coastal Chapter, Southern California Chapter and Texas Chapter; (b) the European Bamboo Society which is an umbrella organizations for all bamboo societies in Europe; (c) the Pacific Bamboo Council which is a non-profit group of growers, artists and craftspeople who promote the use and awareness of bamboo in the U.S.; (d) the Australian Bamboo Network; (e) the New Zealand Bamboo Society; and (f) the Swiss Bamboo Society.

The contact persons for these societies are also accessible via the Internet. They provide information on bamboo for the various countries such as U.S.A., Australia, Belgium, France, Germany, India, Italy, Japan, Kenya, the Netherlands, New Zealand, Switzerland, and the United Kingdom. The names and addresses of these contact persons are listed in Appendix Table 4.4.1.

The activities of these societies and some bamboo projects are also available in the Internet. For example, there is the IRB project which is a collaborative project between the UK-based Natural Resources Institute and the Kerala Forest Institute of southern India funded by the UK ODA. IRB is developing models for the conservation and increased cultivation and use of rural bamboo by focusing on genuinely multi-disciplinary approaches, inter-organizational collaboration and establishing dialogues between bamboo producers, users and development organizations. Another is the series of workshops sponsored by the various societies and organizations.

3.4.5.2 International bamboo foundations, association and network

There are two bamboo foundations, namely, (a) the EBF and (b) the IBF of America. The EBF has its headquarters in Bali, Indonesia and played a key role in holding the IV International Bamboo Congress on June 19-22, 1995 in Indonesia. Currently, EBF activities include the establishment of a bamboo training center (funded by USAID and Earth Love Fund), watershed management and reforestation projects in Bali, the development of earthquake-resistant

architecture in Flores (funded by the World Bank), forest preservation in Sulawesi, a land erosion program in Sumatra, and the establishment of bamboo plantations throughout Indonesia.

The IBA is composed of the different bamboo societies and other organizations in various countries involved in bamboo development. The membership is as follows: American Bamboo Society, Australian Bamboo Network, Bangladesh-Forest Research Institute, Colombia-Oscar Hidalgo Lopez, Costa Rica-National Project of Bamboo, China-Subtropical Forest Research Institute, China-Yunnan Bamboo Society, China-Bamboo Information Center, China-Nanjing Forestry University, Environmental Bamboo Foundation, European Bamboo Societies in Belgium, England, France, Germany, the Netherlands and Switzerland, India Bamboo Society, Indonesian Bamboo Society, International Network for Bamboo and Rattan, Japan Bamboo Society, New Zealand Bamboo Society, Philippines-DENR, Thailand-IUFRO/Kasetsart University and Zaire Bamboo Workshop.

INBAR was created by IDRC of Canada in 1993 to consolidate the informal bamboo and rattan research network operating for over a decade through various individual projects funded by IDRC in Asia. It is presently co-funded by the IFAD to strengthen its socio-economics and postharvest technology programs and the Japanese government to support its biodiversity, genetic resources and conservation program through the IPGRI. INBAR is thus a network for research and related activities with a broad mandate relating to better uses of bamboo and rattan to alleviate poverty and enhance production for meeting increasing demand. It seeks to improve sustainable management, conservation and utilization of the resources, build capacity in partner institutions, and forge links with small industries. Its major activities focus on production management, postharvest technology and utilization, genetic improvement, biodiversity and conservation, socio-economics, and information and training.

4.5 Policy Environment

4.5.1 General Policy Directions and Goals

The country's overall policy direction and goals are spelled out in the Philippine Medium-Term Development Plan (1993-1998). These are intended to achieve sustainable agro-industrial development and emphasize efficiency, equity and environmental objectives. They also apply to the development of the bamboo industry, hence bamboo policy directions must be consistent with such objectives.

4.5.1.1 Long-term economic and export-led growth through global competitiveness

Sustained economic growth is to be achieved through competitiveness of Philippine export products including bamboo, moreso, because it has been included among the country's export winners. Competitiveness means being able to produce goods (and services) at lower prices and better qualities vis-a-vis foreign (or local) rivals, leading to higher profits and

increasing shares in the international (or local) markets. In order to sell products at lower prices, the costs of raw materials, labor and other inputs must be kept at reasonably low levels. An adequate supply of raw materials transported in the form, time and volume required by users at the lowest possible cost is necessary. Other productive factors need to be used in optimal scale and technological level to ensure cost/price and quality competitiveness.

4.5.1.2 Environmental sustainability

Economic growth must be achieved without adverse environmental impacts. This requires that the development of any industry must enhance conservation of resources, biodiversity, and environmental protection. The increasing awareness on green GDP and implementation of programs in line with the concepts of green marketing and consumerism reflect efforts of public and private organizations to ensure environmental sustainability. In the case of the bamboo industry, this is consistent with maintaining adequate supply of raw materials which is needed to keep production cost low and which provide important ecological and environmental functions.

4.5.1.3 Equitable distribution of economic benefits

Sustainable development is consistent with intra-generational (present) and intergenerational (future) equity, the latter to emphasize sustainability. It is imperative that development of the bamboo industry must reflect equity in distribution of benefits, meaning that the disadvantaged and marginalized sectors of society must obtain a fair share of benefits. These sectors primarily include the gatherers; small bamboo producers, traders and manufacturers; workers; and poor rural communities. If these people are able to share equitably in the benefits, they would be willing to share in the responsibilities, costs and risks of development activities such as planting and protection of bamboo resources, postharvest, and various manufacturing activities with labor as major input. The approach adopted by DENR which stresses community-based forest management and strengthening links between small producers and large manufacturers and exporters is consistent with equitable sharing of benefits and costs among industry sectors.

4.5.2 Macroeconomic Policies Affecting the Bamboo Industry

In pursuit of these objectives, the government adopts a policy of trade liberalization implemented through tariff reforms and lifting of import restrictions. This is in contrast to the previous policy regime of (a) protection to domestic industries which did not allow competitive pressures for such industries and (b) creating unfavorable bias against export industries. Both resulted to costly misallocation of domestic resources.

Trade liberalization is presently complemented by policy initiatives to liberalize foreign exchange market, fiscal and non-fiscal incentives and, outward market orientation, and other tax

95

measures and financial packages. These are intended to boost export promotion and industrial growth. Trade liberalization is consistent with the government's commitment to the GATT-WTO, AFTA, APEC, and other international agreements. Such commitment will allow the country to benefit from the tariff concessions and liberalization measures made by member-countries by gaining greater market access and investment opportunities.

4.5.2.1 Foreign exchange

Estimates show that Philippine peso remains overvalued relative to the US dollar by at least 20% with the effect of encouraging imports and discouraging exports. Hence, exports of bamboo-based products tend to grow at the rate less than what it would had the exchange rate been more competitive. On the other hand, it is possible that entry of imported products and articles which substitute for bamboo-based products is greater than with a competitive exchange rate. Production cost for these products even if manufactured locally is also lower (hence are sold at relatively lower price) due to cheaper importation of raw materials and inputs.

When the peso depreciates, exporters benefit through higher peso returns per dollar worth of export and greater competitiveness of exports in the international market. Although the country's nominal exchange rate rose from P6.00 per US dollar in 1970 to P7.47 in 1980 and P26.25 in 1997, the country's rate of real currency depreciation remains lower than that of Indonesia and China (a major bamboo exporter) which have aggressively undertaken substantial real currency depreciations.

Policy initiatives involve (a) liberalization of foreign exchange rate, that is, lifting of requirements for exporters to surrender export receipts and dismantling of controls on capital repatriation, dividend and interest remittance; and (b) BSP intervention on the exchange rate for greater stability.

For the bamboo manufacturing industry, some imported inputs (varnish, leather) may become expensive with greater peso devaluation but such potential negative effect appears to be less relative to greater gain due to enhanced exports and reduced imports of substitute products.

4.5.2.2 Minimum wage

For large export-oriented manufacturing firms which are largely dependent on hired labor, rising wages increase production cost without corresponding productivity growth and reduces their degree of competitiveness due to higher prices of their products. This eventually can lead to lower profitability, lower rate of employment and lower exports. Thus, recent proposals for increasing minimum wage have been largely opposed by the industrial sector.

4.5.2.3 Interest rate and financing policy

Studies show that interest rates in the Philippines are higher than in competitor countries in Asia. High interest rates dampen demand for credit for investment purposes on productivity-

increasing facilities and technologies.

Policy initiatives therefore also include deregulation of market for loanable funds and liberalized bank branching and entry of new domestic and foreign banks. This results to a greater number of financing institutions in both urban and rural areas and availability of credit to industries and enterprises. Among the various credit programs intended for small and medium scale enterprises, the following may be availed of by the bamboo industry:

- GFSME which provides loans on fixed asset acquisition (with maximum of 25% of loan for land), plant construction, and temporary and permanent working capital, with loan size of P50,000 to P8 million.
- IGLF for manufacturing, cottage and small and medium enterprises and agri-based projects in regions other than NCR, Regions III, IV and VII.
- Funds under the SBGFC as provided for in the Magna Carta for Small Enterprises which is for manufacturing, processing and agribusiness (except for farm level production) and service (except pure trading).
- Financing program of the ULFD of TLRC for manufacturing firms

The specific credit facilities offered by the lending institutions under various programs are presented in Table 4.4.4. The LBP has 4 programs, DBP has 3, DOLE has 3, Livelihood Corp. has 1, and TLRC has 4. These programs are described in Appendix Table 4.4.2.

4.5.2.4 Money supply management

Comparatively, the inflation rate in the Philippines (which is influenced by money supply) is higher and more variable than in our neighboring countries. High inflation rate increases production cost, puts strong pressure on wages, and discourages savings and investments in the long term. As of June 1996, inflation rate is 1.1% in Singapore, 2.8% in Taiwan, 3.6% in Malaysia, 4.6% in South Korea, 6% in Vietnam, 6.9% in Thailand, 8.2% in Indonesia, 9.7% in China, and 11.3% in the Philippines. Recent efforts in the Philippines to reduce and stabilize inflation rate through intervention by the BSP may bring about favorable expectations among investors with the effect of greater investments including that in the bamboo industry.

4.5.2.5 Trade agreements

The basic provisions of trade agreements entered to by the Philippines relate to liberalization of imports. GATT/WTO ratified in 1994 provides for tariff concessions and liberalization measures to enhance trade flow between and among 120 member countries. AFTA is a 1992 agreement among ASEAN member countries which provides for CEPT scheme for progressive reduction of tariffs on the region's manufactured goods and processed agricultural products to the 0-5% within the 1998-2000 period. Availment of preferential tariff is subject to condition that at least 40% of the product's value is of ASEAN origin.

4.5.2.6 Fiscal and non-fiscal incentives

Fiscal incentives are policy measures aimed at reducing tax burden either by outright, total or partial exemption from a particular tax, or preferential tax treatment which raises the rate of return on the firm's investment. They include income tax holidays, tax deductions and credits, exemptions from indirect taxes including tariff duties, and grants and subsidies. Non-fiscal incentives are other measures providing indirect benefits to investors and include basic investment rights and guarantees, foreign equity participation, employment of foreign nationals, repatriation of profits, intellectual property protection, and other services to investors. Both are intended to make investments attractive, promote partnerships or joint ventures, and dampen adverse impact of trade liberalization on domestic industries.

According to BOI, the Philippine investment incentives are comparable with other countries except for the absence of accelerated depreciation and net loss carry-over provisions. In summary, the country's incentive package consist of the following: 40% foreign equity, FOREX remittances and capital repatriation allowed, FOREX deregulation, 40% real estate ownership, 50-75 years land lease, 35% corporate income tax, compensation guarantee in case of nationalization, and tax holidays promoted for firms 3-8 years.

Specific provisions are indicated as follows:

(a) Omnibus Investment Code of 1987

Registered bamboo enterprises that are export-oriented (under furniture, gifts and houseware like basketware and Christmas decor) and classified as SMEs and other projects which BOI promotes are entitled to various forms of incentives like income tax holiday; duty-free importation of capital equipment, machineries and accompanying spare parts and tax credit on domestic capital equipment up to December 31, 1994; additional deduction for 50% of labor expense from taxable income; tax and duty-free importation of genetic materials; tax credit for taxes and duties paid on raw materials, supplies and semi-manufactured products used in the manufacture of export products; and exemption from wharfage and export tax.

(b) Magna Carta for Exporters (Export Development Act of 1994)

The minimum incentives given to exporters who can open up new or greater markets are:

- exemption from PD 1853 requiring advanced payments of duties and taxes for imports
- zero% duty on importation of machinery and equipment accompanying spare parts for 3 years
- tax credits for imported inputs and raw materials not readily available locally for 5 years
- tax credits for increase in current year's revenue (1st 5% increase means a credit of 2.5%, next 5% increase means 5% credit, next 5% increase means 7.5% credit, in excess of 15% increase means 10% credit)

- non-traditional exporters who use locally produced raw materials, equipment and/or spare parts are entitled to tax credits equal to 25% of duties that would have been paid
- government credit institutions (DBP, PNB) will develop long-term peso and dollar credit facilities to be used for equipment expansion purposes.

(c) Republic Act 7160 or LGC of 1991

Under this law, local governments are granted broad autonomous powers "through ordinances duly approved, to grant tax exemptions, incentives or reliefs under such terms and conditions as they may deem necessary" in pursuit of economic development in their respective communities. Although, there appear to be some restrictive provisions in the implementing rules and guidelines, a liberal interpretation of the LGC provision allows such measures to be undertaken to support development plans, objectives and priorities. These measures may include provision of basic services and facilities (Sec. 17) such as:

- information services like investment and job information systems
- industrial research and development services, as well as the transfer of technology
- investment support services, including access to credit financing.

4.5.3 Sectoral Policies Affecting the Bamboo Sector

4.5.3.1 Bamboo collection and harvesting

The collection and harvesting of bamboo in forest lands is governed by the existing DENR Policies and Regulations through the issuance of cutting permit as specified for in the Revised Forestry Administrative Order No.11 dated September 14, 1970. This is lumped with the other non-wood (minor) forest products. However, pursuant to DAO 38, Series of 1990 and in line with the DENR policy on decentralization, the issuance of permit has been delegated to the DENR Regional Offices. Applications for cutting permit may, therefore, be filed through the CENRO concerned (Malvas 1995).

The AAC of a bamboo permittee is guided by the following formula:

$$AAC = Ap \times Av \times 4$$

where: Ap = Area covered by permit (ha)
Av = No. of clumps per ha
4 = No. of culms harvested per clump

(The formula is based on the assumption that a clump could yield 4 culms).

4.5.3.2 Forest charges

DAO 40 dated November 8, 1994 provides the following rates of forest charges for bamboo pursuant to RA 7181 and based on FOB market price of forest products:

Bamboo Species	Rate (P/piece)
Kauayan tinik/kiling	6.00
Bayog	3.00
Boho/bolo	2.00
Other species of erect bamboo	1.50
All climbing bamboos	0.50

The exemption from payment of forest charges for planted bamboos harvested from ITPs and private lands covered by existing titles or tax-declared A&D lands still remains.

4.5.3.2 Bamboo planting/plantation development

Bamboo is included as one of the species that could be used in the Forestation Program of DENR. The hectarage that would be developed through the program depends on whether bamboo.would be selected by the participant. This was done by expanding the then IFPP into now IFMAA. For its watershed rehabilitation projects, the DENR has considered bamboo as one of the important species for soil erosion control. It is also being used by DENR in its ISF projects and recently in its CFP which is currently known as CBFM program.

4.5.3.3 Transport policy

Aside from the cutting permit that must be obtained and forest charges that must be paid for harvesting bamboo in public lands, DENR monitors movement of bamboo by requiring a CNFPO. This is specified in DENR AO 59 issued on September 30, 1993. Exempted are those planted inside private and tax-declared A&D lands provided that they are certified by the CENRO as such. There are, however, irregularities since even those coming from public lands can be certified as such which partly explains why DENR statistics on harvest appear underestimated. It results to losses in government revenues and unsustainable harvesting practices.

4.5.3.4 Import/export regulations on bamboo

Based on the amended rules and regulations implementing PD 930, bamboo poles are prohibited for exportation except for scientific or testing purposes which need export clearance from the government. Exporters of manufactured bamboo products follow the general procedures required for exportation, such as securing export clearance, standardization and inspection by commodity offices, payment of inspection fees, submission of export declaration to authorized agent banks, and registration of this in accordance with the BSP rules including all loading and payment procedures required. Importation of bamboo poles for commercial purposes is also not allowed by the government, except for non-commercial purposes (e.g. for pearl farm fencing). These policies should be reviewed to encourage bamboo plantation development and sourcing of raw materials elsewhere as necessary to support development of bamboo-based industries.

3.5.3.5 Cooperative development

Under RA 6938, the Cooperative Code of the Philippines, it is a declared policy of the State to foster the creation and growth of cooperatives as vehicle for promoting self-reliance and harnessing people power for attaining economic development and social justice. On the other hand, RA 6939 created the CDA to promote the viability and growth of cooperatives as instruments of equity, social justice and economic development, defining its powers, functions and responsibilities.

In the urban and rural areas alike, cooperatives are encouraged as a way of pooling people's resources for collective undertaking of business activities at all stages of production. In the bamboo industry, cooperatives also have the potential to support business undertakings of farmers and small traders and manufacturers in terms of collective procurement of raw materials and inputs, marketing of products, and facilitating access to other productive factors and services on technology adoption, training for skills and manpower development, information on markets and prices, and financing.

4.5.4 Support Mechanisms and Services

4.5.4.1 Technical assistance

Various national and LGUs, SCUs, private organizations and individuals extend technical assistance on bamboo production and development.

Government agencies

DOST-PCARRD through its different regional consortia conducts farmers and investment fora and workshops on bamboo propagation technologies especially in regions where bamboo as a commodity is a flagship program. Technical assistance of the consortia is also extended through its OSIS located in strategic areas of the country.

DENR through ERDB and the Regional Research Sector also provides year-round technical assistance on production technologies to interested parties in the regions upon request which is free of charge. Foremost among the recipients is the *Kawayan* Foundation in Bacolod whose members have established bamboo plantations. The DENR Regional Research Sector in Region VI through its PCARRD project on Pilot Application of Technology Packages has assisted a cooperative (TABARGA) in Duenas, Iloilo in establishing a communal plantation and nursery. The cooperative was successful in providing income to members through selling of potted seedlings of giant bamboo that it was awarded the best PCARRD community-based R&D project in 1996.

One LGU initiative, the "Kawayan: Yaman Laguna", is a project spearheaded by Gov. J. Lina of Laguna which aims at rehabilitating and greening 17 river banks of the province and providing livelihood opportunities to beneficiaries through training of farmers in bamboo propagation, culture and farm management. As of February 1997, a total of 255,000 seedlings have been distributed to beneficiaries such as the DA, DAR, Provincial Population Office, farmers' groups, Rural Improvement Club, religious groups, schools and individuals.

Private sector

The NEPA-Q-Mart Industries Bamboo Production Pilot Project founded by Atty. Nereo J. Paculdo is giving out bamboo seedlings to individuals and organizations free of charge. The condition is that the recipient will plant the bamboo and take care of it until maturity and on the fourth year, he will return to the Nepa-Q-Mart 5 seedlings for every seedling received which will also be distributed free to other participants of the project. Between May 1990 and March 1993, the project has distributed 20,304 seedlings, 279,756 pieces of plastic (potting) bags covering 56 provinces in 265 demonstration farms and nurseries with 1,600 participants from NGOs, GOs, cooperatives and individuals (Paculdo 1992).

Among private individuals offering technical assistance is Mr. Domingo J. Alfonso of Kawayan Farms in Pililia, Rizal. Aside from selling ready-to-plant bamboo propagules, he offers a training package on kauayan tinik propagation if the client needs a large volume of planting materials.

Another individual who provides technical assistance on bamboo growing is Mr. Merdonio Caasi of Davao. Known as the "bamboo king", he started organizing a farmers cooperative for bamboo planting as early as 1989 providing *laak* and kayali planting stocks and technical assistance. This was triggered by the demand for poles for banana props which at that time was estimated at about 13 million poles per year.

4.5.4.2 Methods of technology transfer and information dissemination

Transfer of bamboo propagation and production technologies are primarily being carried out through training, fora, symposia, establishment of demo farms/pilot plantation and nurseries, exhibits and publication of manuals and brochure.

Training

The DENR-ERDB/UNDP Bamboo Research and Development Project (PHI/85/008) has embarked on massive training on bamboo propagation technologies between 1989 to 1993, conducting more then 25 training with more than 600 participants from Itogon, Benguet in CAR to Upi, Maguindanao in ARMM. Target participants are farmers including women, youth organization, ISF beneficiaries, CDOs, CDAs, DENR- CENRO, DA staff and bamboo furniture makers. These training courses cover both lecture and practical aspects of planting bamboo.

At present, bamboo propagation technologies is one of the basic topics included in the module of the on-going DENR Science High School Teachers' Training on DENR" being conducted by ERDB in all regions of the country.

Other agencies such as PCARRD and DA are also conducting bamboo training in coordination with regional consortia.

Bamboo Conferences, Symposia and Fora

Several conferences, symposia, and fora on bamboo have been sponsored by different agencies. Notable among them are:

National Bamboo R and D Symposium - There are three national Bamboo R and D symposia conducted in the recent past (March, December 1990, April 1992 and December 1995). The first 3 were organized and sponsored by the ERDB- DENR/UNDP/FAO Bamboo Research and Development project and the latest is a joint undertaking by ERDB, NEDA and PCARRD. The purpose of these symposia is to exchange information on the recent developments on bamboo production and utilization research and technologies generated. These were participated in by research institutions, academe and private practitioners. The status of bamboo industry and prospects were also discussed relative to constraints, policy issues and strategies for sustainability of bamboo industry. Proceedings of the first symposia have been distributed and are still available at ERDB headquarters in College, Laguna. The printing of the last symposium proceedings is still in progress.

The First National Conference on Bamboo jointly organized by PCARRD-DOST and CITC-DTI held on August 1-2, 1996, Iloilo City also served as a venue for exchange of information on recent developments in bamboo industry including propagation technologies. This was attended by the different agencies, and industry members and research and academic institutions.

From time to time, investors' fora on bamboo are organized by different agencies and private groups where various experts are invited as resource persons. These include the following:

a) Magent Agro-Industrial Corporation which conducted a bamboo seminar/workshop on production and utilization at CEC, College Laguna on October 1996.

b) Technology Forum and Consultative Dialogue on Commercial Methods of Bamboo Propagation, Processing and Utilization held in DAP, Tagaytay City on September 19, 1994.

c) TLRC Techno-Usapan: Bamboo Propagation, Utilization and Business Potential held at TLRC, Makati City on August 18, 1995.

d) Technology Investment Clinic which include Bamboo Utilization Technology held on November 6, 1996 during PCARRD's 24th Anniversary . The Clinic offers an opportune time to settle certain questions, e.g. how fit are the farm resources to the business proposals, how do certain developmental trends in the field affect success of such investments, what are the sources of raw materials and other inputs, how can market tie ups be effected, among others. A one-on-one consultation between participants and resource persons was a major feature of the Technology Clinic.

Bamboo Propagation Manuals and Brochures

There are voluminous manuals and guides on bamboo propagation and plantation establishment published in the country. As early as 1982, the former FORI (now ERDB) published How to Grow Bamboo" with an updated version in 1987. The FDC of the UPCF published an illustrated easy method of producing bamboo entitled Growing Bamboo The Ilocos Way" in 1983. In 1988, the DENR-ERDS Region 11 documented and published Growing Bamboo for Livelihood and Development" based on the experience of Mr. M. Caasi in growing bamboo (*laak*). A more comprehensive publication on bamboo production was published by PCARRD in 1991, The Philippines Recommends for Bamboo Production". In the same year, the RISE published two issues on how to propagate bamboo by species (*bayog, k. tinik, k. kiling* and *bolo*) as a reforestation species.

Recently, the Bamboo Farming" was published by ERDB-DENR/UNDP Bamboo Research and Development Project in 1995 with adaptation in Tagalog (1995), Bisaya (1996) and Ilocano in (1996). This contains all to know about bamboo propagation, plantation establishment, harvesting and management based on the project research results and latest literature. This manual has been translated in other local dialects by the DENR Regional Research Sectors, modified to suit local conditions. In 1996, the MMSU in Batac, Ilocos Norte published a brochure entitled Kawayan Technology: Planting Material Production". The ABS Newsletter, Albany, New York in its December 1996 issue published a full length article entitled "The CAASI Process of Mass Bamboo Propagation by Cuttings and Incubation". Appendix Table 4.4.3 lists some published manuals and guides on bamboo production technologies for information dissemination.

On postharvest utilization and technologies, the conduct of technical training seminar/workshops is one way to impart techniques and demonstrate ways of increasing plant level productivity and improving product quality through the adoption of improved production technologies. Training sessions are conducted by government and non-government agencies sometimes for free. Among the modules on bamboo craft are: bamboo treatment/preservation, bamboo craft skills, update on design, bamboo finishing, jigs making, bamboo processing, etc. Other training needs are in the area of painting and carpentry, speeding-up production and other aspects of bamboo craft making.

Among the training programs related to improving the productivity of the workers are: upgrading skills, innovative designing, team building, supervisory training, quality control, and upgrading management.

Before, some people have the idea that bamboos are only made into useful household furnishing like the famous Filipino *papag"*, baskets,. and bags; while the shoots are popular as table fare. This belief, however, has been gradually changed through technology transfer activities to reach the widest possible and largest number of clientele and consequently make them adopt appropriate technologies developed for them. An example is the introduction of modern and unique technologies of weaving bamboo strips and laminate them into bamboo mat board or lamination of bamboo strips into lumber to be fabricated into floor boards and furniture components. Exquisite novelty items such as fancy baskets, lampshades, brooches, pins and other related products have gained tremendous popularity and acceptance here and abroad. All these are made possible by providing technical services and training to various clienteles. Several.technical training centers are established such as CITC and PDDCP.

4.5.4.3 Research and Development

As early as 1937, Mabayag P. conducted a study on the propagation of *Bambusa blumeana* by cuttings and in 1957, Cabanday worked on the various methods of cutting and layerage of the same bamboo species. There were several other studies on bamboo propagation and planting conducted between this period up to the present but it was not until 1984 when a comprehensive R and D Program on bamboo production and management was formulated under the Corporate Plan of the ERDB, then FORI. However, due to financial constraints, implementation of this plan was sporadic and limited . It was only in 1987 when a revised and updated Bamboo R and D Project was finally implemented with financial support from UNDP/FAO. This 5-year research program had four major components, namely; research, pilot plantation development, extension and technology transfer, and research capability building. The completed research so far are on planting stock production techniques, nutritional requirement, physiology, pest and diseases, taxonomy, and some aspects on socio economics. A 56-hectare pilot plantation *cum* research was also established for various species and sites for studies on bamboo harvesting and plantation management. The later aspect of research which is now being continuously pursued needs a longer observation period in order to come up with proper management regime for various species. Table 4.4.5 shows the species established in plantations, hectarage and specific locations.

Research implementation and pilot plantation development are jointly undertaken by ERDB and the Regional DENR Research Sector in cooperation with some SCUs. Other research agencies and academic institutions such as the DMMSU and the IPB of UPLB are also conducting research in coordination with PCARRD. Mr. Maravilla of Iloilo city has also initiated a study on bamboo culture by airponics method.

Processing and utilization research is also being done at FPRDI, CITC, and SCUs. For example, studies made at FPRDI revealed that small industrial firms are confronted with organizational, managerial, and technological problems as well as economic and marketing deficiencies.

The list of on-going and new R&D projects on bamboo is presented in Appendix Table 4.4.4.

4.5.5 Perceptions of Bamboo Enterprises

4.5.5.1 Existence of government support

Disregarding the few who did not answer the question, majority of the bamboo firms surveyed in 1997 reported that they are unaware of the existence of government support for the bamboo industry (Table 4.4.6). This is based on a sample where half are micro and cottage industries which operate on small scale basis. On the average, awareness is reported by only 17% of the firms. Most of the micro and cottage industries indicated that they are left on their own (*sariling sikap*) without any support. One firm expressed frustration on the government's unsuccessful effort in developing good designs that will create high demand for Philippine products in the world market emphasizing the need for intelligent designers who can create winning products. He feels that government effort has been biased in propagation.

Among those who reported being aware, the various forms of government support ranked according to awareness by the respondents are as follows: training (34%); market linkaging and information (28%); support for export and R&D on bamboo production (24% each); plantation development (21%); R&D on utilization and processing (17%); extension of technologies and other incentives (tax, foreign exchange) (14% each); importation of raw materials and equipment and credit for manufacturing and exporting (10% each); and credit for domestic trading (3%).

The survey in Region VI in 1996 indicated majority (70%) of the firms having received technical assistance from various government agencies with most of them saying that they are satisfied with the services provided. The list of agencies is shown in Table 4.4.7. It also shows that assistance is mostly in the conduct of training, extending small loans and providing common service facilities. This result indicates that government services are generally more available in Region VI than in Pangasinan, Metro Manila and Southern Tagalog regions where the 1977 survey was conducted.

4.5.5.2 Problems and constraints

Table 4.4.8 shows the areas of concern that the surveyed firms reported as needing attention in order to develop the bamboo industry. These were reported by almost 80% of the firms. The areas of concern are ranked according to extent of report as follows: market

linkaging/finding market outlet and plantation development (7 each), credit for manufacturing (4), technology extension and operating capital for trading (3 each), product development/design and training/seminar (2 each), R&D and support for export (1 each).

Similarly, the Region VI survey indicated recommendations to improve government services to the bamboo industry (Table 4.4.9). They focus on finding markets, financing, technology update, improving communication system especially DTI, continuous dialogues among themselves, providing more seminars, and assistance similar to what NACIDA did before.

4.5.5.3 Forms of marketing assistance

On sourcing of raw materials and marketing of inputs, the bamboo enterprises identified specific forms of assistance needed (Table 4.4.10). These include finding market outlets/buyers, sourcing of better products for buy-and-sell operations of traders, finding reliable and cheaper sources of inputs and raw materials, promotion of bamboo here and abroad through fairs/exhibits, and improvement in design.

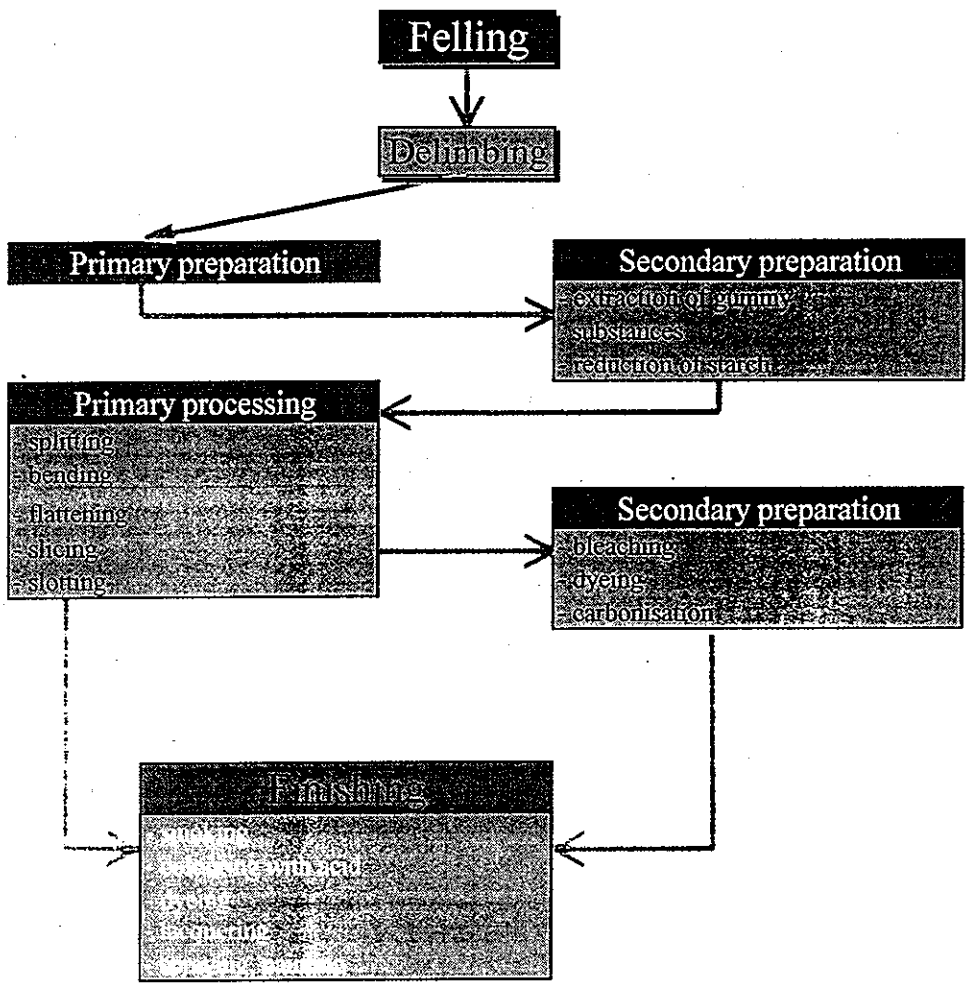

Figure 4.2.1. Process flow common for most bamboo products

Source: Goanaharan and Mostiero.1995. INBAR Report on indigenous tools, equipment and technology for processing bamboo and rattan.

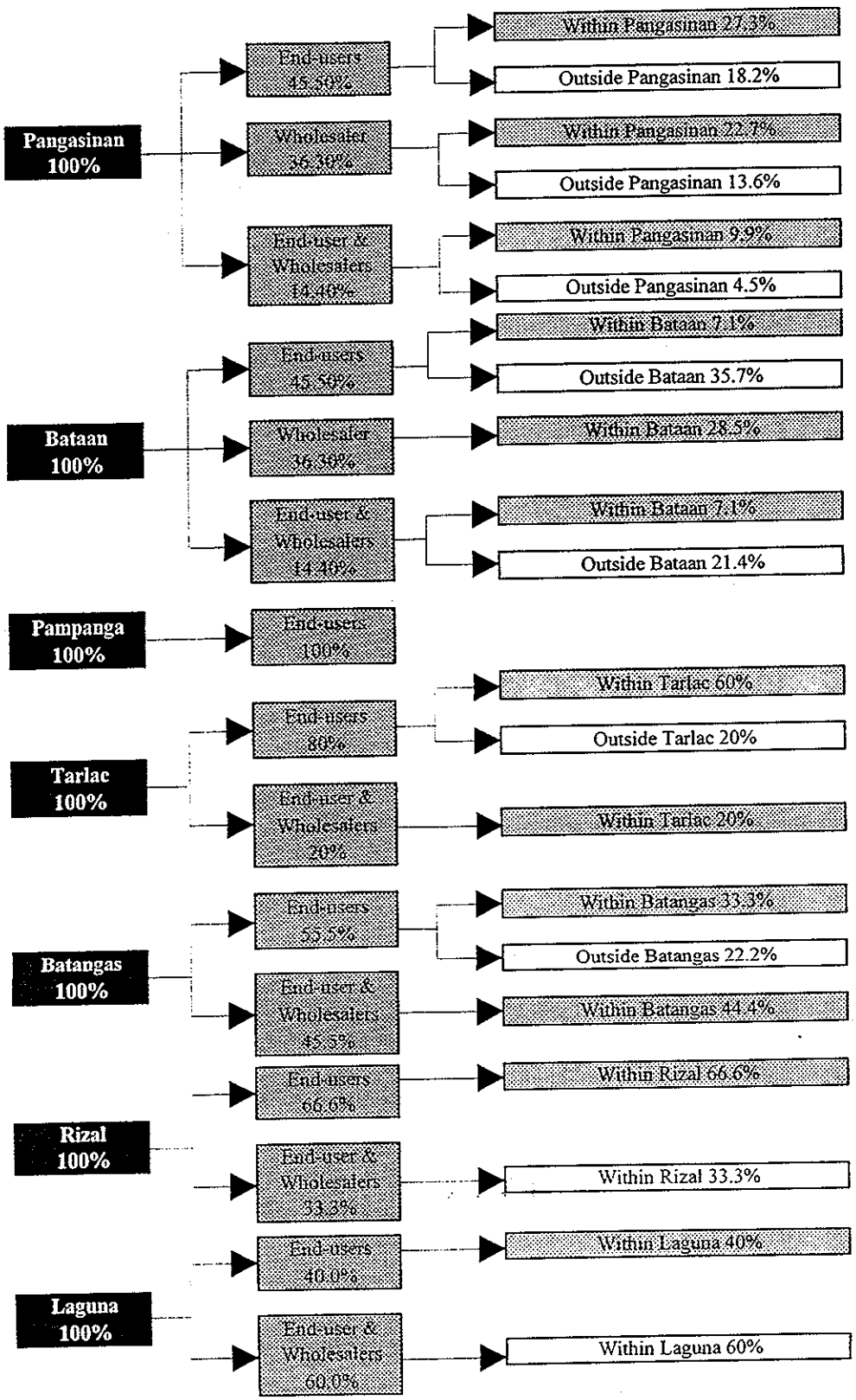

Figure 4.3.1. Distribution (%) of bamboo poles traded by province, 1992

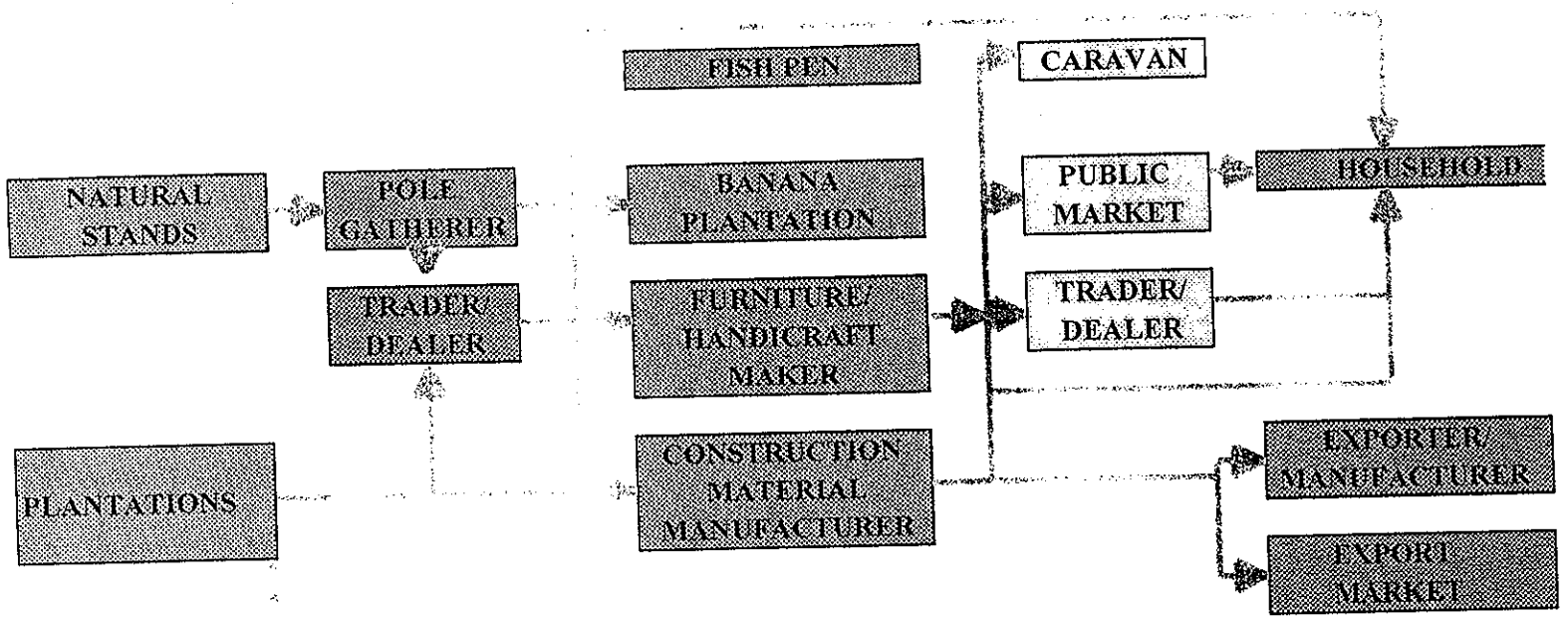

Figure 4.3.2. Distribution channels for bamboo poles and products, Philippines, 1996

Source: Navera (1996)

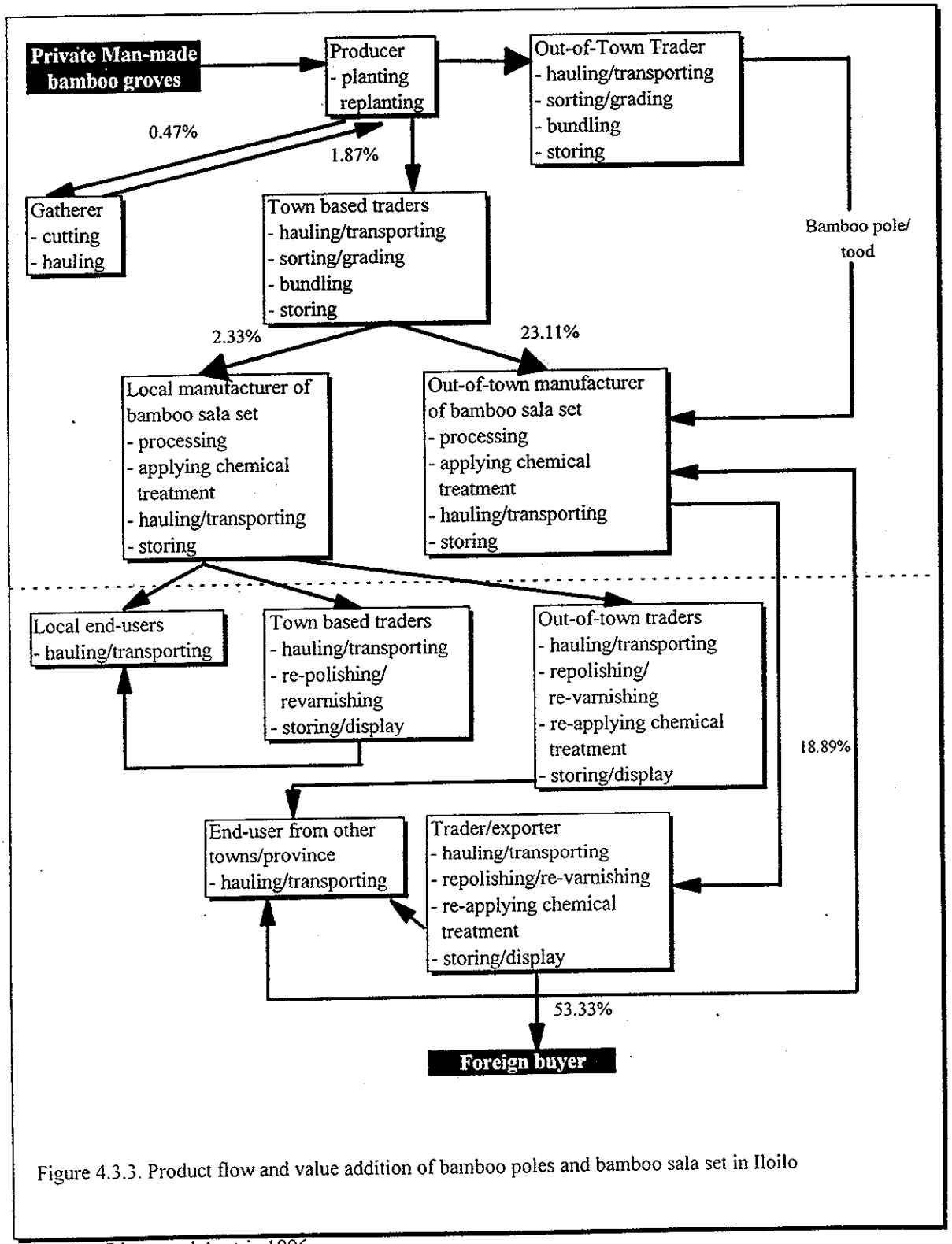

Figure 4.3.3. Product flow and value addition of bamboo poles and bamboo sala set in Iloilo

Source: Rivera and Austria 1996

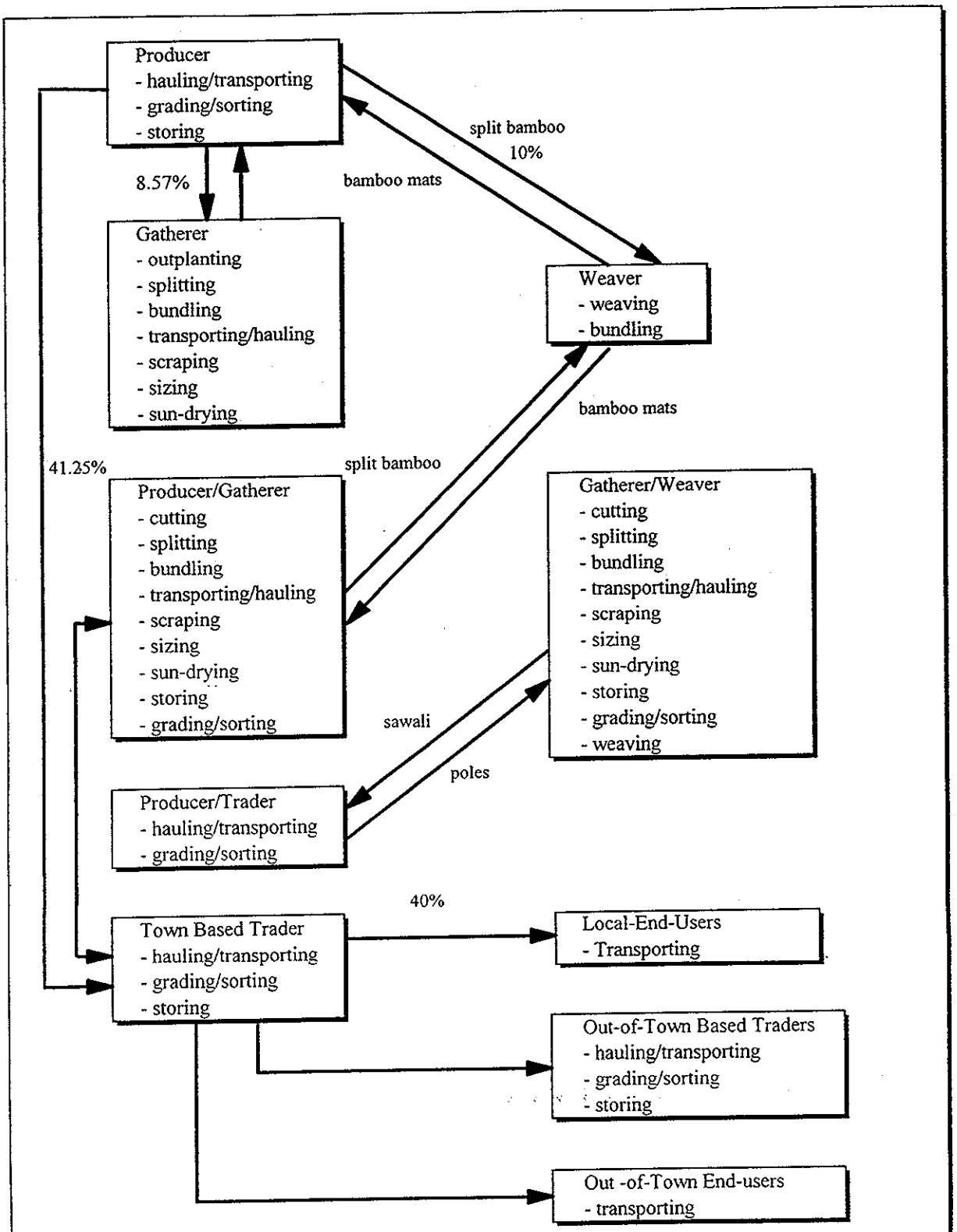

Figure 4.3.4. Product flow and value addition of bamboo raw materials and bamboo mats (*sawali*) in Iloilo

Source: Rivera and Austria 1996

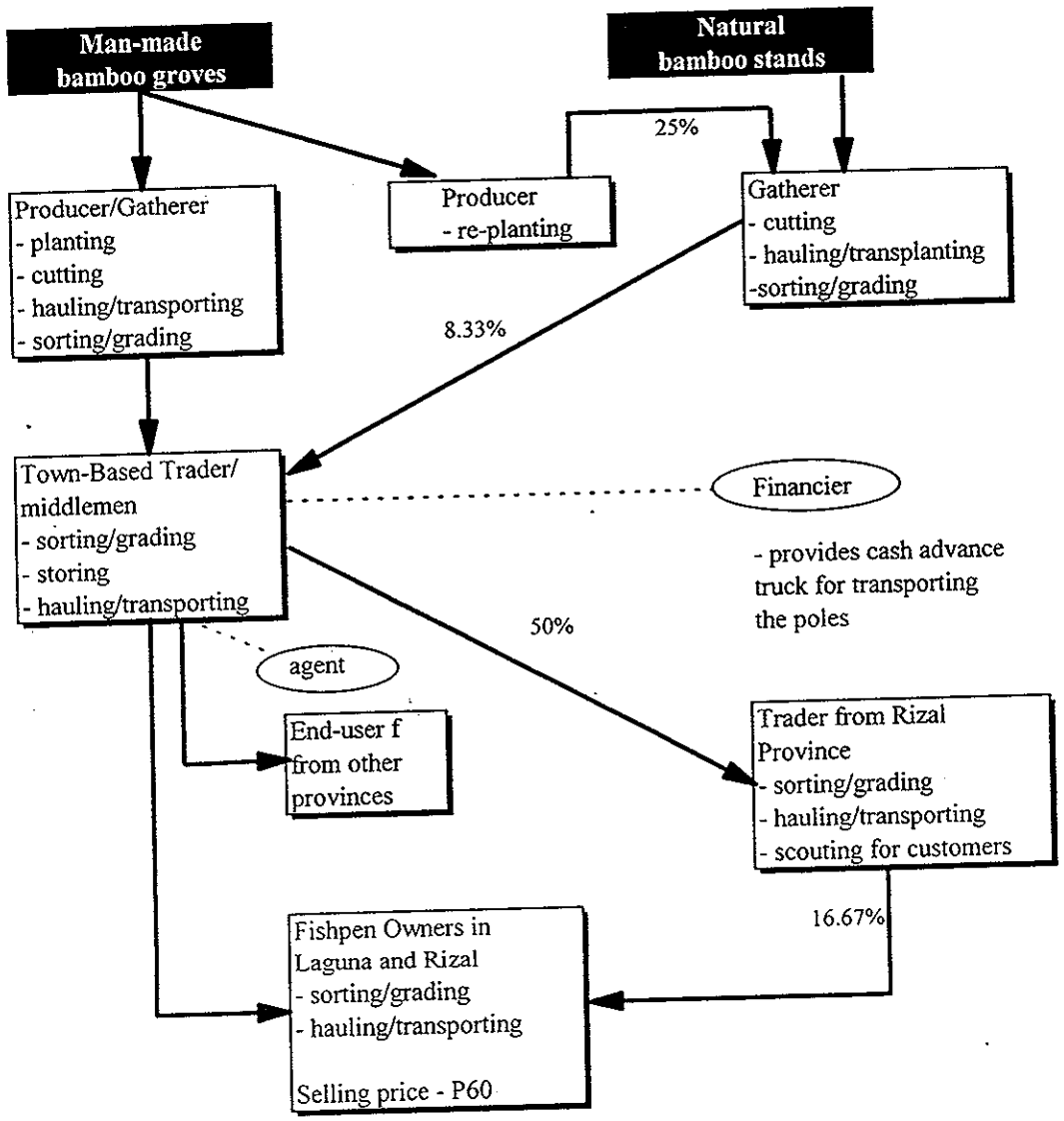

Figure 4.3.5. Product flow and value of bamboo poles from Abra

Source: Rivera and Austria 1996

Table 4.1.1. Number of Philippine bamboos taxonomically recognized and published by various authors.

GENERA	AUTHOR/NUMBER OF SPECIES						
	Gamble (1916)	Merrill (1923)	Santos (1986)	Pancho and Obien (1988)	PCARRD	Schlegel and Tangan (1994)	PROSEA
Arundinmaria	1	1	-	3	3	2	-
Bambusa	5	5	7+1 var	6t1 var	14+2 var.	7	7
Cephalustachyum	1	1	1	-	1	-	1
Chimnobambusa	-	-	-	-	-	1	-
Dendrocalamus	2	1	3	3	4	3	4
Dinochloa	4+1 var	4	3	-	4	3	-
Gigantochloa	-	1	1	-	2	2	2
Guadua	-	1	-	-	-	1+1 var	-
Phyllostachys	-	-	-	3	3	5	1
Pleioblastus	-	-	-	-	-	6	-
Pseudosasa	-	-	-	-	-	2	-
Pseudostachyum	-	-	1	-	-	-	-
Racembambos	-	-	-	-	-	-	1
Sasa	-	-	-	-	-	5	-
Sasaella	-	-	-	-	-	1	-
Schizostachyum	10	10	8	1	11	3	3
Shibataea	-	-	-	-	-	1	-
Sphaerobambos	-	-	-	-	1	-	-
Thyrsostachys	-	-	-	1	1	1	1
Yushania	-	-	-	-	1	2	1
TOTAL	25	25	26	18	47	46	21

Source: Rojo, J. P (1996)

Table 4.1.2 . Area of utilization and specific uses of bamboo in the Philippines

AREA OF UTILIZATION	SPECIFIC USES
1. Construction and Infrastructure:	
Low-cost housing construction	- walls and partition - ceilings and floors - concrete reinforcement - doors and windows - posts and fences - water pipes
Scaffolding for large construction	
2. Handicraft and Furniture Industries	
Handicrafts	- fruit trays - lamp shades - baskets - brooches - napkin rings - pen holders - jewelry boxes - flower bases - fans - wall decor
Furniture	- dining tables - corner tables - center tables - cabinets - lounging chairs - sofas - rocking chairs - beds
3. Agricultural Industries	
Fisheries	- rafts - fish traps/ corrals - fishing rods - outriggers - fishpens - fish shelters - stakes for mussels
Banana	- props in support of fruit bearing banana plants
Tobacco	- bamboo stakes for flue-curing/ sun-drying of tobacco leaves.
Vegetables	- materials for trellises, etc.
4. Industrial Purposes	
Pulp and paper	
Other s	- parquets, laminated strips for aircraft
5. Food and Processing Industries	- Succulent shoots of some species are highly nutritious and palatable and are commonly prepared for various recipes. - Used as materials for cooking devices, etc.
6. Musical Instruments	- horns - clarinets - flageolets - saxophones - flutes - piccolos - xylophones - drums Philippines is world famous for its bamboo organ
7. Landscaping and Ornamental Purposes	- Size, growing patterns and culm color of some bamboo species are highly suitable for landscaping.

Source: PCARRD (1984), Tesoro (1983), Tamolang (1980), Lantican *et al.* (1985) as cited by Tagarino (1990)

Table 4.1.3. Specific uses of 10 common bamboo species in the Philippines

BAMBOO SPECIES		SPECIFIC USES
Scientific Name Common Name Local Names	*Bambusa blumeana* Kauyan tinik, kauyan, tinik	walling, thatching and roofing, construction, basket making, cooking utensils, mats, water and milk vessels, water buckets, cups, container, fuel, agricultural implements, floats for timbers, rafts, tool handle, fences, shoots for food, general utility, checks for doors and windows, haystack stabilizer, horticultural pursuits, cremation, coffins, container for cleaning grain, cart sleds, roofs, fishing implements, boat roofs, culm sheath (irrigation), boat masts, barbecue skewers, trellises, flutes, hats, barrel for toy cannons, sledges transport, handicrafts, sprayers, polomallets, shuttles, afforestation of riverbanks, and soil conservation areas, shelterbelts and windbreaks.
Scientific Name Common Name Local Names	*Bambusa vulgaris* Kauyan kiling, kiling, taiwanak,	thatching and flooring, construction, basket-making, fuel, furniture, agricultural implements, fencing, shoot for food general utility, checks for door and windows, haystack stabilizers, cremation, coffins, containers for cleaning grains, fishing implements, ornaments, bridges, rickshaw hoods, hats, handicraft, jaundice treatment, afforestation of riverbanks and soil conservation areas, shelterbelts and windbreaks.
Scientific Name Common Name Local Names	*Dendrocalamus latiflorus*	furniture, fences, shoot for food, cremation, coffin, containers for cleaning grains, afforestation of riverbanks and soil coservation areas, shelterbelts and windbreaks.
Scientific Name Common Name Local Names	*Bambusa sp.1 (formerly known as D. merrillianus* Bayog Bayog	construction, basket-making, mats, fuel, agricultural implements, tool handles, fences, shoots for food, general utility, cremation, coffins, containers for cleaning grains, cart sheds, roofs, cordage, sledges (transport), afforestation of riverbanks and soil conservation area, shelterbelts and windbreaks.
Scientific Name Common Name Local Names	*Dendrocalamus latiflorus*	furniture, fences, shoot for food, cremation, coffin, containers for cleaning grains, afforestation of riverbanks and soil coservation areas, shelterbelts and windbreaks.
Scientific Name Common Name Local Names	*Gigantochloa levis* bolo	construction, mats, water and milk vessels, water backets, cups, containers for cleaning grains, food (shoots), fishing implements, irrigation (culm sheaths), boat masts, toy cannons, afforestation of riverbanks and soil conservation areas, shelterbelts and windbreaks,
Scientific Name Common Name Local Names	*Dendrocalamus asper(formerly known as Gigantochloa aspera)* giant bamboo	pulp and paper, construction material, food (shoots) handicraft, agricultural implements
Scientific Name Common Name Local Names	*Schizostachyum lima* Anos	stoves, construction materials, bows and arrows, fuel, fence, fishing rods, cremation, coffins, musical instrument (flutes, marimba, horns, clarinets, flageolets, saxophones, piccolos, drums) afforestation of riverbanks and soil conservation areas shelterbelts and windbreaks.
Scientific Name Common Name Local Names	*Bambusa sp. 2* laak	banana props, riverbank stabilization and water-logged areas
Scientific Name Common Name Local Names	*Gigantochloa attar* kayali	banana props, construction materials

Source: PDC (1983) as modified

Table 4.1.4. Availability of bamboo in nine provinces of the Philippines, 1983.

PROVINCES	NUMBER OF TOWNS	TOTAL AREA COVERED WITH BAMBOO (ha)	TOTAL CLUMPS	TOTAL CULMS	AVERAGE NUMBER OF CLUMPS PER HECTARE
Luzon					
Tarlac	14	141	14,523	392,121	103
Pangasinan	19	240	42,801	1,178,268	177
Ilocos Norte	11	212	49,608	1,209,808	243
Ilocos Sur	15	468	66,856	1,871,988	143
Visayas					
Iloilo	20	3,412	607,336	20,649,424	178
Aklan	6	118	26,904	2,049,256	228
Capiz	5	70	23,800	666,400	340
Antique	7	101	27,472	796,688	272
Mindanao					
Davao Norte	23	128	34,944	1,048,320	273
TOTAL	122	4,890	894,244	29,862,273	
AVERAGE			99,360	3,318,030	216

Source: Virtucio, *et. al*. 1984. Survey of some erect bamboo stands in the Philippines. Unpublished report. ERDB, Los Baños, Laguna, Philippine.

Table 4.1.5. Bamboo resources in dipterocarp forests (RP - German Forest Resources Inventory 1988) in million lineal meters (lm) and million culms.

COMMON NAME	CULM DIAMETER < 2 cm	NUMBER OF CULMS	CULM DIAMETER >= 2 cm	NUMBER OF CULMS	TOTAL	
					(lm)	(culms)
Anos	132.2	16.5	85.3	10.7	217.5	27.2
Bayog a/	2.4	0.2	3.1	0.2	5.5	0.4
Bikal	3799.6	139.0	2257.8	69.0	6057.4	208.0
Bikal-babo	1754.2		504.5		2258.7	
Bocaue	1.9	0.1	0.0	0.0	1.9	0.1
Bolo a/	7.0	0.4	0.0	0.0	7.0	0.4
Buho	721.3	60.0	1341.9	112.0	2063.4	172.0
Kauayan-kiling a/	12.0	0.8	70.4	4.7	82.4	5.5
Others	10.0	-	26.2	-	36.2	-
TOTAL	6440.6	217.0	4289.2	196.6	10730.0	413.6

a/ Not naturally growing in forests

Table 4.1.6. Regional distribution and volume (no. of clumps) of different bamboo species in the Philippines (partial data a/).

Region	*K. tinik*	*Bayog*	*K. kiling*	*Buho*	*Bolo*	*Botong*	Bamboo b/	*Kayali*	Chinese Bamboo	Giant Bamboo	Pole Vault	Total
I	11,603	13,973	1,343	390								27,309
II	110	50	50									210
III	298,188	21,807	5,608	126,531								452,134
IV	3,500											3,500
V	17,588		11,459	361	690							30,098
VI	9,867		2,824			7,043						19,734
VII												0
VIII	13,653		7,609			6,709						27,971
IX	7,001	164	2,420	985	4,055	147	108					14,980
X								1,365	54	1,516	1,417	4,352
XI	16,763	15,163	1,600		1,600							35,126
XII			342							372		714
CAR												0
TOTAL	378,273	51,157	33,255	128,267	6,345	13,899	108	1,365	54	1,888	1,417	612,028

a/ Based on reports submitted by the regions (ERDS) compiled by ERDB 1991

b/ Not identified

Table 4.1.7. Total number of clumps and aggregate area covered with bamboo by province, Region 1.

PROVINCE	NUMBER OF CLUMPS	AGGREGATE AREA (ha)
Ilocos Norte	16,780	167.8
Ilocos Sur	22,828	240.3
La Union	13,194	145.6
Pangasinan	25,984	305.7
TOTAL	78,786	859.4

Source: Uriarte N. U. and Maligalig B. B. 1992

Table 4.1.8.Existing bamboo plantations in Region 3 as of December, 1993.

PROVINCE	TOTAL AGGREGATE AREA (ha)	SPECIES PLANTED
Pampanga	198.31	*Kauayan tinik, Bayog, Kauayan kiling, Buho*
Bulacan	11.207	*Kauayan tinik, Bayog, Kauayan kiling, Buho*
Bataan	977.75	*Kauayan tinik, Bayog, Kauayan kiling, Buho*
Tarlac	74.85	*Kauayan tinik, Bayog, Kauayan kiling, Buho*
Zambales	6,905.35	*Kauayan tinik, Bayog, Kauayan kiling, Buho*
Nueva Ecija	38	*Kauayan tinik, Bayog, Kauayan kiling, Buho*
TOTAL	8,205.47	

Source: Tuddao, V.B. Jr.1994.

Table 4.1.9. Estimated number of hectares planted to bamboo in Region IV by Province.

Province	No. of Municipality Sampled	Approx Area (ha)	Average Age	Estimated Harvest (no of poles/ yr)	Species
Laguna (as of Aug. 7, '96)	7	141.50	1-2 yrs old	28,800	Bamboo Tsina *Matinik* *Taywanak buho*
Batangas (as of Aug. 1996)	5	60.00	10 - 12		*Kauayan tinik*
Romblon (as of Sept. 20, '96)	6	19.00	5-10 yrs. old	1,500	*Kauayan tinik*
Quezon (as of Aug. 1996)	8	30.00	5- 10 yrs. old	1,000	*Kauayan tinik*
Aurora (as of Sept.20, '96)	3	16.00	20 yrs. old	200	Chinese Giant Bamboo *Kauayan kiling* *Bayog*
TOTAL		266.50		31,500	

Source: Summarized by consultant from PENROS and CENROS updated report Region IV as consolidated by Maligalig B. (1996).

Note: Data on bamboo areas in Region IV by Municipality is in Appendix Table 4.1.4

Table 4.1.10. List of existing private bamboo plantations

LOCATION	OWNER	SPECIES	AREA(ha)
Luzon			
Isla Verde, Batangas City	Jose Ma. Pastor	*Kauayan Tinik*	50
Pililia Rizal	Alfonso Domingo	*Kauayan Tink*	20
Agno, Pangasinan	Doctor's Farm	*Kauayan Tinik*	5
Pangasinan	NEPA Q-Mart	*Bayog* and *Botong*	50
Coron Palawan	Francisco Fernada	*Kauayan tinik*	5
Del Monte, Bulacan	Sighn Bambusetum	*Kauayan Tinik*	20
Bula Camarines Sur	Mike Laya	*Kauayan Tinik* and *Kauayan* Buddha	3
Laguna	Various Private Group	*K. tinik*, Giant bamboo and 80% *Laak*	890 a/
Sub-total			**1043**
Visayas			
Murcia, Negros Occ.	R. Jalandoni	*Kauayan Tinik*	160
Murcia Negros Occ.	T.Trebol	*Kauayan Tinik*	20
Murcia Negros Occ.	N. L. Agustin Farms	*Kauayan Tinik*	30
Isabela Negros Occ.	R. Suatenco	*Kauayan Tinik*	5
La Castellana, Negros Occ.	Ferria Farms	*Kauayan Tinik*	14
Manapla Negros Occ.	Lamata Farms	*Kauayan Tinik*	14
Cadiz Negros Occ.	Mirasol	*Kauayan Tinik*	10
Victoria Negros Occ.	Maravilla Farms	*Kauayan Tinik*	10
Moises Padilla Negros Occ.	Feria Farms	*Kauayan Tinik*	7
Valladolid, Negros Occ.	Mayor Presbitero	*Kauayan Tinik*	2
Dingle, Iloilo	Hermontt Enterprise	*Kauayan Tinik*	8
Duenas, Iloilo	Paterno Larida	*Kauayan Tinik*	10
Anilao, Iloilo	Maravila Enterprise	Giant Bamboo	10
Guimaras	SMILE	Giant Bamboo	12
Sub-total			**312**
Mindanao			
Panabo, Davao N.	TADECO	Spiny, *Laak*, Lunas	140
Davao del Norte	Nest Farm	Spiny, *Laak*, Lunas	161
Panabo Davao N.	DAPECOL	Spiny, *Laak*, Lunas	303
Davao del Norte	WADECOR	Spiny, *Laak*, Lunas	80
Davao del Norte	F. S. Dizon & Sons Inc.	Spiny, *Laak*	110
Davao del Norte	AMS-FC Davao Norte.	Spiny, *Laak*	100
Davao del Norte	SFC, Davao Norte.	*Laak*	5
Davao	CFI, Agusan Norte	*Laak*	12
Davao del Norte	Davao Fruits Corp.	*Laak*	434
Davao del Norte	Twin River Plantation Inc.	*Laak*	132
Pandadan, Tagum D.N.	Caasi Farm	*Laak*	5
San Isidro Nabunturean D. N.	Caasi Farm	*Kayali*	10
Piang Village, T'boli S. Cot.	P.R. Virrey	*Laak*	2
Mati, Davao Oriental	Rabat	*Tini, botong*	5
Compostela, Montevista D.N.	CBMC	*Laak*	186
Sub Total			**1,685**
Grand Total			**3,040**

Sources: Virtucio and Rivera (1995), Pastor (1995), Alfonso (1995), Caasi (1994), Uriarte and Marquez C. (1995), Basada et al 1997, and Binoya 1997 consultant 1997

a/ Based on the 255,000 seedling planted as of February 1997 through Kawayan: Yaman Laguna Project by private individuals and organization at survival rate of 70% and 200 plants/ha

Table 11. Total area of DENR bamboo plantations projects by location

LOCATION	YEAR ESTABLISHED	AREA (Ha)
Under the regular planting program		
CAR		
1. Laskig, Pidigan, Abra	1986	40
2. Lagangilang, Abra	1986	52
3. Itogon, Benguet	1986	22
4. Mankayan, Benguet	1988	48
5. La Trinidad, Benguet	1987	25
6. Paracelis, Mt. Province	1987	38
Sub-Total		225
Region I		
1. Burgos, Ilocos Norte	1986	23
2. Santiago and San Esteban Ilocos Sur	1986	35
3. Lidlidda, Ilocos Sur	1986	26
4. Pugo, La Union	1986	24
5. Infanta, Pangasinan	1986	33
6. Mangantarem, Pangasinan	1986	52
7. Natividad, Pangasinan	1986	319
Sub-Total		512
Region IV		
1. Pinamalayan, Oriental Mindoro	1986	183
Region VI		
1. San Enriquee, Iloilo	1993	150
2. Duenas, Iloilo	1993	10
3. Dumarao, Capiz	1989	8
4. Banawa, Aklan	1996	2
5. Jawili, Aklan	1996	1
6. Mambusao, Capiz	1996	1
7. Barotac Nueve, Iloilo	1993	3
8. Dingle, Iloilo	1996	2
9. Kabangkalan, Negros Occ.	1996	1
10. Lapaz, Iloilo	1996	1
11. Lambunao, Iloilo	1996	1
12. Maasin, Iloilo	1995	10
Sub-Total		190
Region XI		
1. Cabuyuan, Mabini, Davao Norte	1990	8
2. Langgam, Macó, Davao Norte	1990	8
3. Mabunao, Panabo, Davao Norte	1990	12
4. Marilog District, Davao City	1991	20
5. Bunot, Kiblawan, Davao Sur	1992	20
6. J.P. Laurel, Sarangani	1993	20
7. Acob, Maribel, South Cotabato	1994	20
8. Maganit, New Bataan, Davao Norte	1990	31
9. Maganit, New Bataan, Davao Norte	1991	1
10. Maganit, New Bataan, Davao Norte	1993-1994	50
11. Canidkid, Montevista, Davao Norte	1991-1992	2
12. Canidkid, Montevista, Davao Norte	1991-1992	1
13. Canidkid, Montevista, Davao Norte	1991-1992	5
14. Piang Village, Tboli South Cotabato	1990	9
15. Ran-ay, Banga, South Cotabato	1990	30
Sub-Total		237
Under the Forestry Sector Loan I		
CAR		158
Region I		160
Region II		30
Region III		129
Region IV		45
Region V		10
Region VI		47
Region VII		51
Region VIII		261
Sub-Total		891
Under ERDB and DENR-ERDS Research Plantation		
Region I	1980	8
Region III	1989	8
Region VI	1989	8
Region VII	1989	11
Region X	1989	11
Region XIII	1989	11
Sub-Total		57
GRAND TOTAL		2,292

Source: Malvas J.D. (1995) and NFDO-DENR (pers. com., 1997)

Table 4.1.12. Estimated total aggregate area planted to erect bamboos and pole/culm production in the Philippines from various sources a/

Source/Origin	Estimated Total Aggregate Area Planted (Has)		Estimated Total Number of Clumps (in million)		Estimated Total Culm Productivity per year (in million)	
	Has	% of total	Clumps	% of total	Culms	% of total
Forestlands	20,500-34,000	52.3-64.50	4.10-6.80	68.7 64.5	20.5-34.0	68.7-64.8
Government Plantations	2,236	5.7-4.2	0.2236-0.4472	3.7-4.2	1,118-2,236	3.7-4.2
Private Plantation	3,040	7.7-5.8	0.337-0.6074	5.1-5.8	1,520-3,040	5.1-5.8
"Natural Stand" b/	13,435	34.3-25.5	1.343-2.687	22.5-25.5	6,715-13,435	22.5-25.5
TOTAL	39,211-52,711	100	5.9703-10.5416	100	29,817-52,653	100

a/ Estimated by the consultant

b/ Existing bamboo stand found growing sporadically or in patches in the backyards and/or along riverbanks in either public or private land not covered by forest and established plantations

Table 4.1.13. Recommended age, size/number of nodes and portion of the culm for selected bamboo species in the Philippines.

SPECIES	AGE (YEARS)	NUMBER OF NODES	PORTION OF CULM
Kauayan kiling	1/2-1 a/	1-3	butt to middle
Kauayan tinik	1 a/	1-2	butt to middle
India bamboo	1-2	2-3	butt to middle
Bayog	1 a/	1-2	butt to middle
Bolo	1	1-3	middle to top
Giant bamboo	1-2	1-3	butt to middle
Anos	1-2	2-3	middle to top
Laak	1-2		middle to top

a/ Hoanh (1990) reported that appropriate age for this species is about 1 1/2 to 2 yr. old.

Source: Modified after PCARRD (1991)

Table 4.1.14. Site requirements and geographical distribution of commercially important bamboos in the Philippines.

BAMBOO SPECIES	SITE REQUIREMENT AND DISTRIBUTION
1. Kawayan tinik *(Bambusa blumeana)*	Moist soil, found throughout the settled area in the Phil. at low and medium altitude. Luxuriant growth in river banks, creeks, farmhouses, backyards (Rizal, Camarines Sur and Norte, Cavite, Batangas, Laguna, Pangasinan, La Union, Abra, Ilocos Sur and Norte, Davao Sur and North Cotabato)
2. Kawayan kiling *(Bambusa vulgaris)*	Moist soil, found in backyard periphery of cultivated lands, creeks and at the foot of the hills, (Mt. Makiling and other part of Laguna Provinces, few in northern Luzon)
3. Bayog *(Bambusa sp.1)*	In relatively drier sites at low to medium elevation. Widely distributed in the Phil. (Rizal, Central and Northwestern Luzon, Pangasinan, La Union, Ilocos Norte and Sur, Tarlac)
4. Botong *(Dendrocalamus latiflorus)*	Moist soil, occurring particularly in areas with high rainfall, (Bicol, Visayas, Tagalog provinces and Mindanao-Davao Norte Plantation)
5. Giant Bamboo *(Dendrocalamus asper)*	Moist soil, occurring profusely with well distributed rainfall throughout the year, (Mt. Makiling, Agusan del Sur, Bukidnon)
6. Bolo *(Gigantochloa levis)*	Moist soil, abounds in and around towns and settled area and also in the forest, (Aklan, Capiz, Antique, La Union).
7. Anos *(Schizostachyum lima)*	Relatively moist soil, found along creeks, forest fringes. Widely distributed in the Phil.(Zambales, Bataan, Abra, Cavite, Tarlac, Laguna, Quezon, Batangas and other provinces)
8. Buho *(Schizostachyum lumampao)*	Relatively moist soil, found in forest hills, Widely distributed in the Phil. (Zambales, Bataan, Caliraya,, Laguna, Tanay, Rizal)

Source: Lantican *et al.* (1985)

Table 4.1.15. Recorded productivity estimates of some bamboo species in the Philippines

Bamboo Species	Culms/ Clump	Clumps/ Ha	Culms/ Ha	Annual Growth Culms/Ha	Annual Dry Yield (tons/ha)
Kawayan tinik *(Bambusa blumeana)*	23 30	280 320	7000 8400	1900 -	30.0 -
Kawayan kiling *(Bambusa vulgaris)*	30 40	300 330	9000 10000	2250	20.0 24.0
Botong *(Dendrocalamus latiflorus)*					24.70
Giant Bamboo *(Dendrocalamus asper)*					6.0 11.0
Buho *(Schizostachyum lumampao)*				2500	
Bambus arundinaria				100% of the old culms	
Bambusa tulda				18% of the old culms	
B. vulgaris var striata					1.0 2.0

Source: PDC (1983) as cited by Tagarino (1990)

Table 4.1.16. Five-year growth performance of eight bamboo species variably planted in six pilot plantation sites.

Species/ Plantation Site (Region)	Average No. of Culms After 5-Year Period	Average Basal Culm Diameter (cm)	Average Total Culm Height (m)
1. ***Bambusa blumeana***			
(Kauayan tinik)			
Pampanga (R-3)	16.09	5.67	7.63
La Union (R-1)	6.10	6.46	7.96
Capiz (R-6)	6.67	4.38	5.87
Cebu (R-7)	11.99	3.97	5.48
Bukidnon (R-10)	8.12	4.92	7.96
Surigao del Sur (R-13)	19.00	7.33	12.53
2. ***Bambusa vulgaris***			
(Kayayan kiling)			
Pampanga (R-3)	14.58	4.28	5.46
La Union (R-1)	11.00	5.80	8.80
Capiz (R-6)	11.93	5.32	7.01
Cebu (R-7)	10.44	4.68	6.47
Bukidnon (R-10)	7.51	3.91	5.00
Surigao del Sur (R-13)	27.50	5.91	15.38
3. ***Bambusa sp.1***			
(Bayog)			
Pampanga (R-3)	10.19	4.53	5.29
La Union (R-1)	10.91	5.58	9.37
Capiz (R-6)	5.83	2.85	4.47
Cebu (R-7)	6.93	3.79	5.08
Bukidnon (R-10)	6.06	3.28	4.56
Surigao del Sur (R-13)			
4. ***Gigantochloa levis***			
(Bolo)			
Pampanga (R-3)	10.48	4.57	6.60
Capiz (R-6)	8.53	5.47	5.65
Surigao del Sur (R-13)	34.80	8.17	15.30
5. ***Dendrcalamus asper***			
(Giant Bamboo)			
La Union (R-1)	5.54	6.54	9.15
Cebu (R-7)	3.96	3.95	4.22
Bukidnon (R-10)	6.81	1.45	2.07
6. ***Schizostachyum lumampao***			
(Buho)			
Cebu (R-7)	37.27	1.96	3.97
Surigao del Sur (R-13)	30.30	3.78	9.17
7. ***Bambusa sp. 2***			
(Laak)			
Surigao del Sur (R-13)	33.90	4.05	6.92
8. ***Gigantochloa atter***			
(Kayali)			
Surigao del Sur	22.10	6.73	8.49

Source: Summarized from Virtucio (1996)

Table 4.1.17. Comparative assessment of different methods of propagation.

ACTIVITY	PROPAGATION METHOD				
	Culm Cutting	Branch Cutting	Rhizome/ Offset	Marcotting	Seeds
1. Collection of planting materials	easy	easy	very difficult	limited accessible branches	sometimes not available, depend on species
2. Planting material preparation	easy	easy	easy	very difficult	easy
3. Collection of soils for potting or material for marcotting	easy	easy	easy	moderate	easy
4. Potting	easy	very easy	easy	moderate	very easy
5. Transplanting of young seedling or propagules into the plastic bag	easy	very easy	easy	moderate	easy
6. Duration for clump development	fast	slow	fast	slow	slow
7. Effect of operation on the productivity of the mother clump	enhances emergence of new shoots	enhances emergence of new shoots	reduces producti-vity of the clump	none	none

Source: Hoanh *et al.* (1992)

Table 4.1.18. Financial projection of cash flows for bamboo plantation development (in pesos per hectare)

ACTIVITY	YEAR									
	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
I. Nursery Operations	6,900									
II. Plantation Establishment	8,700	700								
III. Maintenance/ Protection	2,400	4,300	4,000	4,000	5,000	4,000	4,000	4,000	4,900	
IV. Harvesting/hauling						8,000	10,000	10,000	11,000	11,000
Total cost	18,000	5,000	4,000	4,000	4,000	5,000	12,000	14,000	15,000	15,000
Gross Benefits	-	-	-	-	5,000	40,000	4,000	45,000	50,000	50,000
Net Benefits	-18,000	-5,000	-4,000	-4,000	0	28,000	31,000	31,000	35,000	35,000

Source: Uriarte and Piñol 1994

Table 4.2.1. Product lines of bamboo enterprises

PRODUCT CATEGORY	PRODUCT LINE
Furnitures	Sala Sets (whole set, half set, six leggers, oversized six leggers) Dinning Set (set of four) TV Stand (three shelves, four shelves) Telephone Stand Divider/Panel Tables (ordinary, six seaters) Cabinet Bed (single, double, matrimonial, double deck) Lamp Shade Stool Chairs
Gifts ;Toys and Housewares	Placemats Cattery Trays Bird Cage Venetian Blinds Wall self *Bilao* (small, big) *Yakayakan*
Baskets and basketwares	Basket (single, set of three, set of two) Small Basket Hamper (simple, set of three (with/without lining), set of two) Planters (set of three) Picnic Basket Waste Basket Bowl Toiches (sizes 6', 5', 4' 3') Round Basket
Paper	5 x 5 1/2"
Construction	*Bahay Kubo* *Sawali* Bamboo Roof Bamboo Blade Bamboo Spoke (sizes 26",24", 22", 18", 12") Bamboo Split

Source: 1997 Survey

Table 4.2.2. Aspects of needed product quality improvements by size of enterprise

SIZE	ASPECTS OF PRODUCT QUALITY IMPROVEMENT									
	Raw Material Treatment		Product Development		Design		Finishing		ALL	
	no.	%	no.	%.	no.	%	no.	%	no.	%
Micro			5	20.83	1	4.17	2	8.33	8	33.33
Cottage	1	4.17	3	12.50			1	4.17	5	20.83
Small	2	8.33	1	4.17	1	4.17	1	4.17	5	20.83
Medium	1	4.17	3	12.50	2	8.33			6	25.00
ALL	4	16.67	12	50.00	4	16.67	4	16.67	24	100.00

Source: 1997 survey

Table 4.2.3. List of tools, machines and other equipment for bamboo handicraft and furniture production

CATEGORY	SPECIFIC ITEM
Hand Tools	Bow saw & coping saw Carpentry vise Gouge chisel (various width) Manual bamboo splitter (4,6 & 8 blades) Flat chisel (various width) Chip cutter Bolo Bamboo sizer Scraper Bamboo thickener Shaving knife Claw hammer Rasp File Binding Strap (Ratchet type) Hand saw Set of drill bits Jack plane Caliper Spoke shave Sawing & boring jig Plastic/rubber mallet Screw driver Round, triangular & flat file Hole saw of various diameter with chuck holder Steel tape
Machines	Bench-type drill press (3/4 in. dia. capacity) Portable drill (1/2 in. dia. capacity) Disc & drum sander Portable orbital sander Bamboo crosscut saw Bamboo strip fixed-thickness splitter Bamboo strip milling machine Mechanical bamboo splitter Inner and outer node remover Rip saw/fixed-width cutting saw Stick maker/higo machine Fixed-length stick cutting machine
Drying Facility	Furnace type bamboo dryer Moisture meter Weighing scale Oven
Finishing Equipment	Air compressor with air pressure regulator and filter Spray gun (gravity type) with 10 m rubber hose Fladder-type pneumatic sander

Table 4.2.4. Facilities, tools and equipment

ITEM	PRICE PER UNIT (pesos)	SIZE OF ENTERPRISE				MARKET	
		Micro	Cottage	Small	Medium	Export	Domestic
Band saw	7,000		1				1
Planer	8,000		1				1
Dryer	20,000		1				1
Compressor	8,000		2	1	2	2	2
	18,000			1	2	2	1
Grinder							
Portable	3,000			1			1
Bench	2,000			1			1
Drill	3,500			2	2	1	3
Post drill	9,000		1	1			2
Bench drill	-		1				1
Handtool							
Double	1,500			1			1
Single	1,200			1			1
Scissor							
Small	50-300			1			1
Medium	350-400		1				1
Meter	-	4					4
Mold	50-100			1			1
Knife	50	1	1		1	1	2
Electric saw	4,000		1		1	1	1
Electric sander	-				1	1	
Spray gun	-		2		1	1	1
Chisel	60	3			2	1	4
Bolo	120	1			1		2
Longnose	60	1					1
Splitter	-		1		1	1	1
Spook sieve	210	2					2
Blow torch	2500-3000	1	1		1		3
Saw	300	5	1				5
Hammer	70	4	1		1		6
Cutter	1,200	2	1				3
Compound machine a/	2,000,000			1		1	

- not indicated

a/ consists of compressor grinder, beater, refinery, separator, dryer and cutter

Source: 1997 survey

Table 4.2.5. Design derived from basic weaving patterns

BASIC PATTERN	VARIATIONS
Cross Pattern	Cross Pattern Cross Diagonal Pattern Double Cross Pattern Open Cross Pattern
Hexagonal Pattern	Hexagonal Pattern Double Hexagonal Pattern Hexagonal with Perpendicular Pattern Hexagonal Cross Pattern Hexagonal Hemp Leap Pattern Hexagonal Corn Flower Hemp Leaf Pattern Blind Hemp Leaf Pattern Double Blind Hemp Leaf Pattern Interweaving Hemp Leaf Pattern Open Hemp Leaf Pattern Triangle Pattern
Netting Pattern	Netting Pattern Transforming Netting Pattern Square Netting Pattern Rectangular Netting Pattern Continuing Square Netting Pattern Transforming Continuing Netting Pattern Star Netting Pattern Hexagonal Netting Pattern Octagonal Netting Pattern

Source: PHRDC (1997)

Table 4.2.6. Fiber dimensions and derived values of some Philippine bamboos

Species	Fiber length (L) mm	Dimension width (D) mm	Lumen width (l) mm	Cell wall thickness (w) mm	Slenderness ratio L/D	Flexibility ratio (P/D x 100)	Runkel ratio 2 w/l
Anos	1.67	0.022	0.004	0.0090	76	18	4.50
Bayog	2.16	0.014	0.006	0.0040	154	43	1.33
Bikal	2.00	0.021	0.007	0.0070	95	33	2.00
Bolo	1.80	0.022	0.006	0.0080	82	27	2.67
Buho	2.42	0.014	0.006	0.0040	173	43	1.33
Giant bamboo	3.78	0.019	0.007	0.0060	199	37	1.71
India bamboo	1.73	0.022	0.006	0.0080	79	27	2.67
Kauayan-China	1.36	0.018	0.002	0.0080	76	11	8.00
Kauayan-kiling	2.33	0.017	0.004	0.0070	137	23	3.50
Kuayan-tinik	1.95	0.018	0.004	0.0070	108	22	3.50
Pole-vault bamboo	1.86	0.019	0.006	0.0065	98	32	2.17
Spineless India bamboo	1.45	0.200	0.005	0.0075	73	25	3.00
Yellow bamboo	1.66	0.021	0.005	0.0080	73	25	3.20

Source: F.N. Tamolang *et al.* 1957 Fiber dimensions of certain Philippine broadleafted woods and bamboos

Table 4.2.7. Chemical composition of some Philippine bamboos

Solubilities in Species	Holocellulose %	Pentosan %	Lignin %	Alcohol-benzene %	Hot water %	1% NaOH	Ash	Silica %
Bulo	62.9	18.8	24.2	3.2	4.4	28.3	5.3	2.8
Buho	60.6	20.6	20.4	5.0	4.3	31.4	9.7	6.4
Giant bamboo	61.3	19.6	25.5	5.4	3.8	22.3	4.1	2.4
Kauayan-kiling	66.5	21.1	26.9	4.1	5.1	27.9	2.4	1.5
Kauayan-tinik	67.4	19.0	20.4	3.1	4.3	39.5	4.8	3.4
Yellow bamboo	63.6	21.5	25.9	3.7	3.9	24.7	3.0	1.3
Range of values for 10 Indian bamboo species		15.1-21.5	22.0-32.2	0.2-3.2	3.4-6.9	15.0-21.8	1.7-3.2	0.44-2.11
Range of values for 10 Japanese, Burmese, and Indonesian bamboo species	61.9-70.4	17.5-22.7	19.8-26.6	0.9-10.8	5.3-11.8	22.2-29.8	0.8-3.8	0.1-1.78

Source: J.A. Semons, *et al.* 1967. The kraft pulping qualities of some Philippine bamboos. Tappi 50(8): 416-419

Table 4.2.8. Kraft or sulfate pulping and physical test data at 300 ml CSF of some Philippine bamboos

Species	Bone-dry wt/culm kg	Pulp Yield		K No.	Sheet density g/cm	Burst factor	Tear factor	Folding endurance MIT	Breaking length m
		Screened %	Rejects %						
Bolo	9.50	48.00	0.70	18.20	0.57	70	170	1040	8750
Buho	2.50	43.90	1.10	13.10	0.63	66	153	700	8150
Giant bamboo	44.80	42.30	2.80	13.00	0.60	63	195	780	8250
Kauayan kiling	10.90	41.40	0.60	15.00	0.60	64	183	1050	9300
Kauayan tinik	11.30	45.10	0.80	15.50	0.61	64	150	850	8500
Yellow bamboo	12.70	41.30	0.90	17.60	0.65	66	101	610	9300
Range of physical test data for 6 bamboo pulps					0.57-0.65	63-70	101-195	60-1050	8150-9300
Range of physical test data for 5 coniferous pulps					6.61-0.72	69-94	107-148	1000-1300	8500-10500

Source: J.O. Semana, J.P. Escolano and M.R. Monsalud, 1967. The kraft pulping qualities of some Philippine bamboos Tappi 50(8): 416-419

Table 4.3.1. Estimated number of bamboo market participants, Philippines

SOURCE	NUMBER	REMARKS
Pabuayon and Espanto (1997)	More than 70,000 including licensees, processors, exporters, manufacturers, workers	Collated from various sources, certain assumption made, may be overestimated due to inability to separate those involving other materials like rattan, raffia, wicker
Buyer's Guide to Philippines Manufacturers and Exporters 96/97	171 including bamboo-based firms (manufacturers, exporters, limited number of propagators only)	Excludes workers involved in gathering, manufacturing, trading and manufacturing activities
DTI Partial List (1992)	108 bamboo enterprises (manufacturers and exporters)	Distribution: 76 in Metro Manila, 11 in Luzon, 17 in Visayas and 3 in Mindanao

Table 4.3.2. Number of bamboo firms by location, business type, year established, operator type number of employees and product type, Philippines, 1996

ITEM	NUMBER	PERCENT
Location		
Metro Manila	53	31
Luzon	62	36
Visayas	49	29
Mindanao	7	4
All	171	100
Business Type		
Single proprietorship	45	26
Partnership	2	1
Corporation	81	47
Association/foundation	2	1
Unspecified	41	24
All	171	100
Year Established		
Earlier than 1970	9	5
1970-1979	33	19
1980-1989	54	32
1990-present	5	3
Unspecified	70	41
All	171	100
Operator Type		
Propagator	4	2
Propagator/manufacturer	1	1
Manufacturer a/	86	50
Exporter b/	15	9
Exporter/manufacturer	64	37
Developer/contractor	1	1
All	171	100
Number of Employees		
10 and below	13	8
11-50	39	23
50-100	9	5
Grater than 100	16	9
Unspecified	94	55
All	171	100
Product Type		
Planting materials and poles c/	3	2
Poles d/	2	1
Plyboo	1	1
Furniture	43	25
Gifts and housewares	103	60
Furniture, gifts and housewares	12	7
Architectural designs	1	1
Unspecified	6	4
All	171	100

a/ Includes 83 manufacturers, 1 manufacturer/artist and 2 manufacturer/producer

b/ Includes 11 exporters, 1 exporter/buying agent, 2 exporter/buying agent/manufacturers, and 1 exporter/producer

c/ Includes 1 for planting material, and 2 for planting material/poles

d/ Includes 1 for poles and 1 poles and furniture

Source: Buyers' Guide to Philippine Manufacturers and Exporters 96/97, 8th International Edition

Table 4.3.3. Socio-economic characteristics of bamboo participants, Iloilo, Negros Occidental and Abra, 1995

MARKET PARTICIPANT/ITEM	NUMBER REPORTING	PERCENT
Producers of raw materials		
Education: Elementary	7	58
Secondary to college	5	42
Annual income from bamboo (P):		
P5,000 and below	4	57
P5,001 to 20,000	3	43
Other sources of income:		
Farming	10	71
Non-Farming	4	29
Gatherers		
Education: Elementary	9	50
Secondary to vocational	9	50
Household size: 1-6	15	83
7-9	3	183
Member involved in bamboo activity:		
1-4	12	67
None	6	33
Annual income from bamboo:		
P3,000 and below	8	73
Greater than P3,000	3	27
Trader		
Education: Elementary	7	26
Secondary to college	20	74
Household size: 1-6	18	67
7-12	9	33
Members involved in bamboo activity:		
1-7	7	63
None	10	37
Annual income from bamboo:		
P10,000 and below	8	42
P10,001-30,000	7	37
P30,000-50,000	4	21
Manufacturers		
Annual income from bamboo:		
P10,000 and below	4	25
P10,001-20,000	3	19
Greater than P20,000	9	56
Labor Force		
Sex: Male	15	35
Female	28	65
Education: Elementary	8	19
Secondary to vocational	35	81
Primary source of income:		
Bamboo activities	35	81
Farming and others	8	19
Annual income from bamboo:		
P15,000 and below	21	51
Greater than P15,000	20	49

Source of basic data: Rivera and Austria, 1996

Table 4.3.4. Roles and functions of market participants, CAR and Region VI, 1995

MARKET PARTICIPANT	ROLE
Producer/Plantation owner	Produces bamboo raw materials for furniture and handicraft making: expansion and maintenance of bamboo plantation
Gatherer	Gathers poles, transports it from gathering site to assembly point where truck is stationed
Association/ Cooperative	Links exporter to the weaver/manufacturer of handicraft. Supplies raw materials to the member. Acts as a marketing arm of the members of all its products.
Raw material trader - Town-based/ out of town	Buys poles/split from gatherers/producers in the area and sells it to end-user or other traders within the town or nearby towns; gives financing in form of cash advances to gatherers; scout possible buyers
Manufacturer Furniture	
Large	Produces furniture both for local and foreign market (export products are made in limited volume and finished products are processed in combination with other materials like wood and steel).
Medium	Produces lower quality furniture for buyers within the locality or neighboring provinces/cities; financing from savings banks; employs 2-3 workers and even family members.
Small	Produces furniture in small shops only for the locality; employs family members by which they derive income to support daily needs.
Handicraft Large/Indirect	
Exporters	Produces still unfinished products (unpainted, undecorated, slightly varnished); for exporters: provides little incentives to workers; may also produce for local buyers.
Medium	Produces finished handicraft items within locality or neighboring provinces/cities; employs subcontractors which includes women and children alike
Small	Produces handicraft items such as bamboo mats, baskets, rice storage and the like only at his backyard for the locality; employs family help to support daily needs.
Weaver	Sundries split bamboo, weaves both furniture and handicrafts item; usually works in their respective houses and are paid on an output basis, does not receive any incentives
Finished product trader Furniture:	
Retailer	Buys bamboo furnitures from small-scale manufacturer and sells on retail in his small shop located along the highways or in market stalls
Manufacturer/ retailer	Produces bamboo products and sells it in his store/stall; produces made to order bamboo products specially the furniture items
Manila-based trader	Transport bamboo finished products from source to market outlet; buy unfinished products from provincial manufacturers for final finishing and sells it to local or foreign buyers.
Agent/trader	Scout for possible buyers; transports bamboo raw materials and finished products from source to market outlet; receive commission (percentage on sale) or gain profit from selling the products.

Source: RIVERA M. N. and M. V. O. AUSTRIA. 1996. The Bamboo Sector in the Cordilleras and Western Visayas: An Analysis of the Production to Consumption System. Ecosystem Research and Development Bureau, Department of Environment and Natural Resources, College, Laguna, Philippines, March 1996

Table 4.3.5. Number of bamboo licensees, allowable cut and harvest, Philippines, 1970-1995.

YEAR	NUMBER OF LICENSEES	ALLOWABLE CUT ('000 PCS)	HARVEST ('000 PCS)
1970	15	246	389
1971	4	10,961 has	201
1972	15	16,191 has	125
1973	b/	b/	123
1974	b/	b/	199
1975	b/	b/	226
1976	b/	b/	176
1977	b/	b/	787
1978	24	490	426
1979	9 c/	175 c/	1769
1980	13	247	327
1981	15	259	885
1982	b/	b/	647
1983	23	875	410
1984	15	274	309
1985	15	196	644
1986	12 c/	57 c/	428
1987	26	517	402
1988	15	344	133
1989	16	347	204
1990	18	308	984
1991	21	307	892
1992	17	240	704
1993	b/	b/	475
1994	b/	b/	392
1995	b/	b/	307

a/ Bamboo and "buho" combined

b/ Not recorded/ not available in the Philippine Forestry Statistics

c/ For buhoonly; number of licenses and allowable cut for "bamboo" were not recorded in the PFS.

Note: Reported bamboo production does not include bamboo harvested from private lands as these figures are only those reported by permittees who obtained their bamboo from public forest MPFD, Appendix Report 1990).

Source of basic data: Philippine Forestry Statistics, 1970-1995

Table 4.3.6. Import volume and value and unit import value of bamboo poles by year, Philippines, 1981-1995

YEAR	POLES		UNIT IMPORT VALUE US$/Ton
	Tons	'000US$	
1981	0.88	1.20	1,363.64
1982	0.44	0.20	454.55
1983	0.58	0.32	551.72
1984	24.00	4.00	1,667.67
1985	0.03	0.03	1,111.11
1986	3.70	0.46	124.32
1987	-	-	
1988	1.00	0.23	230.00
1989	1.20	0.33	275.00
1990	-	-	
1991	1.20	0.50	416.00
1992	3.00	6.00	2,000.00
1993	27.00	40.00	1,481.48
1994	109.00	58.00	532.11
1995	59.00	39.00	661.02
Total	231.03	150.27	
Average	15.40	10.02	624.55
Growth rate (%)	1,559.58	348.66	63.73

Source of basic data: NSO

Table 4.3.7. Country sources of bamboo imports and their respective market shares, Philippines, 1981-1995

COUNTRY	'000 US DOLLARS	PERCENT
Korea	42.66	29.1
Taiwan	39.88	27.21
Hongkong	32.57	22.22
China	12.76	8.7
Thailand	8.85	6.04
Japan	5.47	3.73
Vietnam	4.07	2.77
Indonesia	0.23	0.16
Singapore	0.1	0.07

Table 4.3.8. Estimates of raw material requirements (poles) for the furniture, handicraft and basket making industry in Region I

Product	Average Material Requirements (Culm)	Average Number of Production (Units)	Total Material Requirements per Month
Furniture			
Sala set	10	5	50
Bed	3	2	6
Exec. sala set	10	1	10
Lamp shade	1	3	3
TV table	3	2	6
Dining set	15	1	15
Shoe rock	3	5	15
Cabinet	3	5	15
Chairs	1	10	10
TOTAL			130
Handicraft			
Trays	10	100	10
Brooches	50	100	2
Pen holders	21	21	1
Wall decor	30	90	3
Boxes	15	30	3
Decorative baskets	30	30	1
Vases	18	18	1
Fans	12	50	4
Fancy items	20	100	5
TOTAL			30
Basketry			
Basket	40 sets/culm	120	3
Kaing	30 pcs/culm	200	7
Kapig	1 pc/culm	5	1
Bilao	6 pcs/culm	6	5
Hamper	3 sets per culm	15	16
TOTAL			29

Source: Uriarte and Maligalig (1992)

Table 4.3.9. Distribution of bamboo users and bamboo sources, number of bamboo poles used per dwelling unit, and household bamboo users market index, by province, Central Visayas

Location	Total Number of Respondents	Bamboo Users		Number of Bamboo Poles Used		Distribution of Bamboo Resources(%)		Household Market Index (%)
		no.	%	per dwelling unit	per repair/ dwelling unit	purchased	gathered	
Cebu	340	136	40.00	20.64	15.75	89.58	10.42	35.88
Bohol	88	55	62.50	31.18	23.25	85.45	14.55	53.41
Negros Oriental	89	46	51.68	29.87	22.50	86.96	13.04	44.94
Siquijor	50	37	74.00	18.65	14.00	83.78	16.22	62.00
Central Visayas	657	274	48.32	24.04	18.15	87.59	12.41	42.33

Source: Aliño (1992)

Table 4.3.10. Projected demand for bamboo by province, Central Visayas, 1990-2015

YEAR	CEBU	BOHOL	NEGROS OR.	SIQUIJOR	DEMAND
			Poles		
1990	864,467	689,047	574,424	45,463	4,173,401
1995	945,342	741,956	631,502	49,187	2,367,987
2000	1,022,144	793,925	686,306	52,900	2,555,275
2005	1,162,111	892,556	764,522	59,896	2,879,085
2010	1,226,726	936,111	809,882	63,073	3,035,792
2015	1,286,753	975,194	851,364	65,955	3,179,266

Source: Aliño (1992)

Table 4.3.11. Projected demand for bamboo, Philippines, 1995-2015 ('000 culms)

	1995	2000	2005	2010	2015
Banana props					
High	37800	37800	37800	37800	37800
Low	33464	28737	24677	21191	18197
Fishpens	856	856	856	856	856
Banca Outriggers	340	340	340	340	340
Furniture	1000	1650	2475	3494	4933
Handicraft	219	353	450	575	733
Construction	15208	18503	22512	27389	33322
Panel Boards	17500	28184	35971	45909	54525
Total High	72923	87686	100404	116363	132509
Low	68587	78623	87281	99754	112906

Note: This is part of the 1990-2015 projection made by DENR in the MPFD (1990)

Assumptions:

1. For high estimates, banana plantations hectarage would be constant per year. For low estimates, with the introduction of preservative treatment to banana props, there will be 2-3% per year decrease in demand.
2. Constant hectarage for inland water fishpens and banca outriggers.
3. Three to five percent per year growth in demand for bamboo for construction
4. For furniture, 65% increase from 1995-2000, then decrease to 50% increase from 2000-2005. Annual increase is projected at about 5% per year from 2005-2015.
5. Handicraft demand is expected to increase by 10% annually from 1995-2000. Beyond this period, the growth rate is expected to slow down to about 5% because of competition with other countries, particularly Malaysia and Indonesia
6. For panel board making, it is predicted that real demand from this sector will not come until after 5-7 years from 1990. A medium capacity particle board plant producing about 70t/3-shift-day would require about 17500,000 culms of Kauayan tinik per year. It is estimated that the requirements of that plant will increase by 10% per year for the first five years, then to about 5% per year for the next 10 years, and to about 3% per year up to 2015.

Source: DENR. 1990. Master Plan for Forestry Development (Bamboo)

Table 4.3.12. Volume and value of bamboo exports by product type and year, Philippines, 1981-1995

YEAR	POLES		BASKETS AND BASKETWARE /a		FURNITURE		TOTAL	
	Tons	'000US$	'000 pieces	'000US$	'000 pieces	'000US$	'000US$ At current prices	'000US$ At constant 1987 prices
1981	1	1		9,240	46	961	10,202	23,948
1982	4	5		7,780	42	610	8,395	17,862
1983	-	-		9,120	48	743	9,863	19,077
1984	7	20		9,540	-	678	10,238	13,176
1985	17	37		9,580	-	626	10,243	10,714
1986	2	5		12,640	-	859	13,504	14,023
1987	42	18		17,100	69	1,142	18,260	18,260
1988	41	19		21,260	51	1,335	22,614	20,939
1989	23	33		13,037	51	1,816	14,886	12,202
1990	16	15		13,027	46	1,666	14,708	10,559
1991	23	49	11,847	12,737	49	1,932	14,718	8,898
1992	15	20	21,895	24,216	62	1,836	26,072	
1993	10	6	19,472	23,158	53	1,402	24,566	
1994	39	26	17,805	23,572	36	1,225	24,823	
1995	9	22	16,700	22,774	42	1,510	24,306	
Total	249	276	87,719	228,781	595	18,341	247,398	169,658
Percent		0.11		92.47		7.41	100.00	100.00
Growth rate (%)	192.62	96.05	14.75	10.08	1.48	5.84	9.25	-7.02

- Not available

a/ Estimated at 20% of total export value for baskets and basketwares which includes reed, raffia rattan, bamboo, etc. (pers. com. with personnel)

Source of basic data: NSO

Table 4.3.13. Bamboo by product category, Philippines, 1996-1997, FOB value in US$.

ITEM	1996		1995	
	Quantity	Value	Quantity	Value
PSCC: 0566907 a/			510	2,119
PSCC: 2923100 b/	19,163	42,882	9,251	21,667
PSCC: 8131107 c/	77	581	1,433	5,616
PSCC: 8131307 d/	264	6,569		
PSCC: 9131507 e/	12,058	103,959	3,946	26,002
PSCC: 8131704 f/	7,185,462	4,582,232	2,086,029	3,093,764
PSCC: 8211301 g/	7,042	308,279	4,438	254,515
PSCC: 8217902 h/	43,023	1,264,043	37,172	1,255,713
PSCC: 8997101 i/	28,080,491	39,930,865	39,524,357	51,300,429
PSCC: 8997102 j/	1,746,202	5,514,135	3,188,056	10,326,577
PSCC: 8997902 k/	103	190	1,836	2,150
TOTAL	37,093,885	51,753,735	44,857,028	66,288,552

a/ bamboo shoots, prepared or preserved otherwise than by vinegar or acetic (net kg)
b/ bamboos
c/ chandeliers and other electric ceiling and wall lighting fittings (excluding those of a kind used for lighting public open spaces or thoroughfares), of bamboo (pieces)
d/ electric table, desk, bedside or floor standing lamps of bamboo (pieces)
e/ electric lamps and lighting fittings, N.E.S. of bamboo (pieces)
f/ bamboo torches (pieces)
g/ seats of bamboo (pieces)
h/ furniture of bamboo (pieces)
i/ basket and basketware containers of all kinds of vegetables plaiting materials (e.g. of bamboo, rattan, reed, rushes, osier, raffia, dyed cereal straw) (pieces)
j/ handbag, wallets, purses and similar articles of vegetable plaiting materials (e.g. of bamboo, rattan, reed, rushes, osier, raffia, dyed cereal straw and limebark) (pieces)
k/ woven bamboo strip ("sawali") (net kg)
Source: of basic data: NSO

Table 4.3.14. Country destinations of bamboo furniture exports and their respective market shares, Philippines, 1987-1995

COUNTRY DESTINATIONS	'000 US DOLLARS	PERCENT SHARE
USA	4,408	32.40
Spain	1,347	9.90
France	1,198	8.81
Australia	904	6.64
Italy	281	2.07
Netherlands	197	1.45
Cyprus	93	0.68
Japan	73	0.54
Germany	40	0.29
UK	29	0.21
Hongkong	24	0.18
New Zealand	23	0.17
Sweden	12	0.09
Others	4,975	36.57
Total	13,604	100.00

Source of basic data: NSO

Table 4.3.15. List of destination countries of Philippine bamboo products by type of product exported, 1996-1997

COUNTRY	0566907 a/	2923100 b/	8131107 c/	8131307 d/	8131507 e/	8131704 f/	8211301 g/	8217902 h/	8997101 i/	8997102 j/	8997902 k/
Argentina						✓	✓	✓			
Aruba								✓			
Australia		✓		✓	✓	✓	✓	✓	✓	✓	✓
Austria		✓				✓	✓				
Bahrain							✓				
Belgium		✓				✓	✓	✓	✓	✓	
Brazil					✓		✓				
British West Africa (excludes St. Helena)					✓						
Brunei						✓					
Canada		✓				✓			✓	✓	
Canary Islands		✓									
Chile						✓	✓				
Cyprus					✓		✓				
Denmark						✓			✓		
Dombros, Republic of						✓					
Fiji					✓						
Finland						✓					
France	✓	✓			✓	✓	✓	✓	✓	✓	
French West Indies					✓						
Germany		✓				✓	✓	✓	✓	✓	
Great Bitain		✓			✓	✓	✓	✓	✓	✓	
Greece						✓			✓	✓	
Hongkong					✓	✓	✓			✓	
Israel					✓	✓	✓			✓	
Italy						✓	✓	✓	✓	✓	
Japan (Incl Okinawa)		✓			✓	✓	✓	✓	✓	✓	
Korea, Republic of					✓		✓		✓	✓	
Lebanon			✓				✓				
Malaysia						✓	✓	✓		✓	
Mauritius						✓					
N. Ireland		✓			✓	✓	✓	✓	✓	✓	
Namibia						✓					
Netherland		✓				✓	✓	✓	✓	✓	
New Caledonia						✓	✓				
New Zealand (excludes Western Samba)						✓	✓				
Norway						✓			✓		
Panama (incl Danal Zone)							✓	✓			
Portugal						✓	✓	✓	✓		
Qatar							✓				
Saudi Arabia						✓					
Singapore				✓		✓	✓	✓	✓	✓	
South Africa					✓	✓	✓			✓	
Spain		✓			✓	✓	✓	✓	✓	✓	
Sweden						✓	✓		✓		
Switzerland						✓			✓		
Taiwan		✓			✓		✓		✓	✓	
Trust Territory of Pacific Island						✓	✓				
Turkey							✓	✓		✓	
United Arab Emirates n.a.s.		✓				✓		✓			
United Kingdom		✓			✓	✓	✓	✓	✓	✓	
Uraguay		✓				✓	✓				
USA		✓	✓	✓	✓	✓	✓	✓	✓	✓	
Virgin Islands (US)		✓			✓		✓	✓			

Note: for code please refer to Table4.3.13
Source of basic data: NSO

154

Table 4.3.16. Average annual prices of raw bamboo poles, Philippines, 1970-1995

YEAR	METRO MANILA	PHILIPPINES
	Pesos per piece	
1970	4.50	
1971	4.50	
1972	4.98	
1973	5.75	
1974	8.58	
1975	10.00	
1976	13.83	
1977	18.00	
1978	18.83	
1979	21.25	
1980	24.13	
1981	-	
1982	31.40	
1982	-	
1982	-	
1982	-	
1982	-	
1987	52.16	
1988	60.70	
1989	60.70	
1989	-	
1991		31.80
1992		41.11
1993		45.33
1995		68.86

Source: Philippine Forestry Statistics, FMB-DENR

Table 4.3.17. Unit export values of bamboo export by product type and year, Philippines, 1981-1995

YEAR	POLES (US$/TON)	BASKET AND BASKETWARE (US$/PIECE)	FURNITURE (US$/PIECE)
1981	1,000		20.89
1982	1,250		14.52
1983	-		15.48
1984	2,857		-
1985	2,176		-
1986	2,500		-
1987	429		16.55
1988	463		26.18
1989	1,435		35.61
1990	938		36.22
1991	2,130	1.08	39.43
1992	1,333	1.11	29.61
1993	600	1.19	26.45
1994	667	1.32	34.03
1995	2,444	1.36	35.95
Average	1,348	1.21	22.06
Growth Rate (%/yr)		6.18	7.39

- Not available

Source of basic data: NSO

Table 4.3.18. Average selling price and estimated cost of bamboo products

PRODUCT LINE	ESTIMATED TOTAL COST (₱)	AVERAGE SELLING PRICE (₱)	PROFIT	
			P/unit	% of cost
Sala Sets				
Whole set (six pieces)	2400	3000	600	25
Half set (four pieces)	1133	1833	700	62
Six leggers	1500	2500	1,000	67
Oversized six leggers	1750	2700	950	54
Dinning Set (set of four)	2200	4233	2,033	92
TV Stand				
Three shelves	355	575	220	62
Four shelves	480	600	120	25
Telephone Stand				
Divider/Panel	723	1200	477	66
Tables				
Ordinary	650	750	100	15
Six Seaters	-	-	-	-
Cabinet	190	260	70	37
Bed				
Single	425	675	250	59
Double	583	867	283	49
Matrimonial	675	1100	425	63
Double deck	-	2500		
Lamp Shade	110	225	115	105
Stool	-	-	-	-
Chairs	-	-	-	-
Placemats	18	27	9	50
Cattery	20	27	7	35
Paper	133/bundle	750/bundle	617	464
Trays	-	-	-	-
Bird Cage	-	-	-	-
Venetian Blinds	300	450	150	50
Wall self	-	-	-	-
Bilao				
Small	13	15	2	15
Big	20	50	30	150
Yakayakan	15	20	5	33
Basket				
Single	15	21	6	40
Set of three	63	74	11	18
Set of two	-	-	-	-
Small Basket	27	40	13	48
Hamper				
Simple	50	-	-	-
Set of three	148	190	43	29
with lining	260	290	30	12
without lining	220	250	30	14
Set of two	-	-	-	-
Planters (set of three)	27	40	13	48
Picnic Basket	40	54	14	35
Waste Basket	10	13	3	30
Round Basket	10	13	3	30
Bahay Kubo	8000	12000	4,000	50
Sawali	-	-	-	-
Bamboo Roof	-	450/1000pcs	-	-
Bamboo Blade	-	45/5000pcs	-	-
Bamboo Spoke				
26"	-	67/1000pcs	-	-
24"	-	-	-	-
22"	-	65/1000pcs	-	-
18"	-	60/1000pcs	-	-
12"	-	-	-	-
Bamboo Split	-	54/100pcs	-	-
Bowl Toiches	165	180	15	9
6'	-	28	-	-
5'	-	26	-	-
4'	-	24	-	-
3'	-	18	-	-

- Not specified

Source: 1997 survey

Table 4.3.19. Marketing practices and price determination; bamboo manufacturers and traders

ITEM	MANUFACTURER		TRADER	
	No.	%	No.	%
Mode of buying raw material				
from the source	11	64.71	6	60
Delivered	4	23.53	3	30
Picked-up	0	0	1	10
Delivered and Picked-up	2	11.76	0	0
Not specified	17	100	10	100
Total				
Mode of payment in buying				
raw material from source	8	47.06	7	63.64
COD	8	47.06	4	36.36
Credit	1	5.88	0	0
Not specified	17	100	11	100
Total				
Bamboo Species	11	61.11		
K. tinik	1	5.56		
Buho	2	11.11		
Bayog	2	11.11		
Botong	2	11.11		
Black bamboo				
Reason for buying from the				
source a/	2	8.7	0	0
Size	0	0	4	40
Available	0	0	1	10
Variety of Products	2	8.7	0	0
Proximity	7	30.43	3	30
Price	7	30.43	1	10
Quality	1	4.35	0	0
Volume	1	4.35	0	0
Credit	3	13.04	1	10
Not specified				
Factors consider in pricing				
raw materials/inputs a/	5	27.78	2	18.18
Cost + Margin + Transportation	5	27.78	1	9.09
Prevailing price	5	27.78	2	18.18
Size	1	5.56	2	18.18
Negotiation	0	0	3	27.27
Quality	2	11.11	1	9.09
Not specified				
Factors considered in pricing				
manufactured products a/	1	5	1	8.33
CIF	12	60	4	33.33
Cost + Margins +Transportation	3	15	1	8.33
Design	1	5	3	25
Quality	1	5	1	8.33
Negotiations	0	0	1	8.33
Prevailing Price	2	10	1	8.33
Not specified				
Reasons for selling to the buyer	5	23.81	5	41.67
Available buyer	3	14.29	3	25
Suki	5	23.81	0	0
Good Payer	4	19.05	1	8.33
Volume	0	0	1	8.33
Price	0	0	1	8.33
Ordered	1	4.76	0	0
COD	3	14.29	1	8.33
Not specified				
Mode of sale to the buyer				
of the product	6	35.29	3	30
Delivered	3	17.65	5	50
Picked-up	4	23.53	1	10
Delivered and Picked-up	4	23.53	1	10
Not specified	17	100	10	100
Total				
Mode of payment of the				
buyer of the product a/	8	42.11	8	80
COD	8	42.11	1	10
Credit	3	15.79	1	10
Not specified	19	100	10	100
Total				

a/ Multiple answers
Source: 1997 survey

Table 4.3.20. Bamboo enterprises which experience various forms of rejects for their products by size of enterprise, Philippines, 1997.

SIZE	BAMBOO ENTERPRISES															
	Propagator				Trader				Manufacturer				ALL			
	No reject		With reject		No reject		With reject		No reject		With reject		No reject		With reject	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
Micro	1	8.33			3	25.00	2	12.50	1	8.33	5	31.25	5	41.66	7	43.75
Cottage	1	8.33					1	6.25	1	8.33	2	12.50	2	16.67	3	18.75
Small					2	16.67	2	12.50	1	8.33	2	12.50	3	25.00	4	25.00
Medium									2	16.67	2	12.50	2	16.67	2	12.50
ALL	2	16.66			5	41.67	5	31.25	5	41.66	11	68.75	12	100.00	16	100.00

Source: 1997 survey

Table 4.3.21. Promotional methods used by size of bamboo enterprise, Philippines, 1997

SIZE	PROMOTIONAL METHOD													
	Exhibit		Advertisement		Price Discount		Credit		Display		Free Sample		None	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
Micro	1	25.00			2	33.33	2	50.00	7	87.50	2	20.00	2	28.57
Cottage			1	25.00	1	16.67	1	25.00			2	20.00	4	57.14
Small	3	75.00	2	50.00	2	33.33	1	25.00	1	12.50	4	40.00	1	14.29
Medium			1	25.00	1	16.67					2	20.00		
ALL	4	100.00	4	100.00	6	100.00	4	100.00	8	100.00	10	100.00	7	100.00

Source: 1997 survey

Table 4.3.22. Perceptions of bamboo enterprises on the future outlook of the bamboo industry

PARTICULARS	FUTURE OUTLOOK									
	Sufficient		Insufficient		Assistance Needed		No Answer		ALL	
	no.	%	no.	%	no.	%	no.	%	no.	%
Raw Material Supply										
Size										
Micro	6	17.14	7	20.00		0.00	2	5.71	15	42.86
Cottage	2	5.71	3	8.57		0.00	1	2.86	6	17.14
Small	2	5.71	6	17.14	1	2.86		0.00	9	25.71
Medium		0.00	3	8.57	1	2.86	1	2.86	5	14.29
ALL	10	28.57	19	54.29	2	5.71	4	11.43	35	100.00
Firm type										
Propagator	1	2.86	2	5.71		0.00	3	8.57	6	17.14
Manufacturer	7	20.00	9	25.71	2	5.71		0.00	18	51.43
Trader	2	5.71	8	22.86	1	2.86		0.00	11	31.43
ALL	10	28.57	19	54.29	3	8.57	3	8.57	35	100.00
Market/Demand										
Size										
Micro	7	24.14	6	20.69		0.00			13	44.83
Cottage	2	6.90	3	10.34	1	3.45			6	20.69
Small	8	27.59		0.00		0.00			8	27.59
Medium		0.00		0.00	2	6.90			2	6.90
ALL	17	58.62	9	31.03	3	10.34			29	100.00
Firm type										
Propagator	1	3.45	2	6.90		0.00	3	10.34	6	20.69
Manufacturer	9	31.03	4	13.79	3	10.34	1	3.45	17	58.62
Trader	7	24.14	3	10.34		0.00		0.00	10	34.48
ALL	17	58.62	9	31.03	3	10.34		0.00	29	100.00

Note: Multiple responses
Source: 1997 survey

Table 4.3.23. Future outlook in terms of competitiveness of bamboo products with other countries

BAMBOO ENTERPRISE	FUTURE OUTLOOK									
	Competitive		Not Competitive		Assistance Needed		No answer		ALL	
	no.	%	no.	%	no.	%	no.	%	no.	%
Propagator		-		-		-	6	18.18	6	18.1818
Manufacturer	7	21.21	6	18.18	1	3.03	2	6.06	16	48.48
Trader	4	12.12	2	6.06		-	4	12.12	10	30.30
ALL	11	33.33	8	24.24	1	3.03	13	39.39	33	100.00

Source: 1997 survey

Table 4.3.24. Bamboo species and genera, selected Asian countries

COUNTRY	SPECIES/GENERA
China	>400 species, < 40 genera Types: Monopodial, sympodial and mixed Ph. Pupescens Mazel ex H. de Lehaie most important monopodial accounting for 72% of bamboo area and 76% of total stock volume; sympodial species include B. textilis McClure P. amabilis (McClure) Keng., S. affinis (Rendle) McClure and S. Latiflorus (Munro) McClure
India	125 indigenous and exotic species; 23 genera Major genera: Arundinaica, Bambusa, Chimonobambusa, Dendrocalamaus, Dinocholoa, Gigantcholoa, Indocalamus Ochlandra, Drepanostachyum, Phyllostachys, Phleioblastus, Psendoxyntenanthu, Schizostachyum and Thamnocalamus Major species: *Dendrocalamus strictus, Bambusa arundinaceae, Dendrocalamus hamiltonii, Arundiaria baccifera, Bambusa balcooa, Bambusa tulda, Melocanna baccifera, bambusa nilida, Bambusa vulgaris*
Nepal	53 species, 11 genera *(Dendrocalamus balcooa, D. giganteus, D. hamiltonii, D. hookeri, D. patellaris, D. strictus, D. tulda, D. alamii, Bambusa balcooa, B. glaucescens, B. macala, B. multiplex, B. nan, B. nepalensis, B. nutans, B. stricta, B. tulda, Borinda chigar, B. emeryi, Thamnocalamus aristasus, T. falconeri, T. spathiflorus, Ampelo-calamus patellaris, Cephalostachyum fuchsianum, C. latifolium, Drepanostachyum falcatum, D. falconeri, D. hookerianum D. intermedium, D. jainianum, D. khasianum, Himalayacalamus asper, H. brevinodus, H. cupreus, H. falconeri, H. fimbriatus, H. hookerianus, H. porcatus, Mellocanna baccifera, M bambusiodes, Yushana maling, Y. microphylla, Y. recemosa, Arundinaria, aristata, A. falcata, A falconeri, A hookeriana, A. intermedia, A. khasiana, A. maling, A microphylla, A. racemosa, A. spathiflora*
Philippines	62 species (Arundinaria, Bambusa, Cephalustachyum, Chimo-nobambusa, Denrocalamus, Dinochloa, Gigantochloa, Guadua, Phyllostachys, Pleioblastus, Psuedosasa, Psuedotachyum, Racemobambos, thrysostachys, Yushania), 21 endemic of which 13 are climbers and 8 are erect; 7 are economically important *(Bambusa balumeana, B. vulgaris, B spec 1 (Dendrocalamus asper, D. latiforus, Gigantochloa levis, Schizostachyum lumampao* 19 genera

Source: Pabuayon and Espanto 1997

Table 4.3.25. Bamboo poles harvest by year, selected Asian countries, 1980-1995

YEAR	CHINA a/	INDIA b/	NEPAL c/	PHILIPPINES d/
		Tons		
1980	4,176,154	126,000		1,962
1981	4,389,882	480,743		5,310
1982	4,641,580	488,080		3,882
1983	4,310,071	676,896		2,460
1984	4,674,277	931,843		1,854
1985	4,388,674	1,108,179		3,864
1986	4,733,672	769,539		2,568
1987	5,168,340	822,741		2,412
1988	5,934,799	915,728		798
1989	5,722,707	876,918		1,224
1990	5,768,287	1,045,284		5,904
1991	6,252,344	774,228		5,352
1992	7,221,585	780,829	17,280	4,224
1993	10,451,500	803,866	17,640	2,852
1994	11,287,620	205,764	18,060	2,355
1995	12,190,630	14,400	18,463	3,167
Total	101,312,122	10,821,038	71,443	50,188
Annual Average	6,332,008	676,315	17,861	3,167
Growth Rate (%/yr)	7.98	12.76	2.23	31.62

a/ Number of culms converted to metric tons assuming 13 kg per culm

b/ Based only on reports received from various states for specific years

c/ Number of culms converted to metric ton assuming 6 kg per culm

d/ As reported by DENR; greatly underestimated due to underreporting and exclusion of harvest from A&D lands; culms converted to metric tons assuming 6 kg per culm

Source: Pabuayon and Espanto 1997

Table 4.3.26. Bamboo products output and value, China, 1980-1993

Year	MOSO(> 6 CM)		MOSO (< 6 CM)		OTHER SPECIES		BRANCHES		FRESH SHOOTS		TOOLS	PULP	TOTAL	
	'000 Tons	Million US$	'000 Tons	Million US$	'000 Tons	Million US$	'000 Tons	Million US$	'000 Tons	Million US$	'000 Pcs	'000 Tons	'000 Tons	Million US$
1980	2,453	120	873	18	850	45	256	11	134	13	49,270	86	4,652	207
1981	2,572	136	963	20	855	42	272	11	194	19	44,000	81	4,937	227
1982	2,772	224	981	20	889	41	288	10	239	26	44,200	76	5,245	322
1983	2,432	117	863	22	1,015	49	253	11	370	41	34,500	84	5,017	240
1984	2,646	127	959	28	1,069	55	277	12	330	37	32,810	102	5,383	260
1985	2,331	101	930	24	1,127	62	251	9	464	47	30,000	108	5,211	244
1986	2,544	109	1,002	22	1,188	65	272	9	479	87	69,280	114	5,599	292
1987	2,805	122	1,111	30	1,253	75	301	13	624	92	90,590	115	6,209	332
1988	3,279	208	1,330	44	1,326	88	355	19	644	104	64,786	153	7,087	463
1989	3,290	186	1,097	32	1,336	95	337	19	728	157	81,240	132	6,920	488
1990	3,044	170	1,274	45	1,451	90	332	16	836	174	97,550	-	6,937	495
1991	3,641	210	1,150	42	1,462	88	368	16	872	180	101,770	-	7,493	536
1992	4,119	305	1,524	60	1,579	115	434	20	1,042	218	169,090	-	8,698	717
1993	6,247	510	2,613	105	1,592	127	681	30	1,271	265	-	-	12,404	1,038
Total	44,175	2,645	16,670	512	16,992	1,037	4,677	206	8,227	1,460	909,086	1,051	91,792	5,861
Average	3,155	189	1,191	37	1,214	74	334	15	588	104	64,936	75	6,557	1,038
Percent total	48.13	45.14	18.16	8.72	18.51	17.71	5.10	3.52	8.96	24.92		1.14	100.00	100.00
Growth rate (%)	8.52	17.34	10.73	18.07	5.01	8.79	8.94	10.57	20.23	28.13	1,696.00	5.76	8.40	14.96

Source: Pabuayon and Espanto 1997

Table 4.3.27. Estimated annual value of bamboo exports by product type selected Asian countries

COUNTRY	US DOLLARS	PERCENT
China a/		
Poles	21,223,000	7.14
Shoots	130,017,000	43.76
Leaves	930,000	0.31
Products	119,636,000	40.27
Sub-total	271,806,000	91.48
India b/		
Poles	410	0.08
Products	242,940	0.13
Sub-total	243,350	0.21
Nepal c/		
Poles	757,027	0.25
Philippines d/		
Poles	22,000	0.01
Furniture	1,510,000	0.51
Baskets and baske	22,774,000	7.67
Sub-total	24,306,000	8.19
Total	**297,112,377**	**100.13**

Source: Pabuayon and Espanto 1997

Table 4.3.28. Volume of bamboo exports by product type and year, China, 1981-1993

YEAR	SHOOTS				LEAVES	POLES	HANDMADE PAPER	TOTAL
	Fresh	Watered	Dried	Tinned				
					Tons			
1981	1,357	3,013	341	-	-	36,683	-	41,394
1982	1,299	3,059	421	-	413	46,915	2,439	54,546
1983	909	2,605	546	-	372	43,021	1,976	49,429
1984	666	3,396	355	-	263	48,020	1,460	54,160
1985	1,405	3,754	324	-	374	51,624	2,537	60,018
1986	1,311	4,862	474	-	735	53,888	984	62,254
1987	2,791	11,555	707	-	400	58,360	942	74,755
1988	2,264	14,288	914	-	574	60,835	1,020	79,895
1989	2,142	12,186	810	-	391	70,538	720	86,787
1990	2,497	9,795	1,105	-	600	77,550	394	91,941
1991	2,155	19,701	1,873	-	1,252	73,572	689	99,242
1992	3,991	23,166	1,451	65,337	1,503	94,639	2,675	192,762
1993	4,020	21,496	1,856	77,758	974	98,076	2,810	206,990
Total	26,807	132,876	11,177	143,095	7,851	813,721	18,646	1,154,173
Percent	2.32	11.51	0.97	12.40	0.68	70.50	1.62	100.00
Growth Rate (%/yr)	18.39	24.63	19.51	19.01	19.32	9.05	24.05	16.47

Source: Pabuayon and Espanto 1997

Table 4.3.29. Value of bamboo exports by product type and year, China, 1981-1993

Year	SHOOTS Fresh	SHOOTS Watered	SHOOTS Dried	SHOOTS Tinned	POLES	LEAVES	FURNITURE	COMB	WEAVE PRODUCTS	FAN	CARVING	HANDMADE PAPER	TOTAL (Current US $)	TOTAL (Adjusted US $)
	'000 US Dollars													
1981	567	1,507	1,251	-	6,401	-	502	-	52,988	-	-	-	63,216	88,045
1982	472	1,254	1,246	-	7,334	500	300	760	46,434	1,080	580	1,900	61,860	84,393
1983	470	1,210	1,469	-	6,837	400	-	500	46,282	890	380	1,730	60,168	80,546
1984	454	2,292	905	-	7,940	300	164	850	50,816	560	170	1,410	65,861	85,757
1985	877	2,563	671	-	7,993	380	64	690	33,816	610	110	1,370	49,144	57,211
1986	851	3,522	1,103	-	7,472	490	443	560	40,731	880	100	1,160	57,312	62,363
1987	2,010	9,570	1,830	-	8,310	450	60	640	55,160	1,160	90	1,010	80,290	80,290
1988	2,590	18,840	2,800	-	9,660	560	120	590	67,510	2,130	290	1,670	106,760	88,451
1989	2,480	8,800	2,360	-	14,190	350	140	950	89,040	1,940	210	1,240	121,700	86,743
1990	2,215	8,654	4,075	-	14,816	560	276	720	99,621	1,370	250	520	133,077	93,584
1991	2,072	19,635	8,892	-	13,568	1,200	93	790	128,961	-	270	800	176,281	
1992	4,602	26,898	5,423	68,208	21,820	1,400	-	640	144,575	-	730	1,970	276,266	
1993	5,769	27,755	6,800	89,693	21,223	930	-	1,390	116,306	-	120	1,820	271,806	
Total	25,429	132,500	38,825	157,901	147,564	7,520	2,162	9,080	972,240	10,620	3,300	16,600	1,523,741	807,383
Percent	1.67	8.70	2.55	10.36	9.68	0.49	0.14	0.60	63.81	0.70	0.22	1.09	100.00	80,738.00
Growth Rate (%/yr)	30.06	41.59	24.84	31.5	12.21	13.34	58.82	13.58	8.97	9.46	14.94	10.5	14.98	2.04

Table 4.3.30. Volume and value of bamboo exports by product type and year, India, 1990-1995

YEAR	POLES			PRODUCTS a/			TOTAL			
	Tons	'000 Rs	000 US$	Tons	'000 Rs	000 US$	Tons	'000 Rs	000 US$ At current prices	000 US$ At constant 1987 prices
1990	-	-	-	3	595	35.74	3	595	35.74	28.25
1991	1	10	0.41	1	191	7.81	2	201	18.22	5.7
1992	18	126	4.11	1	67	2.18	19	193	6.29	
1993	-	-	-	-	140	4.46	-	140	4.46	
1994	1.5	12	0.38	4.05	2,669	85.08	5.5	2,681	85.46	
1995	1.3	13	0.41	2.2	7,621	242.94	3.5	7,634	243.35	
Total	21.8	161	5.31	11.25	11,283	378.21	33.05	11,444	393.52	
Percent	65.96	1.41	1.35	34.04	99	96.11	100.00	100		
Growth Rate (%/yr)					394			380		

a/ Bamboo mats, matting, screen and others, cane split or otherwise prepared for plaiting, walking stick. Volume does not include those for mats/ matting and walking sticks which are in sq m and number of pieces, respectively.

b/ At the 1993 USD: Indian Rs exchange rate

Source: Pabuayon and Espanto 1997

Table 4.3.31. Projected demand for and supply of bamboo in selected Asian countries, 2000-2010

COUNTRY	2000		2005		2010	
	Supply	Demand	Supply	Demand	Supply	Demand
	'000 Tons					
China	17,454	13,649	22,276	14,579	25,824	15,510
India	1,422	3,634	2,291	3,660	3,690	3,689
Nepal	20	7	23	17	26	18
Philippines	126	471	126	524	126	597
Total	43,738	17,771	24,716	18,780	29,666	19,814

Assumptions for supply:

China - Based on 5% year growth rate until 2005 and 3% thereafter. The actual combined annual growth rate for poles, branches, shoots, tools, pulp for 1980-1993 is 8.40%.

India - Based on 10% year growth rate. The actual growth rate is 32.94%/year for 1980-1993

Nepal - Based on 2.16%/ year growth rate for poles and shoots for 1992-1994.

Philippines - Assumed constant at 21,000,000 harvestable culms (MPFD 1990) due to lack of basis for projection.

Assumptions for demand

China - based on 10.34 kg per capita consumption and 1.4%/year population; growth rate for 1994-2000, 1.3%/year for 2001-2005 and 1.2%/year for 2006-2010.

India - For pulp and paper mill and board industry

Nepal - Based on growth rate of domestic consumption of 0.74%/year during 1992-1994 period.

Philippines - Based on low estimates of MPFD (1990)

Source: Pabuayon and Espanto 1997

Table 4.3.32. Average nominal prices of bamboo by product type and year, China, 1980-1993 a/

YEAR	MOSO > 6 CM b/	MOSO < 6 CM b/	OTHER BAMBOOS c/	SHOOTS c/	BRANCH c/	HANDMADE PAPER c/
			US$/unit			
1980	0.63	0.27	53.13	100.00	41.33	886.67
1981	0.68	0.26	48.24	94.12	26.47	753.53
1982	0.64	0.26	44.44	105.82	35.45	677.25
1983	0.62	0.33	47.98	111.11	43.33	643.43
1984	0.61	0.37	49.78	109.17	44.28	646.72
1985	0.57	0.34	55.56	102.39	37.65	541.64
1986	0.56	0.29	55.23	130.81	34.01	494.48
1987	0.57	0.35	60.27	147.85	41.94	490.32
1988	0.82	0.43	65.83	161.29	52.42	597.58
1989	0.73	0.37	70.37	212.77	55.85	608.78
1990	0.73	0.42	62.59	209.21	48.12	493.51
1991	0.75	0.47	60.15	206.77	44.17	456.77
1992	0.96	0.51	72.46	217.39	46.20	452.90
1993	1.06	0.52	80.00	243.48		
Average	0.71	0.37	59.00	153.73	42.40	595.66
Growth Rate (%)	4.99	6.00	3.60	7.67	2.93	-4.91

a/ Exclude prices of bamboo-based panels/composite boards which have the following prices per cu m for 1994: mat plywood - US 1,530, curtain plywood - 1,530, strip plywood - 2,186, sliver laminated board - 1,530, particle-board - 656, bamboo-wood parquet - 2,022.

b/ US dollar per pole

c/ US dollar per ton

Source: Pabuayon and Espanto 1997

Table 4.4.1. Tools, machines, equipment and its uses

TOOL	MATERIAL/SUPPLY	PROCESS UTILIZED
Shavers	Shellac/Varnish	Clearing, Designing
Sizer	Bamboo strips	Carving, Cutting
Steel cutter	Rattan strips	Splitting, Shaving
Circular saw		
Knife	Coco shell	Sizing & Refining
Chisel	Sandpapers	
Hammer	Nails	Boring
T-square	Plastic	
Scraper	Sodium Peroxide	
Bamboo shaver	Detergent powder	Treating
Pair of scissors	Linen Cartolina	Clearing, Treating
Pliers		Finishing
Bolo		
Machines & equipment		
Electric drill		
Blow touch		
Lathe machine		
Compressor		
Spray gun		
Pressing machine		
Drill press		

Source: Productivity Assessment of the Bamboo Using Industry in Region VI. UP Visayas College of Management for Western Visayas Agriculture, Resources, Research and Development (WESVARRDEC), August 1996.

Table 4.4.2. Industry associations whose membership includes bamboo using enterprises

NAME OF AGENCY	CONTACT PERSON/ADDRESS	FUNCTIONS/SERVICES PROVIDED
1. Chamber of Furniture Industries of the Philippines	Ms. Myma David Natividad National President Ms. Marilou V. Balano National Exec. Director CFIP, Unit H, 9th Floor Strata 100 Bldg., Emerald Ave., Pasay City	An association established by group of furniture exporters in 1996, whose mission is to the continued growth of the Philippine furniture industry by serving as a body to rationalize the furniture industry & by providing direction to its development efforts. It serves as a forum wherein industry-related issues are discussed & resolved
2. Philippine Chamber of Handicraft Industries (PCHI)	Mr. Benjamin Kalalo, Jr., President PCHI, G/F Money Museum, PICC Bldg., Roxas Blvd., Pasay City	A non-stock, non-profit organization established in 1967 which aims to contribute to the growth of the Philippine handicraft industry by promoting Philippine handicrafts to both local & international markets
3. Philippine Chamber of Commerce and Industries (PCCI)	Mr. Jose T. Pardo, President PCCI, 7/F ODC International Condominium, 219 Salcedo St., Legaspi Village Makati City	An umbrella private sector representative organization having 1,750 members with 139 sectoral trade associations & 85 provincial Chambers of Commerce which provides trade opportunities & buyer-seller matching services for its members & foreign buyers, utilizing a computerized database. It also mounts overseas missions & hosts incoming missions. Some B & R product manufacturer-exporter are members of the Chamber.
4. Confederation Of Filipino Exporters Foundation (PhilExport)	Mr. Sergio Ortiz-Luis President G/F South Side PICC Bldg., Roxas Blvd., Pasay City	An industry association formed in 1991 with the merging private sector exporters' organizations. PhilExport is a non-stock, non-profit service foundation which seeks to facilitate exporters access to trade information & technical services towards expanding & diversifying markets. It also aims at organizing Philippine exporters into a persuasive collective advocate for policy & administrative reforms needed to transform the country into a progressive exporting nation. It provides trade opportunities & buyers-seller matching services using computerized database & regular publications It also has regional network of 8 offices. Some B&R manufacturer-exporter are members of PhilExport
5. European Chamber of Commerce of the Philippines (ECCP)	Mr. Dieter Lehmann, President ECCP, 5/F Kings Court II Bldg., 2129 Pasong Tamo St., 1200 Makati City	The only European bilateral Chamber represented in the Phil. & represents the interest of all European countries as well as those Filipino members. ECCP has offices in Cebu & Manila from which it provides a full range of services including personalized buyer-seller matching & circulation of trade opportunities through its regular publication
6. Cebu Furniture Industries Foundation	Mr. Carlito Fruelda, President Ms. Ruby Babao, CFIP Exec Director 3/F GMC Plaza Bldg., Legaspi Ext., Cebu City	
7. Chamber of Cottage Industries of the Philippines (CCIP)	Mr. Vic Tagle, President 15 Hillside Lane Blue Ridge 1109 Quezon City	
8. Christmas Decor Producers and Exporters Association of the Philippines (CDPEAP)	Atty. Virgilio Sanchez, President CDPEAP 1617 Sisa St., Sampaloc Manila	

Table 4.4.3 . Functions/mandate of agencies under DTI

AGENCY	FUNCTION/MANDATE
National Industrial manpower Training Council (NIMTC)	• Ensure the supply of critical industrial manpower skills
Cottage Industry and Technology Center (CITC)	• Encourage and promote the establishment of micro, cottage and small enterprises; and improve product quality and productivity towards global competitiveness in order to generate employment and livelihood opportunities and contribute to building a reliable supply base for export.
Product Development and Design Center of the Philippines (PDDCP)	• Provide private sector with product research and development services through the conduct of seminars and workshop and the provision of technical advisory assistance on product design development, the conduct of researches on product and product packaging design trends and processing technologies, the organization of design exhibition and the publishing of product design related materials.
Center for International Trade Exhibitions and Missions (CITEM)	• Tasked with organizing, and providing technical expertise to official participation in international trade fairs, exhibitions and expositions in accordance with the trade promotion program of DTI. • Responsible for servicing all incoming missions and conducting outgoing missions relative to international trade fairs and exhibitions • Provide professional consulting services to the private sector
Bureau of Export and Trade Promotions (BETP)	• Development, promotion and expansion of foreign trade; • Formulation of country and product export strategies; • Conduct research on new product development and adaption opportunities in the export, as well as identify domestic supply base for such products; • Maintain an integrated information system on all aspects of the products and commodities for export marketing; • Formulate, plan, supervise, coordinate, monitor and assess all outgoing and incoming missions; • Promote and coordinate international subcontracting arrangements; • Formulate and monitor the implementation of policies and guidelines for the registration and certification of bona fide exporters eligible for export incentives program; and • Review and identify appropriate measures to minimize or deregulate export-import procedures and other foreign trade laws necessary to stimulate the international marketing of Philippine products.
Bureau of Internal Trade Relations (BITR)	• Responsible for all matters pertaining to international trade relations, especially in matters of developing and improving market access
Subcontractors Exchange Program (SUBCONEX)	• Facilitate establishments of market linkages between contractors (manufacturers/exporters) and subcontractors.
Bureau of Trade Regulation and Consumer Protection (BTRCP)	• Responsible for the effective enforcement of trade laws, for regulating domestic trade and trade practices, the supply in sufficient quantity and reasonable pieces of commodities to all part of the country, the regulation of business names and the accreditation of establishments and practitioners, protection of consumer rights;
Bureau of Small and Medium Business Development (BSMBD)	• Responsible for the development of micro, cottage, small and medium enterprises through the provision of delivery mechanisms and linkages for marketing, financial and sub-contracting services and for the development of livelihood programs;
Bureau of Domestic Trade Promotion (BDTP)	• Strengthen the domestic base for exports and provide information on domestic marketing opportunities for new projects, new technologies and investment;
Bureau of Patent, Trademarks and Technology Transfer (BPTTT)	• Responsible for the registration and protection of patents, licenses, intellectual properties, trademarks and technology transfer arrangement;
Bureau of Product Standards (BPS)	• Ensure that consumers are assured of quality products through product standards testing and formulation, establishment, certification and regulation of standards for Philippine products;
Foreign Trade Service Corps (FTSC)	• Responsible for providing to Philippine businessmen, producers and exporters market and commercial intelligence information, project development support, assistance in trade (import/export) administration and liaison with foreign governments and foreign trade partners;
Philippine Trade Training Center (PTTC)	• Upgrade the capacity of local business to improve access to international markets through the provision of training programs in import/export techniques and procedures, improving awareness of export opportunities and alternative sources of imports, overcoming barriers to market penetration, international trade practices, inspection techniques and mounting exhibitions
Management Information Service Office (MISO)	• Monitor industrial sector performance and provide management information pertinent to industrial policy and program formulation;
Bureau of Import Services (BIS)	• Monitor, analyze and forecast import levels and prices of imported, particularly liberalized, items;
Board of Investments (BOI)	• Responsible for formulating policies and guidelines that enhance the environment conducive to business expansion, formulating and implementing short-, medium-, and long-term plans and promoting investments in the country through the registration, monitoring and granting of investments incentives to individual enterprises

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Table 4.4.4. Financing schemes available from different lending institutions showing interest rates and collateral required for bamboo industry development

INSTITUTION/SCHEME	RECIPIENT	INTEREST RATE (%)	COLLATERAL
Land Bank of the Philippines (LBP)			
1. Cooperative Lending Program	Cooperatives of small farmers	12 - 16	Deed of assignment, promissory note, true receipts of PCIC insurance or guarantee coverage for crop production loan
2. Countryside Partnership Scheme	Cooperatives	14 +	Chattel mortgage of stocks, real estate mortgage
3. LDB-OECF Financing Program	Cooperative	12- 14 +	Deed of assignment, promissory note, true receipts of PCIC insurance or guarantee coverage for crop production loan
4. Integrated Social Forestry Program	Cooperative	12-14 +	deed of assignment, promissory note or trust receipt, chattel mortgage
Development Bank of the Philippines (DBP)			
1. Pangkabuhayan ng Bayan	Individual, partnership, corporation	17.76- 19.75	Real estate mortgage and chattel
2. Export Development Financing Program	Individual, partnership, NGOs, trade associate	case to case	Letter of credit, purchase order, real state mortgage, chattel
3. DBP-DOST Special Financing Program for the Commercialization of New Products	Individual, partnership, corporation	NEDA inflation rate + 2%	Fully or partially secured collateral or joint or several signature
Department of Labor and Employment			
1. Women Workers Employment and Enterpreneurship Development	group loan	6 - 18%	No collateral specified
2. Expanded Livelihood Development Program -OWWA	Individual and organization of OCWs	6 - 15%	real estate and chattel mortgage, machinery, equipment appliances and furniture, surety bonds

Table 4.4.5. ERDB-DENR/UNDP FAO bamboo pilot plantation sites cum research for various species planted in different sites.

SPECIES	SITES AND AREA PLANTED (Has)						
	La Union	Pampanga	Capiz	Cebu	Bukidnon	Surigao	Total
Bambusa blumeana (K. tinik)	2	2	2	2	2	2	12
Bambusa sp. 2 (laak)							
Bambusa vulgaris (K. kiling)	2	2	2	2	2	2	12
Bambusa sp.1 (bayog)	2	2	2	2	2	-	10
Dendrocalamus asper (G. bamboo)	2	-	-	2	2	-	6
Gigantochloa atter (kayali)	-	-	-	-	-	2	2
Gigantochloa levis (bolo)	-	2	2	1	1	1	7
Schizosachyum lumampao (buho)	-	-	-	2	2	6	6
TOTAL	8	8	8	11	11	11	57

Source : Bamboo R and D Progress Reports ERDB College, Laguna 1994, and personal communication.

Table 4.4.6. Perceptions of bamboo enterprises as to existence of government support

GOVERNMENT SUPPORT	BAMBOO ENTERPRISE															
	Propagation				Manufacturing				Trading				ALL			
	aware		unaware		aware		unaware		aware		unaware		aware		unaware	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Plantation development	1	3	4	14	4	14	10	34	1	3	9	31	6	21	23	79
Credit for manufacturing	0	0	5	17	2	7	12	41	1	3	9	31	3	10	26	90
domestic trading	0	0	5	17	1	3	13	45	0	0	10	34	1	3	28	97
exporting	0	0	5	17	2	7	12	41	1	3	9	31	3	10	26	90
Research and development on																
Bamboo propagation	2	7	3	10	4	14	10	34	1	3	9	31	7	24	22	76
Utilization and processing	1	3	4	14	3	10	11	38	1	3	9	31	5	17	24	83
Market linkaging and information			3	10												
on prices, buyers and sellers	2	7	2	7	4	14	10	34	2	7	8	28	8	28	21	72
Training	3	10	4	14	5	17	9	31	2	7	8	28	10	34	19	66
Extension of technologies	1	3	4	14	3	10	11	38	0	0	10	34	4	14	25	14
Importation of raw materials	1	3	4	14	2	7	12	41	0	0	10	34	3	10	26	90
Machineries and equipment	1	3	4	14	2	7	12	41	0	0	10	34	3	10	26	90
Support for Export	1	3	4	14	3	10	11	38	3	10	3	10	7	24	22	76
Other Incentives (tax, foreign																
exchange, etc.)	1	3	4	14	2	7	12	41	1	3	9	31	4	14	25	76

Source: 1997 survey

Table 4.4.7. List of government agencies and nature of assistance.

GOVERNMENT AGENCIES	NATURE OF ASSISTANCE
PDDCP	Conduct training on design
TESDA	Provide training on bamboo
Government Bank	Extend loan
DOST	Conduct training
DENR	Conduct training
DOLE	Conduct training
DSWD	Extend small loans
LGU	Extend loans
DA	Conduct training
NMYC	Conduct training
DTI (CARD)	Provide common service facilities

Source: Productivity Assessment of the Bamboo Using Industry in Region VI.
UP Visayas College of Management for Western Visayas Agriculture.
Resources, Research and Development (WESVARRDEC), August 1996.

Table 4.4.8. Problems and constraints according to bamboo enterprises

PROBLEMS AND CONSTRAINTS	NUMBER	PERCENT
Plantation development	6	20.69
Extension of technologies	3	10.34
Product development and design	2	6.90
Market linkaging/outlet	7	24.14
Credit for operating capital for trader	3	10.34
manufacturing	4	13.79
Training and seminars	2	6.90
Research and development	1	3.45
Support for export	1	3.45

Note: Multiple answers
Source: 1997 survey

Table 4.4.9. Recommendations to improve the services of government agencies

RECOMMENDATIONS
1. Look for more markets for bamboo products.
2. Assist the bamboo enterprises not only in marketing but also in the financial area.
3. Improve communication system, specifically DTI.
4. Continuous support.
5. Assist the bamboo enterprises in updating technology.
6. Conduct seminars.
7. Continuous dialogue, discussions with bamboo enterprises.
8. Assist the bamboo enterprises in their field work just like what NACIDA did before.

Source: Productivity Assessment of the Bamboo Using Industry in Region VI.
UP Visayas College of Management for Western Visayas Agriculture,
Resources, Research and Development (WESVARRDEC), August 1996.

Table 4.4.10. Forms of marketing assistance needed to improve sales and competitiveness in soucing raw materials and selling products

BAMBOO ENTERPRISE	ASSISTANCE NEEDED a/	NUMBER	PERCENT
PropagatorS	Exhibits/Fairs	1	16.67
	No Answer	5	83.33
Manufacturers	Promotion/Exhibit in other countries	4	23.53
	Promotion of bamboo as a wood substitute	1	5.88
	Source of buyers	3	17.65
	Improvement in design	1	5.88
	Information of cheaper raw materials	1	5.88
	No Answer	7	41.18
TraderS	Sourcing of better products	2	16.67
	Market outlets	3	25.00
	Information of cheaper sources of inputs	2	16.67
	Continuous supply of inputs	1	8.33
	No Answer	4	33.33

a/ Multiple answers

Source: 1997 survey

Appendix Table 4.1.1. Bamboos reported found in the Philippines

SCIENTIFIC NAME	COMMON NAME	HABIT	USE	ORIGIN
1. *Arundinaria amabilis* auct.	------	Erect	Ornamental	Chile
2. *A. argenteostriata* (Regel) Ohwi	Variegated dwarf bamboo	Erect	Ornamental	Native to Japan
3. *A. graminea* (Bean) Makino	Taimin-chiku or tsusi-chiku	Erect	Ornamental	Native to Ryuku Is.
4. *A. pygmaea* (Miq.) Mitf	Dwarf Bamboo	Erect	Ornamental	Native to Japan
5. *Bambusa atra* Lindley	Loleba	Erect	Basketry, Handicraft	New Guinea, Molucas and probably Southern Mindanao
6. *B. Bambos* (L) Voss Syn. *B. Arundinacea* (Retzius) Wild. *B. spinosa* Roxb.	India Bamboo	Erect	Multipurpose edible shoots, household uses, basic construction material	India to Southern China Thailand and Indo-China
7. *B. blumeana* J. A. & J.H. Schultes Syn. *B. Spinosa* Roxb. sensu Merrill *B. pungens* Blanco *Bambus arundo* Blanco	Kauayan-tinik	Erect	Multipurpose: edible shoots, basketry, construction material, household uses, pulp and paper	Native to Sumatra, Java, Borneo and Lesser Sunda Island. Probably introduced in the Philippines in pre- historic times.
8. *B. cornuta* Munro Syn *B. horsfiedii* Munro	Lopa	Erect	Household use	Native of Java and the Philippines (Nueva Viscaya and Benguet, a rare species).
9. *B. dolichoclada* Hayata	Chinese bamboo	Erect	Construction purposes, agricultural tools windbreaks	Endemic to China, Taiwan and Haian
10. *B. dolichomerithalla* Hayata	Taiwan Bamboo	Erect	Ornamental: in Taiwan as blow pipes	Endemic to Taiwan
11. *B. floribunda* Nakai	---	Erect	Ornamental	probably native to Japan
12. *B. merrillii* Gamble	Merrill Bamboo	Erect	Household use	Endemic to the Philippines: rare
13. *B. multiplex* (Lour) Raeuschel ex J. A. & J. H. Schultes Syn. *B. nana* Roxb. *B. glaucescens* (Willd.) Sieb. ex Munro	Kauayan-tsina	Erect	Excellent hedges and as ornamental	It probably originated form Indo-China and China
14. *B. oldhamii* Munro	Old ham Bamboo	Erect	Construction purposes	Native to Southern China

Appendix Table 4.1.1 Continued...

15. *B. tulda* Roxb.	Spineless India bamboo	Erect	Construction, edible shoots, household use, handicrafts, windbreaks	Northern India, Bangladesh, Burma and Thailand
16. *B. tuldoides* Munro Syn. *B. ventricosa* McClure	Budda bamboo	Erect	Ornamental, hedges, handicrafts, farm implements	Native to Southern China and Vietnam, widely cultivated
17. *B. utilis* Lin	Taiwan useful bamboo	Erect	Windbreaks for farm implements, building and supporting poles, edible shoots	Native of Taiwan
18. *B. vulgaris* Schrader ex Wendland (There exist three groups of this species, namely; green culm group, yellow culm group and Buddha's belly group called wamin in Burma)	Kauayan-kiling	Erect	The most used of all bamboos, rather rarely used as construction material because it is susceptible to powder post beetle attack.	Originated in the Old World probably tropical Asia. the most widely cultivated bamboo in the tropics and subtropics.
19. *Cephalostachyum mindorense* Gamble	Mindoro bikal or bakto	Subscandent or Semi-Erect	Can probably be used for making kaing	Endemic, Camarines and Mindoro
20. *Chimonobambusa falcata* Mak	-------	Erect	Ornamental	Probably South East Asia and China
21. *Dendrocalamus asper* (Schultes f.) Backer ex Heyne Syn. *D. merrillianus* (Elmer) Elmer *sensu* Dransfield & Widjaja (1995)	Giant Bamboo	Erect	Building material for houses, edible shoots	Thought to be in South-East Asia.
22. *D. giganteus* Wallich ex Munro	Giant Bamboo	Erect	Construction materials, edible shoots, thick culm wall good for production of bamboo boards, etc. as well as for ornamental purposes	Southern Burma and Western Thailand
24. *D. merrillianus* (Elmer) Elmer (In the sense of Dransfield and Widjaja thus species is reduced to *D. asper* Syn. *D. parviflorus* Hack	Bayog (Note: Bayog, as we have known it, does not botanically belong to Dendrocalamus. It is tentatively designated as *Bambusa* species 1).	Erect	Construction materials, farm implements	Endemic to the Philippines
25. D. strictus (Roxb.) Nees	Solid Bamboo	Erect	Used for many purposes such as building materials, furniture, basketry, mats, agricultural implements, raft and wares.	Widespread and native in India, Nepal, Bangladesh, Burma and Thailand.
26. *Dinochloa dielseana* Pilger	Tagisi	Climbing	General purpose	Endemic to the Philippines
27. *D. Elmeri* Gamble	Elmer bikal	Climbing	No known uses.	Endemic to the Philippines

Appendix Table 4.1.1 Continued...

28. *D. luconiae* (Munro) Merr. Syn. *D. aguilarii* Elmer *D. scandens* var. *angustifolia* Merr.	Osiu	Climbing	For fences, basketry, household use	Native to Borneo and the Philippines
29. *D. oblonga* S. Dransf.	Palawan bukaui	Climbing	Maybe put to use as bikal	Endemic to Palawan
30. *D. palawanensis* (Gamble) S. Dransf.	Palawan bikal	Climbing	Maybe put to use as bikal	Endemic to Palawan
31. *D. pubiramea* (Blume) O. Kuntze	Bukau	Climbing	General purposes, baskets	Native, also Borneo
32. *Gigantochloa atter* (Hassk.) Kurz	Kayali	Erect	Building materials, household utensils, basketry handicrafts	Origin is unknown. Cultivated in Indonesia, Malaysia, Borneo and Philippines (Davao)
33. *G. levis* (Blanco) Merrill Syn. *Dendrocalamus curranii* Gamble *D. scribneriana* Merr.	Bolo, botong, patong	Erect	Construction of rural houses, furniture, rafts, fish traps, fishpens, outriggers, edible shoots.	No known origin. Commonly cultivated in the Philippines and Northern and Western Borneo.
34. *Guadua angustifolia* Kunth	---	Erect	Ornamental	Colombia
35. *G. angustifolia* Kunth var. *bicolor* Londoño	---	Erect	Ornamental	Colombia
36. *Phyllostachys aurea* Carr. *ex* A. & C. Riviere Syn. *P. bambusoides* Sieb. & Zucc. var. *aurea* Makin	Running bamboo	Erect	Ornamental, garden plant, also hedges, walking sticks, umbrella handles, novelties	Probably originated from temperate and subtemperate Southern China and Japan.
37. *P. humilis* Muroi	---	Erect	Ornamental garden plant, also hedges, walking sticks, umbrella handles, novelties	Probably originated from temperate and subtemperate Southern China and Japan
38. *P. nigra* (Lodd ex Lind.) Munro	Black bamboo	Erect	Ornamental, also musical instruments and handicrafts, walking sticks, pipe stems	Introduced probably from China.
39. *P. pubescens* Mazel *ex* H. de Leh.	Edible bamboo	Erect	Edible shoots	Warm temperate part of China
40. *Pleioblastus argentostriatus* auct. forma akebono	Akebono- nesasa	Erect	Ornamental	Japan

Appendix Table 4.1.1 Continued...

41. *P. chino* Makino forma *elegantissimus* forma *pumilus* forma *pygmaeus*	Kamoro-sasa Gori-dake Ke-oroshima-sasa	Erect Erect Erect	Ornamental Ornamental Ornamental	Japan Japan Japan
42. *P. distichus* Muroi & *Okamura*	Oroshima-chiku	Erect	Ornamental	Japan
43. *P. fortunei* auct cv. *fortunei*	Chigo-zasa	Erect	Ornamental	Japan
44. *Pseudosasa amabilis* auct.	Cha'D-kon-chuck	Erect	Ornamental	Japan
45. *Pseudostachyum polymorphum* Munro	Bayto	Erect	Ornamental	Japan
46. *Racemobambos hirsuta* Holtum	----	Climbing	General purpose	Palawan and Malaysia
47. *Sasa kurilensis* (Rupr.) Mak et Shibata	Chisima-zasa	Erect	Ornamental	Japan, Chile
48. *S. nipponica* Mak.	Miyako-zasa	Erect	Ornamental	Japan
49. *S. palmata* Nakai	Chimaki- zasa	Erect	Ornamental	Japan, Chile
50. *Sasaella ramosa* (Mak.) Mak. et Shibata	Uzuma-zasa	Erect	Ornamental	Japan, Chile
51. *Schizostachyum brachycladum* Kurz (Reduced to *S. lima* sensu Merril)	Bohong dilau	Erect	Ornamental, split culms for roofing, handicrafts, props, etc.	South East Asia, Thailand, Peninsular Malaysia, Sumatra, Java, Celebes, Moluccas.
52. *Schizostachyum curranii* Gamble	Curran bikal	Climbing	Maybe put to use as bikal	Endemic to the Philippines
53. *S. diffusum* (Blanco) Merr.	Bikal	Climbing	Sometimes for kaing making	Endemic to the Philippines
54. *S. fenixii* Gamble	Puser	Climbing	Fence, other uses	Endemic to the Philippines
55. *S. lima* (Blanco) Merr. Syn. *S. zollingerii* Merr. *S. halliere* Gamble *B. lima* Blanco	Anos	Erect	Material for housing, like sawali-makling, musical instruments, fishing rods, etc.	Native to Borneo, Celebes Mollucas, New Guinea, Solomon Is. and the Philippines.

Appendix Table 4.1.1 Continued...

56. *S. lumampao* (Blanco) Merr. Syn. *S. hirtiflorum* Hack *S. mucronatum* Hack.	Boho	Erect	For sawali-making, basketry, fences, flutes, handicraft and many other uses	Endemic to the Philippines, occasionally cultivated.
57. *S. luzonicum* Gamble	Luzon bikal	Climbing	Could be put to use as bikal	Endemic to the Philippines
58. *S. textorium* (Blanco) Merr. Syn. *S. merrillii* Gamble	Kalbang	Erect	Could be put to use as bikal	Endemic to the Philippines
59. *S. toppingii* Gamble	Topping bikal	Climbing	May be put to use as bikal	Endemic to the Philippines
60. *S. sphaerobambos philippinensis* (Gamble) Dransfield Syn. *Bambusa philippinensis* (Gamble) McClure *Gadua philippinensis* Gamble	Laak (note: the laak which Mr Caasi extensively used in his bamboo farm in Davao does not botanically belong to Sphaerobambos but now tentatively designated as *Bambusa spec. 2)*	Erect	General purpose, banana props, used as kauayan-kiling	Endemic to the Philippines (Davao)
61. *Thyrsostachys siamensis* Gamble	Thailand bamboo	Erect	House construction, household uses, baskets, handicrafts, chopsticks, pulp and paper, ornamental, wind break	Native to Burma and Thailand where it occurs in pure stand.
62. *Yushania niitakayamensis* (Hayata) Keng f. (formerly Arundinaria niikatayamensis Hayata	Utod	Erect	Erosion control, ornamental in low temperature area	Native to Taiwan and the Philippines (Luzon, Mindoro, about 800 m and above altitude.

Source: Rojo 1996

Appendix Table 4.1.2. Important bamboos according to the Plant Resources of South East Asia (PROSEA, 1995)

SCIENTIFIC NAME	COMMON NAME	DISTRIBUTION/USE
1. *Bambusa atra*	Loleba	Bright future for the handicraft industry. It has thin culm wall. Reported to occur naturally in Southern Mindanao but possibly introduced because only one clump was found thereat.
2. *Bambusa bambos*	Indian bamboo	Cultivated in the Philippines. Important material for pulp and paper in SE Asia.
3. *Bambusa blumeana*	Kauayan-tinik	A source of pulp and paper. Number one species for furniture manufacture in the Philippines. Also young shoots.
4. *Bambusa multiplex*	Kauayan-tsina	Excellent for hedges and is common ornamental in gardens.
5. *Bambusa tulda*	Spineless Indian bamboo	Introduced to the Philippines. Generally used for construction, scaffolding, furniture.
6. *Bambusa tuldoides*	Bhudda bamboo	Mainly cultivated as an ornamental - bonsai and horticulture.
7. *Bambusa vulgaris*	Kauayan-kiling	Most widely cultivated bamboo throughout the tropics and subtropics. Of many uses like furniture, basketry and temporary construction material. There exist three forms or groups, green, yellow (or striated) and wamin. Possibly, la-ak (*Bambusa* spec. 2) is conspecific.
8. *Dendrocalamus asper*	Giant Bamboo	Thick culm wall and durable, building materials for houses and temporary bridges, containers for water, etc. Also planted for its shoot which is desirable. Large-scale plantation for young shoots favorable.
9. *D. giganteus*	Giant Bamboo	Many purposes as scaffolding, construction and rural houses.
10. *D. latiflorus*	Taiwan giant bamboo or machiku	Introduced in Cotabato and Davao where this is called botong there. Most important for its young shoots. Also for pulp and paper, construction, basketry and even ornamental.
11. *Dendrocalamus strictus*	Solid bamboo	In India, source for pulp and paper. For furniture where it is possible to produce curve parts like rattan; used also for mats and baskets. Culms variable in diameter size depending on where the species grows.
12 *Gigantochloa atter*	Kayali	For banana props, chopsticks, toothpicks, basketry.
13. *Gigantochloa levis*	Bolo, botong patong	Good quality young shoots, furniture, pulp and paper, fish traps, outriggers of boats.
14. *Schizostachyum brachycladum*	Buhong dilau	Growing wild and cultivated. For roof splits and handicrafts.
15. *Schizostachyum lima*	Anos	Native. Used for split roofing, also handicrafts and musical instruments like flutes and also whistles.
16. *Schizostachyum lumampao*	Buho	Endemic. Many uses. Now used in the production of "plyboo".
17. *Thyrsostachys siamensis*	Thailand bamboo	House construction, baskets, chopsticks, young shoots.

Appendix Table 4.1.3. A to Z of bamboo uses

	BAMBOO USES
A	Activated charcoal, acupuncture needles, airplane parts (wing members and stress skin for fuselage), alarms, alcohol, anchors, antenna supports, arbors, arrows and arrow tips, ashtrays, awnings.
B	Baby carriages, bagpipes, barrels, baskets, beads, beanpoles, beds, beehives, beer, bilge pumps, blinds, blowguns and darts, boards, boat and boat hoods, bolts, bookcases, bottles, bowls, bows, boxes, bracelets, bridges, broom, brushes, brush pots, buckets, buttons.
C	Cables, cages, candle sticks, canes, canteens, carts, catalyst, caulking, chairs, charcoal, chicken coops, chisels, chopsticks, cigarette holders, clothes, clothes racks, clubs, calendars, combs, cooking vessels, cradles, crates, crib, crosses, crutches, cups, curtains.
D	Dams, defensive fortifications, deodorizers, desks, dikes, dolls, domes, dowel pins, dredges for fishing
E	Eggcups
F	Fans, farming articles, fences, fenders, fertilizer, fifes, firearms, fire starters, firewood, fireworks, fishnets, fishpoles, flagpoles, flails, floats, flooring, flowerpots, flutes, food, forage, frames, fruit pickers, fuel, furniture
G	Gabions, games, garments, gates, grain storage, graters, green houses, guns, gutters
H	Hairpins, hampers, handles, hats, hawsers, hedges, helmets, hinges, hoops, house plants, houses, humidors,
I	Incense sticks, insect cages, irrigation pipes
J	Jackets, jars, jewelry, joss sticks
K	Kiosks, kits
L	Lacquerware, ladders, ladies, lamps, lamp shades, landing docks, landscaping, lanterns, latching, laundry poles, light bulb filament, lofts, looms
M	Markers, masts, matting, mattress, medicines, mills, mobiles, mushroom culture, musical instrument
N	Nails, napkin rings, net floats, nets, needle
O	Organs, ornaments, outriggers, ox carf beds, ox carf roofs, ox goads, oyster cultivation
P	Packaging, paper cutters, paper pulp, pegs, pen and pencil holders, pen, pillows, pins, pipes, plant stakes, plates, ply bamboo, poles, polo balls, polo mallets, posts, printing pads, propellers, props
Q	Quivers
R	Racks, rafts, raincoat, rain spouts, rakes, rattles rayon, record needle, reeds, reinforcement for concrete and adobe, rings, ritual objects, roofing, ropes, ring poles, rulers.
S	Sail covers, sail, sail stays, salt well drilling, sandals, scaffolding, scales, scarecrows, scoops, scratches, screens, scrubbers, sedan chair, shades, sheath shields, shingles, ship design, shoehorns, shoe soles, shoot for food, shovels, shuttles fore weaving, shelves, silk industry, skewers for cooking, ski poles, slide rules, snow fences, spears, splint, spout spray guns, springs, stakes, stave, sticks, stilt, stools, strings.
T	Tables, tea strainers, tea whisks, tents, temporary structures, tiles, towers, trailers, traps
U	Umbrellas
V	Valiha (musical instrument)
Y	Yokes for Carabao, yardsticks
W	Wagon, walking sticks, walls, water jugs, water pistols, water storage, water wheels, weapon, weaving shuttles, wheel barrows, whetstones, whips, whistle, wicks, windbreaks, windmills, wind storage, winnowing machines, writing brushes and pens
X	Xylophones
Z	Zither

Source: David Farrelly-INBAR Newsletter Vol. 3 No. 3 (1995)and 4 (1996) and Vol.4 No. 1 (1997).
[1] supplied by the consultant 1997

Appendix Table 4.1.4. Estimated number of hectares planted to bamboo by municipality, Region IV

PROVINCE	MUNICIPALITY	APPROXIMATE AREA (ha)	AVERAGE AGE	ESTIMATED HARVEST (no of poles/yr)	SPECIES
Laguna (as of August 7, 1996	Magdalena (24 brgys)	72	1-2 yrs old	28,800	
	Majayjay (35 brgys)	17.5	1-2 yrs old	42,000	*Bamboo Tsina* *Matinik* *Tawanak*
	Luisiana (15 brgys)	17.5	1-2 yrs old	19,500	*Bamboo Tsina* *Tawanak*
	Cavinti (4 brgys)	5	1-2 yrs old	2,000	*Bamboo Tsina* *Tawanak*
	Liliw (28 brgys)	14	1.5-3 yrs old	3,000	*Bamboo Tsina* *Tawanak*
	Nagcarlan (49 brgys)	12.5	1.5-3 yrs old	1,500	*Bamboo Tsina* *Tawanak*
	Rizal (9 brgys)	3	1.5-3 yrs old	1000-1500	*Bamboo Tsina* *Buho*
Total		141.5			
Batangas (As of August 1996	San Juan a/	-	-	-	*Kauayan tinik*
	Ibaan a/	-	-	-	*Kauayan tinik*
	Mabini a/	-	-	-	*Kauayan tinik*
	Lipa City a/	-	-	-	*Kauayan tinik*
	Isla Verde,	-	-	-	*Kauayan tinik*
	Batangas City b/	60	10-12 yrs old	68,000	*Kauayan tinik*
Total		60		68,000	
Romblon (As of Sept 20, 1996)	Odlongan	10	5-10 yrs old	1,500	*Kauayan tinik*
	San Andres	3	5-10 yrs old	500	*Kauayan tinik*
	Looc	3	5-10 yrs old	500	*Kauayan tinik*
	Calatrava	1	5-10 yrs old	150	*Kauayan tinik*
	Alcantara	1	5-10 yrs old	150	*Kauayan tinik*
	Ferrol	1	5-10 yrs old	150	*Kauayan tinik*
Total		19		2,950	
Quezon (As of Aug 1996)	Atimonan	5	5 yrs old	100	*Kauayan tinik*
	Plaridel	2	5 yrs old	300	*Kauayan tinik*
	Gumaca	10	7 yrs old	3,500	*Kauayan tinik*
	Pitogo	4	6 yrs old	2,000	*Kauayan tinik*
	Perez	3	5 yrs old	350	*Kauayan tinik*
	Alabat	3	6 yrs old	350	*Kauayan tinik*
	Quezon	2	5 yrs old	300	*Kauayan tinik*
	Tagkawayan, Lucban	1	1 mo. to 5 yrs old	500-1,000	*Kauayan tinik*
Total		30			
Aurora (As of Sept 20, 1996	Casiguran	3	20 yrs old	200	Chinese Giant Bamboo
		7	20 yrs old	1,000	*Kauayan kiling*
		1	20 yrs old	50	*Bayog*
	Dinalungan	1	10 yrs old	30	*Bayog*
		1	10 yrs old	120	*Kauayan kiling*
	Dilisag	2	10 yrs old	100	*Kauayan kiling*
		1	10 yrs old	60	*Bayog*
Total		16		1,560	
Grand Total		266.5			

a/ only along riverbanks
b/ Pastor Plantation

Appendix Table 4.1.5. Giant bamboo clonal propagation and production

ITEM	DESCRIPTION
Distribution	Giant bamboo is cultivated in Impasugong, Malaybalay and its adjacent areas. It is also being cultivated in Los Baños, Laguna, Baguio City, Samar, Leyte and Taminla, Duenas, Iloilo (TABARGA MPC).
1. Selection/Collection of Planting Stock	Select branches from a good mother clump of giant bamboo. The culm should be from 1 1/2 to 2 years old. Collect only those branches which are bigger and are found on the upper portion of the culm. Cut the branches carefully using a sharp saw or bolo.
2. Transport of Collected Propagules	Immediately after collection, planting materials must be placed inside wet sack. If planting materials will be transported in far places they must be packed in boxes with wet saw dust and properly arranged to avoid dehydration which will cause low germination.
3. Planting Stock Preparation and Potting	Prior to the collection of planting stock see to it that all materials needed for propagation like plastic potting bags, potting medium, rooting hormones, clonal chamber, etc. are ready. Soak the bottom of the branches in the mixture of 5-100% rooting hormone for at least 3-5 minutes. Then plant it inside the potting bag with ordinary garden soil. Place the potted cutting under shade with 50-60% sunlight or inside the clonal chamber.
4. Clonal Propagation	After propagules are potted, they are placed inside the clonal chamber. The cutting inside the clonal chamber must be reached by the sunlight at least 30-40%. The chamber is covered with plastic to maintain high relative humidity inside the chamber which will hasten the growth of the root system. The potted propagules should stay inside the chamber for at least one month.
5. Hardening	After propagules have developed leaves and root systems, the plants must be hardened off. Gradually remove the shade of the rearing shed until such time the plant could withstand the direct heat of the sun. Likewise, watering will also be controlled.
Outplanting	After the plants have undergone hardening, they are ready for outplanting. Prepare the planting holes, in advance, the size of hole is 1/2 meter cube. In digging, separate the top soil from sub-soil. Before planting place the top soil at the bottom of the hole, then place the plant and cover it with the sub-soil. The surface of the soil in the planting hole should be lower than the natural ground. Planting distance of giant bamboo in pure stands is 10 m x 10 m or if used as a water embankment stabilization, it is spaced at 5 m - 7 m between hills and rows using the zigzag double row.
Maintenance and Protection	The bamboo plants should be well maintained especially during the first two years. Ring weeding at 1-2 meters in diameter must be conducted and weeding frequency varies depending on the kind and population of the dominant weed species. Basal application of 50-100 grams of complete fertilizer (T14) 15 cm around the base of the plant should be conducted on newly planted bamboo, and every quarter thereafter for one year. Mulching must also be practiced in order to reduce water loss from the soil and also to supply certain amount of plant nutrients from organic mulch for the plant. In cases of bamboo plantation, firelines should be constructed, especially if the planting site is located in cogonal areas. The fireline should be constructed at the end of the rainy season.

Source: Gigare *et al.*, 1992

Appendix Table 4.1.6 . Branch marcotting method of propagating kawayan tinik (*Bambusa blumeana*)

STEP	DESCRIPTION
1	During the monsoon months, the branches of young culms are marcotted. For a period of about a month after the unfolding of the leaves of a new culm, roots can be induced to grow at the branches by marcotted without the necessity of ringing, or scraping, or the use of hormones.
2	After about 2 week's time, roots inside the marcot bags will have become visible through the plastic film. The rooted branches are then cut off from the culms.
3	They are then pruned and potted in the nursery.
4	The marcots remain in the nursery until the following rainy season, by which time they will have developed into clumplets
5	At this stage, they can be set out in the field with the minimum of land preparation, with little after-care, and with 100% survival.

Source: Alfonso Domingo 1990

Appendix Table 4.1.7. Kawayan technology: planting material production

	PROCEDURE
Propagation	• Kawayan can be propagated by using one-node cuttings. • Select 2 to 3-year old poles from healthy clumps. • Select nodes with well developed buds, these can be found in the basal, middle, and on the top portions of the pole. • Cut 2 to 3 inches below the node and 4 to 5 inches above the node. A sharp cross cut saw of knife may be used for this purpose. • The cuttings can be directly planted in 7 x 7 x 11" black plastic bags provided sufficient water is available. Use a 2:1 mixture ratio of ordinary garden soil and fine river sand as potting media. • 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 the river sand. If plenty of cuttings are to be propagated, the bed can have a 3 m x 5 m dimension. It could be smaller depending upon the number of cuttings to be propagated. Use fine river sand as rooting media. Keep the misting bed moist everyday. Within 20 to 25 days, transfer the rooted cuttings in black plastic bags. • For every plastic bag, apply 20 g 14-14-14 NPK fertilizer. Water immediately. Water 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 in the soil. As a general rule, keep the nursery clean. The plants should be ready for outplanting after 6 months.

Source: S.C. Malab, J.T. Agustin, S.M. Pablico and L.G. Battad, 1996

Appendix Table 4.1.8 . The Caasi process for mass propagation of bamboo

The Caasi Process: 42 Day Average Cycle Bamboo Propagation from Cuttings	
A. Steps	(Day One) 1. Prepare incubation beds with well-dampened but not saturated washed river sand (cleaned of silt, dirt, leaves, etc.) and sterilized by fungicide as growing medium. Beds are raised about 6 to 8 inches above ground level and contained with boards, rocks, coconuts, logs, brush cuttings, bamboo, drift wood or whatever works. 2. Sterilize both cuttings and medium with CAPTANTM, or equivalent, solution mixed 1:4 or as directed on label. The medium is saturated with the solution and then left to dry for a day. The cuttings are dipped in five gallon buckets of fungicide solution before placing in the incubation bed. 3. Plant in incubation bed previously prepared cuttings consisting of one node cut approximately 2-3 inches below the node and 5-6 inches above with the node having at least one strong branch with some leaves remaining cut approximately 5-6 inches away from the node. Lay cuttings tightly together with the node covered with sand leaving the upper portion of the cutting and the branch exposed. Tamp sand firmly into the spaces between cuttings. The incubation beds are kept covered with a layer of clear plastic to retain moisture. (Day Two) 4. Saturate bed filled with cuttings with Hexa Plis tm, or equivalent, solution mixed 1:4 or as directed on label. The key ingredients are micro-elements or trace minerals, growth, hormones and NPK fertilizer, NPK fertilizer alone is not adequate to supply the nutritional requirements essential to propagation success. (Days Three, Eight, Fifteen, Twenty, Three, Twenty Nine and Thirty Six) 5. Don't - DO NOT - water the incubation beds in order to maintain consistency of HexaPlus solution. (Days Four, Five, Six; Nine, Ten, Eleven; sixteen, Seventeen, Eighteen and other intervening days) 6. Water incubation bed to keep sand moist -do not saturate. Keep plastic sheet in place between watering. (Day Twenty One) 7. Transfer rooted cuttings to one gallon polybags
B. Soil Medium in Polybags (standard nursery type with drainage)	The most important consideration is to make the soil medium porous, a good sandy loam or other mixture with a high humus or organic component. Compost works very fast in the tropics where there is also a wealth or organic matter available. Other ingredients used as dry sawdust from a local sawmill and coconut coir dust (coconut coir is the pith of the coconut between the shell and the nut). When mixed, the soil medium should be exposed to the sun and air for about two weeks before filling polybags. Then the filled polybags benefit from another two weeks in the sun. The preparation times gives the soil elements a chance to mix well. The sun exposure helps to prepare the soil in many subtle but effective ways.
C. Steps in Transplanting to Polybags	1.Thoroughly water the sun dried soil in polybags and allow to drain until soil is damp not saturated. 2. Punch a hole about ½ inches in diameter in the middle of the soil in polybag. 3. Pour CAPTAN 1:4 solution to again saturate and to fumigate soil. Allow to drain through. 4. Insert/plant rooted cuttings in the polybags. Be careful that roots are given adequate soil contact and not damaged through abrasion by the soil mixture. Firmly tamp soil around cutting. 5. Out polybags in an area which is not totally shaded. Arrange them in staggered rows of ten across so that there is maximum interpenetration of the bamboos with each other. They like company at this stage. (Day Twenty Two) Saturate each polybag with Hexa Plus 1:4 solution. Check for effective drainage. Watch carefully for any signs of mold or fungi growth (Days Twenty eight - Thirty Five) Spray polybag areas adequate to dampen foliage only (Day Forty Two) Apply solid fertilizer (14-14-14-11S) to polybags. Punch two ½ inch diameter holes in the soil per polybag and put one punch in each hole. Water as conditions suggest. Maintain a moist but not saturated soil

Source: Mr. Caasi

Appendix Table 4.2.1. Sources of tools and equipment

SOURCE	TOOL/EQUIPMENT AND DESCRIPTION
Regional Design and Technical Development Centre Office of the Development Commissioner (Handicrafts) 32, Victoria Road Bangalore 560 047 India	a. Tool kit for processing bamboo and rattan (a complete set of 21 various tools designed to suit all types of bamboo and rattan work - supplied in a wooden box) b. Bamboo splitting tool, with 8 blades or 16 blades c. Bamboo splitting machine for agarbathi sticks, hand or power operated d. Bamboo round sticks (3.5 mm dia) making gadget (hand operated)
Cottage Industries Technology Center (CITC) 20 Russet Street, SSS Village, Metro Manila, Philippines	a. Bamboo pole cutter - Seesaw Type (for cutting bamboo poles into desired length) Power - 220 V, 60 Hz Motor and overload protection - 1.5 HP, single phase Saw blade - 12" dia, carbide tipped Main Frame - 2" x 2" x 0.5" angle iron (ai) b. Circular table saw. (for cutting bamboo furniture component into actual length) Power - 220 V, 60 Hz Motor and overload protection - 1.5 HP, single phase Saw blade - 12" dia, carbide tipped Table - adjustable up and down Main Frame - 2" x 2" x 0.25" ai c. Bamboo outer node remover (for removing the outer node of bamboo prior to splitting) Power - 220 V, 60 Hz Motor and overload protection - 1.5 HP, single phase Cutter or grinding stone Sliding stock feeder frame with slanting roller bearing Main Frame - 2" x 2" x 0.25" ai d. Double head disc sander (for cleaning the solid or laminated bamboo furniture component) Power - 220 V, 60 Hz Motor and overload protection - 1.5 HP, single phase Disc dia - 12"-14"

Appendix Table 4.2.1 Continued ...

	Sanding table - adjustable Main Frame - 2" x 2" x 0.25" ai e. Double head air drum sander (for cleaning of solid or laminated bamboo furniture) Power - 220 V, 60 Hz Motor and overload protection - 1 HP, single phase Drum with air valve - 120 mm x 250 mm dia Main frame - 2" x 2" x 0.25 ai f. solid drum sander (for sanding flat laminated bamboo component or with plywood backing) Power - 220 V, 60 Hz Motor and overload protection - 1.5 HP, single phase Drum - 6" dia x 30" long Sanding table - adjustable Main Frame - 2" x 2" x 0.25" g. Bamboo shaver (to determine the uniform thickness of slot or bamboo weaver) h. Bamboo sizer (to determine equal length and uniform width of bamboo weaver) i. Bamboo scraper (to remove the outer skin of bamboo poles prior to spitting process j. Bamboo hand splitter (8 and 10 blades) (to cut bamboo slot into the same size for lamination purposes with the plywood backing) k. Bamboo chip cutter (Guillotine type) l. Bamboo slicing machine (to separate the skin of bamboo from the pitch) Power - 220 V, 60 Hz Motor and overload protection - 0.5 HP, single phase, induction motor Feeding speed - 100'/min Thickness of available material - 1 mm max. Width of available material - 2 mm max. Slicing thickness - 300 mm (w) x 900 mm (H) x 600 mm (L) Machine weight - 100 kg m. Bamboo splitting machine (to make number of slat bamboo in one operation)

Appendix Table 4.2.1 Continued ...

	Power - 200 V, 60 Hz Motor and overload protection - 3 HP, single phase, induction motor and magnetic switch Length of bamboo - 2-9' Diameter of bamboo - 2-6" Splitting blades - 4-15 Machine dimension - 700 mm (W) x 1,050 (H) x 4,100 mm (L) Machine weight - 450 kg Production capacity - 350 poles/hr n. Bamboo splitting machine (to produce small pieces of bamboo slat on side skin process) Power - 220 V, 60 Hz Motor and overload protection - 0.5 HP, single phase, induction motor Feeding speed - 100'/ min Width of available material - 40 mm Machine dimension - 330 mm (W) x 850 mm (H) x 565 mm (L) Machine weight - 100 kg o. Bamboo sizing machine (to determine the uniform width of bamboo weaver in a fast operation) Power - 220 V, 60 Hz Motor and overload protection - 0.5 HP Feeding speed - 100'/min Width of available material - 14 mm Thickness of available material - 3 mm Machine dimension - 500 mm (W) x 770 mm (H) x 690 mm (L) Machine weight - 100 kg
National Small industries Corporation, Ltd. Prototype Development and Training Centre Balitikuri 711 402 Howrah District, West Bengal India	Tool kit
Bamboo Information Centre (China) Chinese Academy of Forestry 100091 Wan Shou Shau Beijing	Directory of Chinese Bamboo Processing Machines
Garrett Wade Australia PO Box 1185 Collingwood Vic 3048 Australia Fax (03) 882 8710	Tool supplier

Appendix Table 4.2.2. Proximate chemical composition of six species of Philippine bamboo shoots at three different age levels.

SPECIES	NUTRIENTS g/100 g E.P.[1]					
	Moisture (g)	Protein (g)	Fat (g)	Ash (g)	Total Carbohydrates (g)	Crude fiber (g)
Kauayan-Tinik						
7 days old	90.6	5.6	0.4	1.0	2.4	1.0
10 days old	89.7	4.1	0.5	1.0	4.6	1.3
15 days old	90.2	3.9	0.6	1.0	4.4	1.3
Kauayan-kiling						
7 days old	92.0	2.6	4.1	0.9	0.4	1.1
10 days old	91.4	2.80.6	0.9		4.3	1.3
15 days old	91.5	2.42.8	0.8		1.5	1.1
Giant Bamboo						
7 days old	93.8	0.8	9.4	0.8	0	1.1
10 days old	93.3	3.27.2	0.8		0	1.0
15 days old	92.1	3.88.7	0.8		0	1.1
Yellow Bamboo						
7 days old	91.6	1.8	11.8	0.8	0	2.3
10 days old	92.5	2.1	7.2	0.8	0	1.2
15 days old	91.6	2.5	9.0	0.8	0	1.6
Bayog						
7 days old	91.2	2.1	3.7	0.7	2.3	1.9
10 days old	91.4	2.9	7.4	0.7	0	1.7
15 days old	91.3	1.2	3.9	0.7	2.9	1.1
Bolo						
7 days old	92.2	2.4	5.4	0.7	0	0.5
10 days old	92.2	8.0	7.6	0	0	1.8
15 days old	91.7	3.7	8.9	1.1	0	1.6

[1] Edible Portion
[2] By Difference
Source: GONZALEZ E. and L. APOSTOL. 1978. Chemical properties and eating qualities of bamboo of different species. Unpublished final report. PCARR Project No. 283. PCARR, Los Baños, Laguna 18 pp.

Appendix Table 4.2.3. Mineral and vitamin contents of six species of Philippine bamboo shoots at three different age levels

SPECIES	MINERAL mg/g E.P. a/		VITAMINS mg/g E.P. a/		
	Calcium mg	Phosphorous mg	Iron mg	Thiamine mg	Ascorbic mg
Kauayan tinik					
7 days old	31.5	39.7	1.1	0.1	12.0
10 days old	37.5	74.5	2.0	0.1	10.0
15 days old	38.5	40.1	1.6	0.1	10.0
Kàuayan kiling					
7 days old	22.8	37.0	1.1	0.0	3.1
10 days old	20.6	19.2	1.0	0.1	4.2
15 days old	25.5	32.1	0.8	0.1	6.1
Giant bamboo					
7 days old	17.8	32.6	1.0	0.0	0.0
10 days old	26.3	30.5	1.9	0.0	0.0
15 days old	25.5	27.1	0.8	0.0	0.0
Yellow bamboo					
7 days old	28.6	27.5	1.4	0.0	0.0
10 days old	27.1	29.9	0.6	0.1	0.0
15 days old	25.9	38.7	1.0	0.1	0.5
Bayog					
7 days old	26.1	38.2	1.2	0.1	1.2
10 days old	22.6	28.6	2.8	0.1	6.7
15 days old	19.8	28.5	3.0	0.1	4.3
Bolo					
7 days old	32.4	29.1	1.4	0.1	5.1
10 days old	31.2	27.0	0.7	0.1	3.8
15 days old	28.4	24.0	0.9	0.1	1.5

a/ Edible portion

Source: Gonzales and Apostol 1978

Appendix Table 4.4.1. Bamboo contacts outside the USA

COUNTRY	NAME AND ADDRESS	
Australia	Mr. Peter Bindon P.O. Box 174 Fremantle, Western Australia 6160 Tel: 61-619-339-6481 Fax: 61-619-319-1247 E-mail: bindop@muswa.dialix.oz.au	Dumford L. Dart Belli Bamboo Parkland MS 330 Kenilworth Road Belli Park Via Eumundi Queensland 4562 Australia Phone and fax 61-74-47-0299 E-mail: ozbamboo@ozemail.com.au/ozbamboo Homepage: http://www.odyssey.com.au/ozbamboo
Belgium	Johan Gielis Nottebohmtraat 8 2018 Antwerp Tel: 32 3 236 46 29 E-mail: Johan.Gielis@rug.ac.be	
France	Bernard Pinoteau, President 311 Avenue du Prado 13008 Marseille Tel: 33 91761216 Eric LATAUD Piau Le Moulinet 47290 CANCON Lot et Garonne France Stanislas Noel Administration member of EBS-France Jardin d'art d'essais F-76640 Normanville, France Tel & fax: (33) 35 29 62 39 E-mail: 100622.3100@compuserve.com	Yves Crouzet Director of Bambouseraie de Prafrance 30140 GENERARGUES (Gard) France Mr. et Mme Fosse Guy et Mauzole Rosalyne, Secretaries 19, av. anne de Noailles 95200 Sarcelles Tel & fax: 39 94 52 31
Germany	Wolfang Eberts Saarstrasse 3 D- 76532 Baden - Baden Germany Tel: 0049 7221 5074 0 Fax: 0049 7221 5074 80 E-mail: WolfangEberts@swol.de Oliver Korfmacher (Rhein-Main area) E-mail: okor@ netcs.com Homepage: http://www.netcs.com/PEOPLEokorf.html	Frau Edeltraud Weber John Wesley Strasse 4 63584 Grundau (Rothbergen) Germany Tel: 49 6051 17451
India	Dr. U.M. Chandrashekara Kerala Forest Research Institute Peechi Thrissur Kerala 680 653 India Dr. Cherla Sastry. The Bamboo Information Centre E-mail: csastry@idrc.ca	Ramanuja Rao Chief Scientist, INBAR E-mail: rrao@idrc.ca
Italy	Mario Brandazzi Via Dosso di Matina 19 Credera Rubbiano CR Tel: 39 373 61009 Friedrich Schlegel Advising IFAD on INBAR (Bamboo and Rattan Network in Asia) second phase proposal. Also in contact with bamboo flower research in Bern. Giving technical support to the Orto Botanico di Roma which has a 80 taxons Bamboo collection. E-mail: Friedrich.Schlegel@fao.org	Lorenzo Baar Fraz. Mascarelli 47 I-12064 La Morra (CN) Tel: 0039 173 509 354 Fax: 0039 173 509 279 E-mail: lorbar@vol.it
Japan	Harutsugu Kachiouagi Fugi Take Shokobutsuen 885 Minami-isshiki Nagaizumi-cho Sunto-gun SHIZUOKA-KEN 411 Japan	Claude Rifat 3-38-8 Otsuka Bunkyo-ku Tokyo 112 Japan

Appendix Table 4.4.1 Continued ...

Kenya	Reid Harvey Africa Regional Centre for Computing (ARCC) P.O. Box 58638 NAIROBI, Kenya Tel: +254-2-570176/726914/723552 Fax: 728351 E-mail: attic@arcc.or.ke or ATTICERAM@AOL.COM Homepage/World Wide Web: http://www.arcc.or.ke	
The Netherlands	Wim Masman, Secretariat Borculoseweg 2 7261 BJ Ruurlo the Netherlands Tel 31 5734 51465 Fax: 31 5734 52665 E-mail: esoldaat@worldonline.nl	
New Zealand	Clive Higgie, President, New Zealand Bamboo Society P.O. Box 11 Fordell Wanganui NEW ZEALAND Tel: (country code) 64 6 342-7857 Tom Vallings, Secretary, NZBS Maungakaramea PDC Whangarei NEW ZEALAND Tel: (country code) 64 9 432-3858	John Rogers 254 Whitmore Road RD6 Warkworth NEW ZEALAND Chris and Dave Brown 39 Brois Street New Plymouth NEW ZEALAND Tel & Fax: 06 753-9901 Tel: (country code) 64 6 753-9901
Spain	Jose M. Viure Carretera de Cardedeu a Canoves 08440 Cardedeu Barcelona Tel: 34 93 8462001	
Switzerland	Robert Linder, Chairman - Swiss Bamboo Society Strandweg 22 CH-3286 Muntelier Tel: +41 37 71 34 83 Margrit Blaser Strandweg 22 CH3286 Muntelier Yvonne Edwards-Widmer Geobotanisches Institute ETHZ Gladbachstrasse 114 CH-8044 Zuerich Switzerland Tel: ++411 632 5181 Fax: ++411 261 0595 E-mail: yedwards@umnw.ethz.ch	Toni Grieb La Fenettaz Ch-1588 Montet/Cudrefin Tel : +41 37 77 16 77 Marc Solioz, Clinical Pharmacology, University of Berne Murtenstrasse 35 3010 Berne, Switzerland email: solioz@ikp.unibe.ch Tel: +41 31 632 3268 Fax: +41 31 381 4713 Homepage: http://ubeclu.unibe.ch/ikp/bamboo/bamboo.htm Daniel Vergeres La Fayaulaz CH-1583 Villarepos Tel: +41 37 76 13 31 E-mail: vergeres@vpri.ch
United Kingdom	David Helliwell 43 Whitehouse Road Oxford, OX1 4JQ United Kingdom Tel: 44 865 728135 E-mail: djh@vax.ox.ac.uk Tony Churly The Little House 18 Gladtone Road Fakenham, Norfolk ENGLAND, NR21 9BZ Tel: 01328 863350 E-mail: tony@churly.demon.co.uk	Mick Blowfield Natural Resources Institute Chatham Maritime Kent ME4 4TB United Kingdom E-mail: michael.blowfield@nri.org Dr. Eric Boa International Mycological Institute Bakeham Lane Egham, Surrey TW20 9TY United Kingdom E-mail: e.boa@cabi.org

Appendix Table 4.4.2. Lending institutions financing schemes in bamboo enterprise development

ITEM	DESCRIPTION
Land Bank of the Philippines (LBP)	
1. Cooperative Lending Program	This scheme provides cooperatives of small farmers and fishermen loans for agricultural production, livestock and poultry agricultural facility loans, operating capital, commodity loan for marketing and livelihood projects. The interest rate 12% per annum for not more than 2 years for short-term production loans, more than 2 years medium to long term loans and not more than 1 year operating capital loans. A 16% per annum interest rate is charged on other types of loan. In addition, a 2% supervision fee is likewise charged. Collateral requirements include Deed of Assignment of individual member, promissory note and true receipts of PCIC, insurance or guarantee coverage for crop production loans.
2. Countryside Partnership Scheme	This is a fixed asset financing program that provides cooperative loans for fixed asset acquisition specifically for pre-post harvest facilities The interest charge is as follows: 14% per year plus 2% supervision fee for 17% of the project cost. No interest is charged on the 25% sponsor's fund and 5% equity of the borrower. Continuing chattel mortgage of stocks or real estate mortgagee of chattels may be presented as collateral
3. LDB-OE CF Financing Program	This program provide cooperatives loans for production, marketing, working capital and fixed asset. A 12% rate of interest per annum is charged on production and working capital loan while 14% per annum is charged on fixed asset loans. An additional 2% supervision fee is likewise charged. The list of documents which may be presented as collateral includes the following: Deed of Assignment of individual member; promissory notes or trust receipts for production loan; Deed of assignment of PCIC Insurance or guarantee coverage for marketing and working capital loans, object of financing or chattel or real estate mortgage for fixed assets loan
4. Integrated Social Forestry Program	This scheme provides cooperatives loans for crop production, operating capital and fixed assets for livelihood projects specifically in upland area. For production and working capital loans, 12% per year is charged while 14% per annum is charged for fixed assets loans. A 2% interest rate is charged as supervision fee. For production and working capital loans, deed of assignment of member, promissory note or trust receipt may be forwarded as collateral while assets loan require continuing chattel mortgage of object of financing is required as collateral.
Development Bank of the Philippines (DBP)	
1. Pangkabuhayan ng Bayan	This scheme provides individual, partnership and corporation loans for production, manufacture or processing of commodities preferably for export. Interest rates may be 17.76% for one year or less; 18.75% for three years and 19.75% for six-year loan.
2. Export Development Financing Program	This provides individuals, partnerships, NGOs and trade associates for direct or indirect exporting. It also provides pre-shipment working capital loans. Interest rates vary on case-to-case basis while collateral may be Letters of Credit Purchase Order, real estate mortgage, chattel.
3. DBP-DOST Special Financing Program for Commercialization of New Products and Technologies	This scheme provides individual, partnership and corporation loans for commercialization of new products and technologies. The minimum interest rate equivalent to the NEDA inflation rate plus 2 % while collateral may be fully or partially secured collateral or joint and several signatures.

Appendix Table 4.4.2 Continued ...

Department of Labor and Employment	
1. Women Workers Employment and Entrepreneurship Development	This provides group loans for entrepreneurship and income generating projects. Interest rates are 6% per annum for non-government organizations and 18% per annum for clients. No collateral was specified.
2. Expanded Livelihood Development Programs-OWWA	This scheme provides individuals and organizations of OCWs microenterprise financing. It also provides individual technical assistance, entrepreneurship development training, and technical skills training, consultancy services and client organizing. The interest rate charged ranges from 6-15% per annum for direct lending and 2% per annum for ACPs Collateral accepted includes real estate and/or chattel mortgage, machinery and equipment, household furniture and appliances. In addition, surety bond shall be required for ACPs.
3. Promotion of Rural Employment Through Self-Employment and Entrepreneurship Development	This provides cooperatives and NGOs for all livelihood projects for landless farmers, farm workers in other rural economic activities. A 5 percent interest per annum is charged for NGOs while 18% per annum for clients. No collateral is needed to avail of this loan.
Livelihood Corporation	
1. Guarantee Funds for Small and Medium Enterprises	This provides cooperatives, banks and NGOs loans for credit guarantee with lending institutions. The interest rate is 30% inclusive of all fees charged while no collateral is required.
Technology and Livelihood Resource Center	
1. Agro-industrial Transfer Program (Window II)	This scheme provides individual, cooperatives and corporations loans for start-up and expansion of cultivation, post-harvest and processing projects. Interest rate charged is 12% per annum for short term loans and 13% for long term loan Collateral includes real estate mortgage, guarantee or insurance coverage, chattels and mortgages on loan acquired assets.
2. Balikatan sa Kabuhayan	This program provides individual, corporations and CARP beneficiaries loans for agribusiness, livestock and poultry project, production and cultivation of non-traditional crops. For the direst lending scheme, a 15% per annum interest rate is charged while 12% per annum is pegged for special lending projects Any real estate mortgage, building and land improvement, transportation equipment, office equipment, household appliances, furnitures and/or other bonds and securities may be offered as collateral.
3. Technology Utilization and Financing Programs	To help technology development by filling the "technology delivery gap" between research and development and technology utilization in the business and industrial sectors. This program was on conceptualized and implemented. Furthermore, through these scheme, the problems encountered by technology developers of bridging the gap is addressed. Thus, this scheme provides individual and corporation loan for aid and tools for crop production and post harvest facilities, food processing and alternative sources of energy. Interest rate charged is 15% per annum and collateral accepted may either be private land, building and improvement, equipment and/or vehicle.
4. Urban Livelihood Financing Program	To hasten the development of industry sector and to generate livelihood opportunities for small and medium scale entrepreneurs, this program offers financial assistance. This is designed for special projects such as manufacturing and processing concerns of trade associations, cooperatives and NGOs. An interest rate of 17% is charged while collateral such as land, building, machinery, tools, equipment and vehicle is accepted.

Source: Rivera, M. N. and C.D. Apolinar 1995

Appendix Table 4.4.3. Published manuals guides and brochures on bamboo production indicating titles authors and year published

TITLE	PUBLISHER	AUTHOR	YEAR
Growing Bamboo the Ilocos Way (An Illustrated Easy Method of Producing Bamboo)	Forestry Development Center College of Forestry UPLB	avier. D. M. Abella M. J. Lumdang E. G.	1983
How To Grow Bamboo	"How to Series" Forest Research Institute	Lasmarias V. T.	
The Philippines for Bamboo Production	PCARRD Philippines Recommends Series No.53-A	PCARRD	1991
Giant Bamboo Clonal Propagation and Production Technology	Technology Transfer Division ERDS-DENR 6	N. Gigare Reposipolo A. Binoya F. Jr	
Manual on Bamboo Farming	ERDB/DENR		

5. DEVELOPMENT ISSUES, PROBLEMS/CONSTRAINTS AND THREATS

5.1 Bamboo Resources and Raw Material Production

One of the more important issues relating to bamboo resources is the absence of an updated and comprehensive survey and accounting of the actual extent and distribution of existing bamboo stands in the country (Table 5.1.1). This is essentially true especially for bamboos found in the "natural stands". This information is imperative since the bulk of the present needs for bamboo are derived from natural stands. Availability of this information will provide more reliable and accurate data base on actual area covered, volume, species and specific locations. Such data base will provide basis for estimating the bamboo-based industries that can be supported by existing stands or the area that is needed to be developed to augment the raw material base for supporting the present and future needs of bamboo-dependent industries.

Related to this issue is the seeming lack of concerted and planned effort for bamboo plantation development despite the felt need as perceived by the industry stakeholders. Indicative of this problem is the lack of land use related policy for the delineation of area for bamboo plantation development. Under the present government initiative, the area for bamboo development is solely dependent on whether bamboo will be selected by the participants in the government reforestation programs or not. No guidelines are in place on bamboo species site-matching considering the demand for specific species, site preferences and requirements and potential uses, in spite of the fact that bamboo has been considered as one of the reforestation species. These issues and problems may be attributed to other related problems such the as the lack of an aggressive campaign with regards to the importance of bamboo and its prospects; inadequate technology transfer and dissemination resulting to slow rate of adoption; and limited efforts to bring to the clienteles the required support services available for bamboo development.

The experience on the gregarious flowering of *buho* (*Shizostachyum lumampao*) resulting to the dying of some bamboo stands in some areas of the country poses some threats to the sustainable supply of raw materials. Likewise, bamboo pests and diseases while at present pose no foreseeable danger must be continuously monitored. Very adverse climatic and environmental conditions may also affect, to some extent, the supply of bamboo poles. Not very apparent, but poses a greater danger to the bamboo resource stability is the indiscriminate and uncontrolled harvesting practices particularly in public forest where open access to the resource is common. All these affect bamboo productivity, pole quality and the vigor of the clump in general.

With regards to existing policies on bamboo, there is a need to study the present policy on the determination of AAC based on the current knowledge of the different bamboo species in relation to their growth, yield and clump development as affected by different climatic and edaphic factors.

5.2 Technology, Processing and Utilization

Many researchers in all continents now work on bamboo and are trying to explore its wider application and utilization. Not everyone has sufficient knowledge and experience to appreciate the limitations of bamboo as for any other natural raw material (Table 5.2.1). Presently, there are efforts to extend the limits of the past experience by applying new results and techniques. In this context, however, there is the need to be aware of certain limiting characteristics of the plant and its products so that natural limits are not overstretched. Some important biological aspects that are to be kept in mind are given below.

An increasing demand often leads to premature felling of the culms. This reduces the biological productivity of the remaining culms for new shoots. In addition, the prematurely harvested culms are more liable to splitting and biological attack.

Unlike some wood, bamboo does not have any toxic substances to make it resistant. Consequently, bamboo culms remain liable to biological degradation whenever the environmental conditions are suitable for fungi or beetles.

Unlike wood, bamboo does not possess anatomical pathways which enable a radial penetration of preservatives. Even worse, its outer skin is highly refractory towards penetration and any uptake from the inside is also limited. In spite of several attempts, no method for the preservation of bamboo for furniture, handicraft and panel boards has been developed which is equally technically feasible, cheap, and environmentally safe. As a consequence, when utilizing bamboo, for example, for construction purposes, certain restrictions have to be taken into account. Bamboo is also liable for splitting during drying. Whereas the strength properties are hardly influenced by such cracks the uptake of moisture by the inner part of the culm may lead to a higher rate of biological deterioration.

Many people now realize the great potential of bamboo in the context of declining timber resources. For this purpose, there are efforts to find ways of improving the growth, management and utilization of bamboo.

In recent years, many achievements have been obtained through research. These results need to be applied on a larger scale. It must be known for example, which properties are necessary for the products people want to have. Otherwise, they will buy, in due course, baskets and other articles made of plastic, which are colorful, durable, and even cheaper than those made from bamboo.

Above all, the social acceptance of bamboo by the rural people is limited. This must be considered if programs for a wider utilization of bamboo will be put in place.

Despite the wide acceptance of local handicrafts and furniture in the world market, the said industries are saddled with many problems. The dwindling supply of raw materials threatens the bamboo industry as a whole. This hinders continuous production and limits

productivity. It also encourages stiff competition in sourcing the raw materials and market because of the growing number of new entrants in the industry. This has affected the cottage firms more than the big firms.

Low production, seasonality of furniture/handicraft manufacture, poor product quality, pirating of workers and stiff competition among manufacturers likewise pose a problem to the firms.

Another problem is product design. One observation is that designs do not vary much because of the tendency to copy designs of neighboring shops. Normally, however, the buyers specify their own design and modify the designs given by the producers. However, the manufacturers develop their own design to create distinction.

Some manufacturers/exporters seek the assistance of the DTI-PDDCP for design development. Others even hire their own designers and quality controllers to maintain product quality.

Unfortunately, professional help on furniture design may be too costly for small manufacturers. One approach to this problem can be the conduct of seminars/workshops sponsored by CITC or PDDCP. Moreover, they cannot afford to invest on R&D undertaking and participate in formal training/skill upgrading programs due to cost involved.

The general economic and technical development of pulp and paper as well as bamboo board industries requires costly machineries and equipment and also needs a continuous supply of bamboo materials. In the last couple of decades, bamboo which was an abundant resource and considered inexhaustible, has become a scarce item. The traditional and modern industrial sectors compete for the limited bamboo resource.

5.3 Marketing

Table 5.3.1 presents the weaknesses of the bamboo industry as well as the threats confronting it based on the problems and constraints reported.

Generally, bamboo is still considered a poor man's timber and a "minor" forest product. It is not durable compared to substitute materials and products and is not a primary investment option for forest-based business. Thus, it does not appeal to consumers who can afford other products considered more durable and fashionable, and to producers faced with a wide range of investment options. It is associated with rural life and does not conform with the dynamically changing lifestyles of consumers in rapidly industrializing economies. Among farmers, it is a grass that is naturally growing, hence production is largely extensive without need for intensive management system. This explains its low level of acceptability both as a crop and as a consumable product creating a situation of low supply and demand with limited potential for development.

Products are limited to traditional uses unlike in other countries where uses in pulp and paper and food are highly developed and comprise significant industrial production. In furniture and handicraft, designs are not updated and at least for products directed to low-end markets, product quality is poor with customers complaining of "*bukbok*" and poor workmanship. In some cases, poor demand results from lack of promotional efforts both in local and export markets. While producers are capable of manufacturing high quality products, these are not readily available in the market for customers to see and stimulate their demand.

In the marketing of raw materials, the system is unorganized with great dependency on middlemen for selling poles. While not necessarily bad and inefficient, the system allows little opportunity for buyers and sellers to be adequately informed of the former's demand and the latter's supply potential. In some cases, poor infrastructure and inadequate information system result to poor bargaining position on the part of the bamboo producers and users. The resulting price structure is such that (a) the farm price is very low with little incentive for farmers to expand production, (b) the user price is quite high which increases production cost and limits competitiveness, and (c) the marketing margin is large which could be due to high profit and/or high marketing cost of middlemen.

Due to ineffective linkage (which may arise due to poor infrastructure and information system) between sellers and buyers, there are localized cases of deficits and surpluses (demand-supply mismatch) or extremely high and low prices. This applies to both raw materials and semi-finished or finished products. Thus, there is a problem of market access particularly for small producers while some exporters are unable to meet purchase orders due to limited availability of quality raw materials and skilled labor. There are also cases of delays in transport of raw materials and products due to malpractices of local and traffic officials which increases transaction and business cost.

Small producers are constrained to expand their scale of operation for lack of operating capital even if labor, raw materials and markets are available in the area. While informal markets are accessible, the interest rate is quite high. On the other hand, their access to formal credit sources is constrained by lack of information or stringent bank requirements.

There are also a number of factors that pose as threats to the industry. Inefficient producers will be adversely affected by stiff competition whether in domestic or export market in view of globalization and trade liberalization trends. High-cost producers would end up closing their shops while low-cost producers may find themselves enlarging their market share. The pressure will be felt by those unable to adopt productivity-enhancing measures and those caught up in raw material shortages.

With import liberalization, there will be greater entry from other countries of substitute products (furniture, gifts, toys, housewares, construction materials such as panel boards, etc.) and raw materials such as wood and others that would allow more domestic production and availability of substitute products.

Domestic problems such as labor-management disputes; clamor for higher wages without adequate productivity growth; and implementation constraints related to development of infrastructure, power, and telecommunication system can contribute to the slow development of the bamboo industry. Conflicts between labor and management adversely affect production schedules and can lead to loss of markets. Higher wages unmatched by productivity growth increases production cost and limits competitiveness through higher prices. Poor infrastructure and power failure turn off business partners and limit business opportunities.

At the industry level, the lack of organization and coordination among the various subsectors does not provide the opportunity for coming up with an agenda for action that would spur development of the industry. Such individualistic attitude can work against efforts to increase the aggregate level of demand for bamboo products.

Unfavorable market developments such as what happened to the banana industry which led to the decline in demand for propping materials can dampen development initiatives by the industry. Even political uncertainties with trading partners can threaten the country's market development efforts.

Table 5.1.1. Strengths, weaknesses, opportunities and threats relating to proper resource management

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
1. Growing trend on bamboo plantation development both in private and government sectors	1. Absence of updated and comprehensive data base of bamboo stands	1. Recognized potential contribution to the national afforestation effort	1. Plantation development is subject to government policy changes
2. Several varieties of bamboo species available for planting	2. Integrated program for plantation development is non-existent	2. Enhanced environmental consciousness in the country	2. Gregarious flowering of some bamboo species
3. Readily available technologies on propagation and plantation establishment	3. At present, only few species are commercially used	3. Large tracts of idle, marginal and unproductive lands available for plantation development	3. Very adverse climatic and environmental condition (drought, typhoons)
4. Bamboo as a crop is socially and traditionally acceptable and environmentally beneficial	4. Insufficient information on bamboo plantation management and harvesting regimes	4. Bamboo plantation development is economically viable and environmentally sound	4. Pest and diseases
5. Bamboo considered as one of the DENR's reforestation species	5. Dissemination of available production technologies not very effective	5. Bamboo can be integrated under existing tenurial arrangements of DENR (e.g. CBFM) wherein upland communities are considered partners for plantation development	5. Indiscriminate harvesting and poor management of bamboo resources
6. Shorter growing period and cheaper long-term production cost compared with tree species	6. No definite land use allocation policy for bamboo		6. Peace and order problem in some areas
7. Existing R and D initiatives on bamboo production and plantation management	7. Bamboo farming not considered as business endeavor		
	8. Open access to bamboo natural stands		
	9. Insufficient incentives for plantation development		

Table 5.2.1. Strengths, weaknesses, opportunities and threats relating to technology development, promotion and commercialization

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
1. Readily available R & D on basic and applied working properties and characteristics of bamboo for furniture, handicrafts and construction purposes. 2. Expected assurance and stability of raw material supply due to DENR's effort 3. Direct access to the expertise and consultative services of training centers like CITC, PDDCP, PTTC, TLRC and NGOs. 4. Existing system of technology transfer for bamboo utilization technologies 5. Available technology and previous experience on pulp and paper production 6. Available preservation technology and actual use in fishing industry and propping materials 7. Available technologies on panel board production	1. Limited awareness on the basic properties and characteristics of bamboo as a material 2. Seasonality of demand for furniture/ handicraft manufacture 3. Poor harvesting practices that result to low quality products due to attack of biodeteriorating agents like "bok-bok" and fungal growth. 4. Product designs copied from magazines and catalogues and customers specifications only show the dimensions of appearance and do not include the process and techniques of production. 5. Lack of quality control on finished products 6. Small enterprises very seldom engaged in R and D undertaking due to market risk and cost involved. 7. Skills acquisition is still through the traditional method of learning-by-experience via the master apprentice relationships. 8. Scarcity of skills development programs related to designing, carpentry and finishing of products, etc. 9. Professional help on product design too costly for SMEs 10. Limited access to efficient equipment/ machineries especially among SMEs 11. Unsustainable supply of poles for pulp and paper making and panel board manufacture	1. CITC's Bamboo Craft Development Program provides the skills training to upgrade quality of craftsmanship common facility servicing, and consultancy services 2. Potential for forming associations which can organize training and trade fairs, lobby for policy reforms and provide marketing and production information. 3. Improved communication system, specifically DTI. 4. Government agencies and NGOs extend assistance on design, provide common service facilities and extend loans. 5. Assistance provided by FPRDI on preservation, finishing methods and product promotions 6. Filipino ingenuity on design and workmanship	1. Indiscriminate felling of bamboo will affect the sustainable supply of raw materials for the different industry sectors. 2. Improper bamboo preservation and treatment techniques affect quality of the products intended for both local consumption and foreign market. 3. Peace and order situation in the area of manufacture. 4. Very adverse climatic and environmental conditions (typhoons, drought). 5. Limited public acceptance of bamboo as a material. 6. Pirating of skilled labor by competing countries

Table 5.3.1 Strengths, weaknesses, opportunities and threats relating to market development

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
1. Strong/sufficient demand - increasing export - existing traditional uses - growing demand for high-quality furniture 2. Available labor for training and skills improvement 3. Adequate business/ marketing experience 4. Adequate capacity for exporters and larger firms/ corporations 5. Feasible sub-contracting arrangements 6. Feasible purchase order arrangements 7. Can easily be integrated with rattan and wood based enterprises 8. Bamboo products already acceptable in world market 9. Favorable export promotion policies	1. Perception that bamboo is still a poor man's timber/minor forest product 2. Limited product development and design 3. Poor quality of raw materials that affect product quality 4. Limited promotional efforts and access to trade fairs and exhibits 5.Unorganized marketing system that results to mismatch of demand and supply 6. Ineffective linkage between sellers and buyers due to insufficient information/market intelligence 7. Malpractices in bamboo transport that increase cost and causes delay 8. Poor infrastructure causing problems in sourcing raw materials 9. Inadequate credit for manufacturing and trading	1. Growing awareness of the international community on the importance of bamboo and other NTFPs 2. Increasing attention given by government agencies (DTI, DENR, LGUs) 3. Increasing preferences for products using environment-friendly raw materials 4. Increasing global trade of bamboo 5. Increasing world market access due to WTO, AFTA, APEC and other trade agreements 6. Greater access to imported inputs and equipment due to trade liberalization 7. Improving economic performance of the country and increasing purchasing power of consumers 8. Increasing attention of government on infrastructure development 9. Philippines being known for superior craftsmanship in rattan/wood furniture and handicraft 10. Promotion of cooperative marketing arrangements	1. Growing market competition 2. Entry of cheaper imported substitutes 3. Labor management problem 4. Pressure for increasing wages 5. Implementation problem in infrastructure, power and communication system development 6. Lack of organization and coordination in the industry and among firms 7. Unfavorable world market developments and political uncertainties

6.0 STRENGTHS AND OPPORTUNITIES

6.1 Bamboo Resources and Production

One of the strengths of the bamboo industry is that while there is a felt shortage of bamboo raw materials in some localized areas, it seems that the resource base is broad enough to support the present needs if it can be properly managed. The growing trend on bamboo plantation development also offers a bright prospect for the industry (Table 5.1.1). The wide array of existing varieties of bamboo species of bamboo growing in the country provides several choices of alternative bamboo species suitable for different sites and potential uses. At present, there is an estimate of about 2 million hectares of grasslands and degraded areas in the country which could be rehabilitated and made productive if planted to bamboo. Being a reforestation species, bamboo is socially and traditionally acceptable and can be integrated under the existing DENR tenurial arrangement of CBFM. The short growing period of bamboo and cheaper long-term production compared with other forest tree species make it economically viable. Its massive root system makes it ideal for soil erosion control, riverbank stabilization and watershed rehabilitation thus making it a suitable species for environmental management.

6.2 Processing and Utilization in Various Industries

The readily available R&D and existing system of technology transfer for bamboo utilization technologies are strengths of the bamboo industry (Table 5.2.1). This includes available technology and previous experience on pulp and paper production. Available preservation technology such as the HPSD was actually used to treat bamboo poles for fish pens and as banana props.

Bamboo board (sawali board) manufacture is being piloted in Bacolod. Plyboo manufacture was started in Abra and plyboard in Iloilo.

With regard to the furniture and handicraft industries, CITC's Bamboo Craft Development Program provides skills training to upgrade quality of craftsmanship, common facility servicing, and consultancy services. Other government agencies and NGOs extend assistance on design, extend loans, preservation, finishing methods and product promotions. The bamboo industries themselves form associations/ organizations which can organize training and trade fairs, lobby for policy reforms and provide marketing and production information

Shrinkage of the forest area, coupled with increasing demand and over-exploitation is depleting the bamboo wealth. This is a matter of serious concern, particularly for the poorer folks who depend solely on bamboo for their livelihood and who cannot compete with large organized industries for their raw material. DENR's efforts on research on the cultural and agronomic techniques can boost bamboo production so that raw material in sufficient quantity can be made available to farmers, rural households and large industries.

6.3 Marketing and Trade

Table 5.3.1 also presents the strengths and opportunities which the industry can take advantage of in pursuing development options and interventions.

The strengths of the industry are seen in terms of the following: market demand, availability of labor whose skills can be developed, management experience of firms, available productive capacity especially for large firms, diversification, feasible production and marketing arrangements, and favorable trade policy environment.

Bamboo has strong market potential as can be gleaned from the growing export market, acceptability of Philippine bamboo products in the world market, the large (and growing) domestic market both for traditional uses and high quality finished products. Such potential demand, however, should be translated in terms of effective and realized demand through more aggressive market development efforts.

The industry also appears to have the ability to respond to increases in market demand due to adequate business experience of firms and productive capacity. Exporters are well experienced in the trading business and Filipino firms are able to deal effectively with foreign partners. Moreover, the Philippines is known worldwide for its superior craftsmanship in rattan and wood-based furniture and handicraft and such image can also be developed for bamboo products with greater emphasis on quality control.

Large firms also have some free capacities which can be enhanced in terms of availability of workers who can easily be trained (as they have adequate schooling) as well as feasible subcontracting arrangements in case physical in-house capacity becomes limited. This allows for feasible purchase order arrangements, an alternative to continuous production system.

Furniture and handicraft firms are also diversified in terms of products, raw materials being used, and markets. Thus, bamboo can easily be integrated into rattan, buri and wood-based production and marketing systems. This allows fuller utilization of productive capacities and spreading of risks and costs.

The development of the industry is enhanced by favorable trade policies particularly the export-led growth strategy based on international competitiveness being pursued by the government.

Market opportunities and prospects also seem to favor the development of the bamboo industry. In recent years, the international community has become keen on the importance of bamboo as source of employment and income for dependent sectors and its significant contribution to environmental protection and biodiversity. This is happening in the local economy as well with increasing attention being given by the government and NGOs particularly among environmentalists who promote bamboo planting for its ecological function and consumption of products which utilize environment-friendly raw materials.

As presented earlier, global trade of bamboo is growing and the Philippines should be able to get a good share of the expanding bamboo market. This market expansion is expected to be further enhanced by greater market access resulting from trade agreements among countries such as the WTO, AFTA and APEC.

With globalization and trade liberalization, access to imported inputs (varnish, leather, glues and adhesives) and machineries and equipment can also be improved. Such access can enhance technology adoption which is essential to productivity improvement.

Other positive developments support the development of the bamboo industry. These are the improving economic performance of the country which translates into higher purchasing power of consumers and favorable image of the Philippines in the international community; increasing attention being given by the government in infrastructure development which has a direct effect in attracting foreign investments and partners; and improving information technology and communication systems which can lead to more efficient trading and marketing both in local and international markets. Higher income can stimulate demand for good quality products and provide scope for consumers to pay attention to aesthetic and environmental values of bamboo products. Their willingness-to-pay for such products even at a higher price can be enhanced. Trading and business deals and acquisition of market information as well as technology is facilitated through the Internet and other modern communication systems.

At the local level, the promotion of cooperative marketing arrangements which have started even in the bamboo industry provides scope for bulk marketing of raw materials and finished products. This can lower cost and enhance the participation of small producers through improvement in their bargaining power in both input and product markets.

7.0 THE PLAN

7.1 Vision and Development Thrust

A progressive, productive, dynamic and globally competitive bamboo industry with a sustainable resource base propelled by organized and coordinated efforts of private entrepreneurs doing profitable business and equitably sharing the benefits therefrom.

7.2 Development Goals and Objectives

Goal: To make the bamboo industry a sustainable source of income and employment of dependent sectors and a significant contributor to the country's foreign exchange revenues.

Objectives: Relative to the vision and goal, the Plan should address the following:

(a) Sustainable supply of bamboo resources for meeting the raw material needs of the industry;

(b) Maximum contribution of bamboo in environmental protection and biodiversity;

(c) Higher efficiency and productivity in the production of bamboo products for meeting domestic needs and expansion and diversification of bamboo exports;

(d) Favorable policy environment for the sustainable development of the bamboo industry;

(e) Organized, cohesive and united bamboo sector; and

(f) Equitable sharing of development costs, risks, responsibilities and benefits therefrom and higher income for the disadvantaged and marginalized bamboo subsectors.

7.3 Development Framework

The Bamboo Master Plan framework must be consistent with that of the Philippine Medium-Term Development Plan (1993-98) which focuses on agro-industrial development and is anchored on the following objectives:

- industrial restructuring for world competitiveness and expanded production of goods and services for the domestic and export markets including tourism

- strong productive and ecologically-sound links between agriculture, fisheries and forestry; and industry

- higher income and productivity, and better access to resources among small entrepreneurs, farmers and fishermen.

Given the current trends of globalization, trade liberalization, outward business orientation, industrialization, and environmental sustainability, it is safe to assume that the country's present economic development framework could apply in the next 10-20 years. Thus, it can be adopted for the Bamboo Master Plan.

Because international competitiveness is a key development thrust, the Plan must be based on its basic foundations and determinants. These are described below.[1]

Basic Foundations of International Competitiveness

- Productivity of bamboo resources - the growth rate of bamboo resources must keep pace with its rising utilization rate, the latter being based on effective management and efficient use and allocation of bamboo resources among competing uses and industries.

- Efficacy - refers to the efficiency and effectiveness of implementation of government policies (macroeconomic and sectoral) and support institutions in order to reduce cost of doing business; this requires improvement in infrastructure, streamlining of government procedures, more responsive government bureaucracy, and greater congruence among government policies for clarity of interpretation and firmer implementation.

- Innovation - applies to (a) bamboo raw material production and utilization/manufacturing techniques (both process and product), (b) capital equipment/machines, and (c) people and institutions in terms of management and coordination within firms and for the industry as a whole.

- Values - refers to people's valuation system such as drive for education and training; openness to science and technology; improving work ethics, attitudes and habits; outward orientation vis-a-vis the rest of the world, etc.

[1] As elaborated in "A Framework for Agro-Industrial Restructuring for International Competitiveness", Philippine Institute for Development Studies (PIDS), Makati City, Philippines

Key Determinants of International Competitiveness

- Factor conditions - refers to quantity, quality, growth, skills, accessibility, costs and capital requirements of productive factors for raw material production, intermediate and final products manufacturing, and trading activities.

- Technology - focuses on the rate and nature of technology generation, adaptation, transfer and diffusion; and enhancing the country's stock of scientific and technical knowledge in both government and private institutions including individual firms/entrepreneurs.

- Policies - includes both macroeconomic and sectoral policies that are conducive for the sustainable development of the bamboo industry (or at least they should not create a bias against the bamboo sector).

- Support systems - concerned on the need for favorable institutions and mechanisms in both government and private sectors involved in technology generation and dissemination; product development; domestic marketing and international trade; access to financial resources; and development of transport infrastructure, electric power and telecommunications.

7.4 Strategic Directions

Given the development vision, goals, objectives and Philippine economic development framework vis-a-vis international competitiveness, the Bamboo Master Plan must focus on strategic directions based on the following principles:

- Market-led and market-created: Production must not only be based on present market demands and requirements but also on creation of demand for new products and those with great market potential.

- Private sector-led with broad-based participation of different subsectors and with minimum government interventions and subsidies: Development programs must be spearheaded by the active participation of the private sector (including POs and NGOs) with government support and public investments focused on infrastructure, government services, social preparation and essential "public goods".

- Advanced technology-based: Production systems shall use advanced technologies for greater efficiency and productivity with sustained efforts for "technology leap-frogging".

- Liberalized trade-based: The industry will support trade commitments made through WTO, AFTA, APEC and other trade agreements and in the process take advantage of greater market access created through the same agreements.

- Transparency in program implementation: Transactions will be transparent for effective monitoring and evaluation achieved through strong and organized bamboo sector.

- Resources, information and technology sharing: Industry players shall share resources, information and technologies for a more expanded development base particularly to less advantaged subsectors in order to maximize benefits of public investments.

- Adoption of viable agribusiness and management approaches: Such include vertical and horizontal integration, contract arrangements, cooperative marketing, joint ventures/partnerships, farmer-end user linkages, etc.

Based on these principles, the strategic directions for the bamboo industry will be as follows:

- Proper resource management for the sustainable development of the bamboo resource consistent with the requirements of the industry and dependent communities, and environmental protection and biodiversity

- Market development and effective linkages between farm-level production and management systems (i.e. supply and input markets) and processing and utilization (i.e. demand and output markets).

- Continued pursuit of, and when necessary, refinements and reforms of macroeconomic and sectoral policies affecting the bamboo sector.

- Strengthening of institutional support structures and government-private sector coordination, both in the provision of support services and in the promotion of positive values for greater acceptability of, and enhanced demand for bamboo products both in domestic and export markets.

- Enhancing technology adoption and commercialization and accessing of needed equipment and skills focusing on product development consistent with the requirements of and opportunities present in target domestic and international markets.

- Continuing research and development in all aspects of the industry in response to dynamic changes in markets and to address medium and long term objectives.

The entire development framework for the Philippine bamboo industry is depicted in Figure 7.4.1. It shows that component programs comprising the strategic directions are intended to achieve structural and behavioral changes in the industry for the attainment of objectives relative to the vision of having a progressive, productive, dynamic and globally competitive bamboo industry able to contribute to the country's efforts of generating employment, income and foreign exchange on a sustainable basis. The component programs focus on 6 major strategic directions, namely; proper resource management, market development, technology adoption and commercialization, institutional development, policy reforms, and R&D.

The development framework is also seen in terms of interventions and support focused on the 4 subsystems comprising the bamboo agribusiness system (Figure 7.4.2)[2]. The subsystems include those on inputs, farm level bamboo production, processing and manufacturing, and marketing. These subsystems must all be market-oriented, that is, "producing for the market and economic value". In this sense, the true economic/social value of bamboo includes its ecological importance in environmental protection and promoting biodiversity. Figure 7.4.2 also highlights the support and feedback mechanisms between the 4 subsytems and needed interventions from both public and private sectors.

7.5 Development Scenarios and Growth Targets

7.5.1 Without intervention and development plan

Without any intervention in the bamboo industry, its future would simply depend on current situation and trends. The resource base will consist mainly of natural stands and limited plantations according to what can be developed by the public and private sectors. As there is no concerted plantation development effort vis-a-vis poor management of existing stands, the supply of raw materials cannot be expected to be sustainable. On the other hand, demand will primarily be in its traditional uses in agriculture, fishing, housing, furniture, handicraft with moderate growth expected due to increases in population, export of furniture and handicraft and possibly in the high-end market for housing components and furniture. With limited supply, market development is not expected to take off. The result is a low demand-supply equilibrium situation and a bamboo industry that is slow-growing with limited potential for generating income, employment and export revenues.

Table 7.5.1 depicts the scenario for the bamboo resource base in the next 10 years (1998-2007) without intervention. Supply will mainly come from domestic production since pole import has historically been insignificant. Domestic production will be about 38.01 million culms in 1998 which is expected to increase to 42.27 million culms in year 2007. The high

[2] Adopted from Clarete and Gonzales (1996). ADB Philippine Agricultural Study

estimate is 48.35 million culms in 1998 increasing to 54.03 million culms in year 2007. The increase in production is expected to come from the few plantations already established by the government through DENR and private sector. Moreover, it is assumed that the government will allow harvesting in its harvestable plantation areas. On the 6th year, it is expected that the DENR will increase its effort and establish more plantations at about 5% annual growth rate.

Table 7.5.2a shows the demand scenario given current uses of bamboo. Agriculture is expected be the major user of bamboo particularly the banana industry, other crops, and farm implements. While the demand by the banana industry is expected to decline due to use of preservative treatment in banana props and substitute propping materials, such is expected to be offset by increasing use in other agricultural crops including livestock and poultry. Demand by the fishing industry is based on existing hectarage of fishpens and mariculture and number of fishing boats. There is no expected increase in fishpen area due to environmental considerations. Bamboo furniture demand will largely be in the rural areas plus export which is expected to grow a little more than the current rate. Handicraft demand is also primarily for export. The optimistic annual export growth rate for furniture is 3% for 1999-2002 and 6% for 2003-2007. For handicraft, this is 15% for 1999-2002 and 20% for 2003-2007. Construction is mainly for rural housing with growth due to increase in population. The estimated demand in 1998 is 52.25 million culms which is expected to increase to 53.74 million culms in year 2007.

As the demand would be higher than the supply, there is an expected deficit of about 14.24 million culms in 1998 but this will narrow down until year 2003 with forthcoming harvests from previously established plantations (Table 7.5.3a). The deficit is expected to rise gradually thereafter at about 11.47 million culms in year 2007 due to assumed increase in export of furniture and handicraft. If the high supply estimates are considered, the deficit would be only 3.90 million culms in 1998 declining to only 290,000 culms in year 2007.

7.5.2 With intervention and development plan

The development plan for the bamboo industry reflects a high supply-demand equilibrium scenario and is based on the following agenda:

(a) at least maintain current uses in agriculture, fishing, domestic consumption of furniture/other household items, and rural housing with growth mainly due to population increase;

(b) create demand for and develop new products particularly pulp, plyboo, laminated floor board, plyboard and sawali board;

(c) expand export of furniture and handicraft through product and market diversification; and

(d) close the demand-supply gap through proper management of existing stands and development of new plantations by both government and private sectors.

Two development scenarios are presented in Tables 7.5.2b and 7.5.2c. The first one (Plan A) assumes (i) maintaining current uses; (ii) a conservative export volume growth for

furniture at 3%/year in 1999-2002 and 6%/year in 2003-2007 and for handicraft at 15%/year in 1999-2002 and 20%/year in 2003-2007; and (iii) commercial production of pulp, plyboo, plyboard, laminated floor board and sawali board starting year 2003, or five years after establishment of plantations intended to supply the requirements of new plants for these products. One plant for each product is envisioned each requiring 2,500 poles per day or 650,000 poles per year. On the third year of operation, the pole requirement is expected to increase at 10% per year. For pulp, a 5,000-ton capacity plant is to be established with annual requirement of 3.0 million culms. Due to increased demand, deficit is expected to be larger starting year 2003 when the new plants become operational, about 16.90 million culms increasing to 18.28 million culms in year 2007 (Table 7.5.3b).

The second scenario (Plan B) adopts the Plan A assumptions but a higher export growth is targeted, that is, 6%/year in 1999-2002 and 12%/year in 2003-2007 for furniture and 25% in 1999-2002 and 30%/year in 2003-2007 for handicraft. This is to be achieved through more aggressive efforts and support for export development leading to more diversified products and markets. Deficit is therefore expected to be even higher than in the first scenario with about 17.51 million culms in year 2003 reaching 20.38 million culms in year 2007 (Table 7.5.3c).

Figures 7.5.1a, 7.5.1b and 7.5.1c compare the demand-supply gaps in three scenarios, namely; (a) without intervention/development plan (the base case scenario), (b) with intervention/development plan A, and (c) with intervention/development plan B. The base case scenario is the low growth, low supply-demand equilibrium situation associated with limited potential for employment, income and export revenue generation. The other two scenarios reflect the high growth, high supply-demand equilibrium situation with great potential for generating employment, income and foreign exchange and for contributing to environmental protection and biodiversity. The gaps depicted in the graphs reflect the magnitude of plantation development and resource management needed to achieve equilibrium in all three cases. Clearly, more concerted, serious and directed effort from both the government and private sector is needed to achieve the high-growth development scenario envisioned for the bamboo industry. It goes without saying that development targets higher than those depicted in Plan A and Plan B must be matched by similar targets on the supply side, that is, more plantations and effective and efficient resource management.

Based on the expected yield of 1,000 culms per hectare of properly managed plantations, the required plantations to be established to support the industry would approximate the amount of deficit for each development scenario. Since integrated operations are envisioned for commercial production of new products for greater efficiency, plantations should be located where they are accessible for transport of poles to the plants. For plyboo, one option is to revive the existing plant in Abra. Plyboard can be produced in Iloilo while the plants for laminated floor board and *sawali* board can be located in Bacolod. It is in these areas that the technologies are currently being tried and where commercial production although in limited scale has been started. Plyboo, plyboard and *sawali* board are potential substitutes for plywood and lawanit while laminated floor board provides an alternative flooring material. R&D results also show the basic properties of these products being acceptable for intended purposes.

Plantations of appropriate species should be started in the first year of the planning period in order to obtain harvestable culms on the 6th year when the plants for the new products are expected to be operational. *Buho* is suggested for plyboo, *botong* for *sawali* board and *kauayan tinik* for the other products. The allocation of plantation hectarage could be as follows:

	Plan A	Plan B
For operational plants of new products	7,000 ha	7,000 ha
For other "demand centers"	11,000 ha	13,000 ha

7.5.3 Market Focus

The domestic market will remain the stronghold of the industry with major uses in agriculture, fishing, housing/construction, and other household uses including furniture. The traditional uses (derived demand) in agriculture and fishing industries are expected to remain strong due to development programs in these sectors resulting from increased population pressure and emphasis on high-value vegetable crops, livestock and poultry production, and aquaculture.

Use of bamboo as low-cost construction material in the rural areas may decline as the proportion of rural households declines over time but this is expected to be offset by increasing demand in urban residential houses and recreation facilities using high-cost bamboo-based architectural designs. This will be enhanced by the availability of bamboo products (floor and wall boards) as housing and construction components which are planned to be commercialized during the middle part of the planning period.

The growing environmental awareness coupled with people's increasing consideration of aesthetic and social values of bamboo both here and abroad will be a potential major area for promoting bamboo use in a rapidly growing economy. Similarly, while demand for the low-cost/quality bamboo furnishings may decline, increasing demand for high price/quality furnishings due to improving purchasing power is expected. Development of high quality bamboo products augurs well with the optimistic growth scenario for the local economy. Product development and promotion should therefore focus on the quality, environmental and aesthetic attributes of bamboo.

In the export market, the Philippines should continue to produce high quality furniture and handicraft (basketware, houseware) targeted for the middle and high-end markets but with a broad range of product designs. Export markets are already highly diversified at present - what is needed is to maintain and increase the volume of exports to these markets. This will require expanding the present level of production and adopting the optimal level of mechanization for achieving economies of scale, reducing cost and making price competitive; while at the same time maintaining a high level of craftsmanship for producing premium quality products.

With more aggressive and concerted export development efforts, export revenues from furniture and handicraft (including products other than furniture) are expected to grow at a much

higher rate than before. The expected export revenues in Table 7.5.4 corresponding to the Plan A and Plan B scenarios are based on the following annual growth rates:

	Plan A	Plan B
Year 1999-2002		
Furniture	10%	20%
Handicraft and others	10%	17%
Year 2003-2007		
Furniture	20%	25%
Handicraft and others	15%	20%

If these growth targets can be achieved, total export revenues could increase from US$32.17 million in 1998 to US$95.98 million and US$152.98 million in year 2007 under Plan A and Plan B scenarios, respectively. The behavior of export revenue targets for the 1998-2007 period is shown in Figure 7.5.2.

7.6 Agenda For Action

This section covers the specific programs and interventions that will be implemented during the planning period. Beyond the planning period, specific interventions may be continued or redirected to other concerns as market and industry developments require. Programs and interventions are classified as follows: (a) resource management; (b) technology development, promotion and commercialization; (c) market development; and (d) institutional and policy strengthening.

7.6.1 Bamboo Resource Management

7.6.1.1 National bamboo survey and inventory

This program aims to come up with updated and comprehensive information in order to ascertain the actual extent and distribution of bamboo resources in the country by species, location and nature of the bamboo stands (Table 7.6.1). The information to be generated by this survey can serve as a reliable basis for sustainable bamboo production resource planning and management. Another expected outputs of this project is a national bamboo resource map which could serve as a tool in monitoring the changes and dynamics of the bamboo stands in the country through time.

To facilitate and accelerate the implementation of this activity, the Secretaries of the DENR and DA will be requested to issue a memorandum to their respective field offices through the MAO and CENRO for a survey of bamboo stands in their respective areas of jurisdiction. The MAO of the DA shall be responsible for the survey of the bamboo stands found growing in private lands while the CENRO of the DENR will be responsible for the survey of bamboo stands in public lands. ERDB of DENR will be responsible for the collation and analysis of data.

This activity will have a duration of two years and will be undertaken in the first year of program implementation. It would require an estimated budget of P500,000.

7.6.1.2 Development of computerized database on bamboo production and management

This activity would involve the installation and development of an operational facility for a computerized data information system to provide ready access, storage and retrieval of all information related to bamboo resources, production and management. This database will be linked not only to the different regions in the country but also to various bamboo institutions and societies in the world through the computer international network. This will be continuing activity and would require an initial budget of P300,000 for the first year for hardware acquisition and development of database structure and P100,000 annually for its maintenance and operating expenses. This facility will be housed at ERDB-DENR or in the proposed National Bamboo Center (NBC) once it has been created.

7.6.1.3 Training and information dissemination

At present, there are several technologies readily available regarding bamboo propagation and plantation development which unfortunately have not reached the target clienteles due to inadequate and perhaps ineffective technology transfer and dissemination mechanism. This program is expected to address the said problem to accelerate transfer and adoption of appropriate technologies on bamboo propagation and management. It will involve conduct of training on bamboo farming and development of demo nurseries and pilot plantations in various identified demand centers. This will be supported by the production of information campaign materials for print, radio and if necessary for TV. Initially, five demonstration sites (nursery and plantation) will be established corresponding to the five sites where the proposed bamboo plants will be established. Appropriate training will be also provided to the participants of the project. This activity will be coordinated by the local DENR offices in the different regions. This project would require a budget of P3 million to implement.

7.6.1.4 Establishment of bamboo plantations

The various demand scenarios presented earlier clearly show that with or without the intervention and development plan, the projected demand for bamboo is higher than the projected supply. To address this demand and supply gap, a program for bamboo plantation development must be carried out starting in the first year of the program implementation. This is intended to support the needs of bamboo-dependent industries and the demand for environmental amelioration.

Bamboo plantations will be established in appropriate locations with the required hectarage to meet the needs in various demand centers. These bamboo production areas will be identified by the concerned sector of the industry where there are specific demands for bamboo poles.

Areas that are to be planted to bamboo primarily for environmental protection will be identified and delineated by the FMB of DENR or its Regional Units from existing unproductive, idle, marginal public lands and degraded areas including river banks and other erosion prone areas. These plantations will not be limited to its protection function but may also become additional bamboo production areas.

In order to assure the industry of stable raw material supply, the most optimistic scenario must be used as a gauge for plantation development program. This requires the establishment of about 20,000 ha of bamboo plantations to be phased during the first 3 years of the program as follows: 7,000 ha in the first year, 10,000 ha in the second year, and 3,000 ha in the third year. An area of 650 ha will be initially established in Iloilo and Abra to support the proposed plyboard and plyboo plant, respectively. In Bacolod, 1,250 ha will be established to support the raw material requirements of laminated *sawali* board and floor board plant. An additional 3,000 ha will be established in the first year to supply the raw material requirement of the proposed pulp mill. The remaining area of about 1,400 ha will be allocated to other demand centers which will be determined by other manufacturing sectors. The 7,000 ha plantation would require a total financial input of P250 million spread in five years costing about P126 million in the first year for establishment cost and the remaining amount for the maintenance cost during the next four years.

For the second year when the plantation operation shall been fully stabilized, an additional 10,000 ha will be established in other demand centers as identified and the remaining 4,000 ha will be established on the third year.

The total financial requirement to fully implement this program will be P 720 million spread in 7-year period.

7.6.1.5 Generation, pilot testing and verification of farm level technologies

To keep pace with technological development, a continuing R&D activities on bamboo production and management to generate and verify more efficient and effective technologies will be pursued during the entire development period. This activity will be carried out by the DENR research sector and other research institutions. The estimated financial requirement is P 1 million per year for 10 years.

7.6.2 Technology Development, Promotion and Commercialization

7.6.2.1 Productivity assessment of the bamboo using industry

This program aims to update and come up with comprehensive data and information on the extent of utilization of bamboo using industries including species-end use matching (Table 7.6.2). The major activities will include national/regional survey and interview of bamboo-using industries to generate data on the level of production technology, designs, waste management, marketing practices, human resource development needs, and problems and difficulties. The

generated information will serve as bases for planning activities, e.g., manpower training, research and development, and other bamboo related activities. The information will also serve as important inputs for database development. The expected impact of this program include improved quality and productivity and competitiveness in the world market.

These activities can be jointly spearheaded by DTI and DOST through their regional/provincial offices in cooperation with the DENR, LGUs and industry associations.

7.6.2.2 Manpower training/skill upgrading

Since the application of technological advances in bamboo processing is still low, the program aims to: (a) develop/upgrade manpower capability of bamboo processors; (b) come up with standardized training program; (c) determine product lines including designs suitable for bamboo species available in the area/community; and (d) determine appropriate tooling and equipment configuration and fabrication. The major activities will include analysis of training needs, identification and preparation of experts directory, preparation of standard modules, learning elements and trainors' manual, and actual conduct of training and skills upgrading of industry manpower and trainors. These activities will generate, among others, directory of experts, standard training modules and manuals, and ultimately, trained/upgraded manpower and improved training capability that will enhance productivity, product quality, and competitiveness.

Training institutions under DTI (CITC, TESDA) can spearhead this program in cooperation with DOST, DECS, LGUs, SCUs, and the industry.

7.6.2.3 R&D on product development, designs and other identified technological gaps

The thrust and focus of research and development will be on the development of new competitive products, processes, designs and/or improvement of existing ones. It also aims to develop strong linkage between government and industry in the planning, formulation, implementation, and resource sharing in R&D projects and programs. Among the R&D areas that need attention include formulation of environment-friendly preservative, development of test standards for bamboo and bamboo products, jointing/fastening systems in construction, development/improvement of panelboard products , product designs, architect-designed houses, and development/improvement of other bamboo products.

DOST through its sectoral councils (PCARRD, PCIERD) and RDI (FPRDI) can take the lead in these activities in cooperation with CITC, PDDCP, SCUs and the industry.

7.6.2.4 Massive information campaign/technotransfer on bamboo technologies

This program will include Technology and Investment Forum and the establishment of One-Stop Information Centers. It aims to develop appreciation and awareness among existing and would-be entrepreneurs on bamboo processing. The activities will include the conduct of national, regional, provincial and local fora; identification of potential OSIC sites and/or linking

with existing OSICs; and production of information materials (e.g., pamphlets, how-to, sample products, video tape, etc.). These activities are expected to increase investments and the number of processors, traders, and consumers as well as availment of easy access to information on bamboo technologies at the municipal, provincial and regional levels.

DOST and DTI can jointly undertake the activities through their concerned agencies and regional offices in cooperation with LGUs, NGOs, SCUs and the industry.

7.6.2.5 Commercialization of new bamboo products

The program aims to commercialize new bamboo products, e.g., plyboo, plyboard, *sawali* board and laminated board, and to generate financing schemes and incentives for marketable and highly demanded products. The major activities will include piloting and commercialization of the technology and linkaging with financial and banking institutions. Consequently, it is expected that commercial plants will be established thereby creating employment, higher per capita income, greater product diversity, and readily available financing.

DOST and DTI and its agencies can take the lead in these activities in coordination with LGUs, financing institutions (e.g., LBP, LDP), and the industry.

7.6.3 Market Development

7.6.3.1 Aggressive information campaign for bamboo

Since general awareness on bamboo and its present and potential uses is low, this program aims to develop appreciation for and enhance acceptability of bamboo both as a crop and product (Table 7.6.3). Thus, activities will include (a) development of reading materials (comics, brochures, etc.) that highlight bamboo information and its importance, (b) holding of essay writing and poster-making contests, (c) development and distribution of posters and calendars nationwide, (d) display, use and gift-giving of bamboo products (furniture, handcrafted items) in government offices including public schools, and (e) TV and print advertisements. Contests and advertisements may coincide with the celebration of a "Bamboo Week". It is expected that these activities will bring about high level of awareness among children and adults in both government and private sectors.

The DECS and PIA may be tapped in undertaking these activities while the Office of the President may advise government offices to use bamboo products for furnishings and gift-giving to visitors and guests.

7.6.3.2 Market identification and assessment

This aims to broaden the market base for bamboo products by identifying and assessing existing and potential markets. The major activities will include (a) mobilization of commercial attachés abroad to provide market intelligence reports on bamboo, (b) requiring DTI provincial

offices to provide the same reports, and (c) conducting rapid market appraisals/surveys to determine market requirements (volume, types/kinds of products including quality, terms of sale and payment), intentions to buy, and market potential of new products. It is expected that more market information will be generated which will the basis for planning other activities such as market linkaging and financing of feasible investments for commercialization of new products. Information will also form the basic inputs for database development.

These activities should be spearheaded by DTI and other offices under it and in coordination with DFA. LGUs and SCUs may assist in conducting local market appraisals and surveys.

7.6.3.3 Market linkaging/encounters

In order to provide actual meeting of buyers and sellers, various forms of market encounters should be undertaken. These could be during trade fairs and exhibits, bamboo meetings or conventions where large scale participation is possible or even between any firm/seller and a potential buyer at an appointed time and place. Sellers are thus able to show their products and indicate their supply potentials while buyers are able to actually see the bamboo products they intend to buy and express their requirements in terms of volume, quality and price.

Market encounters can be arranged by DTI-CITEM with the help of LGUs and the Bamboo Secretariat of the proposed National Bamboo Center (see implementation structure).

7.6.3.4 Market testing of new products

Before full commercialization of new products is undertaken, market testing is necessary to determine the degree of market acceptance for these products. This can be done through (a) sales in selected distribution outlets, (b) sending of brochures and free samples to prospective buyers, (c) displays during trade fairs and exhibits, and (d) adopting a feedback mechanism for determining acceptability and improvements to improve the products. More investments can thus be directed to products with a high degree of acceptability and large market potential.

These activities can be undertaken by CITEM and other agencies under DTI with active participation of LGUs and local offices.

7.6.3.5 Market information system (MIS) and networking

In order to effectively link all bamboo market participants and achieve efficient communication among them, there is a need to develop good databases which will provide up-to-date, adequate, timely, and reliable information on almost every aspect of the bamboo industry such as supply potentials, investment opportunities, market requirements, prices, export/import procedures, etc.

MIS development and networking activities may include (a) strengthening DENR's capability to gather and collate information on bamboo resources, (b) accessing international databases on bamboo, (c) membership to and linkages with international bamboo associations, (d) updating directory of bamboo firms including their product lines and supply potentials, (e) maintaining a Philippine bamboo homepage in the Internet, (f) regular annual bamboo meetings, and (g) maintaining an updated library of bamboo materials preferably in one place which is accessible to all users.

The Secretariat at the National Bamboo Center shall coordinate all MIS and networking activities with information inputs from all concerned.

7.6.3.6 Local and international trade fairs

In order to support market linkaging activities, there should be greater participation in trade fairs specific to bamboo among firms especially in key trading centers. Since SMEs have limited financial capability to join such fairs, feasible arrangements like provision of subsidies should be worked out. CITEM with full support of LGUs and local and national associations should lead these activities. International trade fairs should be coordinated with the DFA.

7.6.3.7 Trade missions

Key industry players may be tasked to undertake trade missions abroad in order to (a) gain more exposure to new bamboo products and designs, (b) search for new markets, (c) obtain fresh insights on mechanized and more efficient manufacturing methods as well as determine sources of cheaper machines and equipment, and (d) identify foreign partners for joint-venture activities.

The industry associations should identify people who will undertake these trade missions and coordinate with the DFA.

7.6.3.8 Development of market infrastructure

In order to facilitate buying and selling of bamboo raw materials, there is a need to put up buying stations in strategic areas readily accessible to producers, traders and manufacturers. These buying stations should include raw material treatment facilities and information booth on prices for different bamboo species and grades, buyers and sellers, available supply, and market requirements. These buying stations should be complemented by efficient road network.

These buying stations should be operated by LGUs with active participation and support of local cooperatives or associations of farmers and users.

7.6.4 Institutional and Policy Strengthening

7.6.4.1 Organization of bamboo industry association and bamboo society

There is a need to organize a Philippine Bamboo Industry Association since there is none at present. The main objective of the association is to pursue a united front on all aspects pertaining to the development and promotion of the industry. Membership can be drawn from existing organizations such as CFIP, PCHI, PhilExport, CCIP, local associations such as IFMA, and private individuals like propagators who do not currently belong to any association. The association's activities may include resource generation and management and providing support in MIS and information dissemination.

A Philippine Bamboo Society may also be organized to support policy studies and advocacy, maintain networking activities, and undertake R&D and market related studies including publication of bamboo journals and newsletters. Organization of such society may be initiated by academic institutions like SCUs.

7.6.4.2 Creation of a National Bamboo Center

In order to have a National Secretariat which will be in charge of the overall coordination of development activities for bamboo, a National Bamboo Center should be created. Initially, the Bamboo Division of CITC may be strengthened, reorganized, and provided additional budget to serve this purpose. Since such Center will be composed of various groups wherein the participation of different agencies is crucial, there is also a need to strengthen the capabilities of these agencies in order that they may be able to effectively perform their bamboo-related activities.

7.6.4.3 Development of bamboo-based cooperatives

Since cooperative development is a major thrust of the government for development activities, the same can be pursued for bamboo. Already, there are existing ones but most of them need further strengthening in terms of management capability, financial support, marketing assistance, and information on available incentives from the government. Cross visits to successful cooperatives can be done in order to encourage other members of the bamboo industry to similarly organize themselves and learn from such cooperatives. CDA is the main government agency responsible for organizing cooperatives.

7.6.4.4 Financing of bamboo investments and related activities

New and additional investments require financial support which may already be currently available through various schemes but are unknown to business enterprises particularly the SMEs. They should therefore be properly informed of such financing schemes on matters like how they can be availed of, the lending conditions, and other requirements. As usual, pre-investment and feasibility studies for various bamboo operations (e.g. plantation development,

trading, manufacturing) are needed before negotiations are made between borrowers and lending institutions.

7.6.4.5 LGU strengthening and commitment

Since many development activities will be done at the local level and therefore in coordination with LGUs, there should be a clear understanding of their role and responsibilities including commitment for funding and infrastructure development. A Bamboo Section may need to be established at the Provincial Capitol to coordinate all bamboo-related activities and disseminate information.

7.6.4.6 Policy analysis, advocacy and implementation

In order to provide a favorable policy environment for the bamboo industry, there is a need for continuing policy analysis and advocacy activities. Furthermore, there is a need to ensure that policies and implementing guidelines are properly enforced for the benefit of the bamboo industry. In general, policies should be supportive of making bamboo business profitable, increasing investments, promoting exports and properly managing bamboo resources.

Among the immediate policy studies that need to be undertaken are as follows: area delineation for bamboo plantation; revision of AAC formula; explicit integration of bamboo into CBFM and other community-based management schemes; and guidelines on harvesting, transport, import and export. SCUs may be tapped to undertake these studies with support from the industry and government agencies on data gathering.

7.7 Implementation Structure

In order to effectively implement the Master Plan, there is a need to have a coordinating office to be called the National Bamboo Center which will serve as the National Secretariat tasked to be the overall coordinator of all development activities for bamboo (Figure 7.7). This Center will be under the management of a Head who will be responsible to a Governing Body to be composed by representatives from key government agencies, industry and academe. Such body will have 7 members, one each from DTI, DENR and DOST, and two each from the Bamboo Industry Association and Philippine Bamboo Society. The last two entities will be organized as part of the Plan. Initially, the Bamboo Division of the CITC may be strengthened, reorganized and provided budget to become the National Bamboo Center. Currently, CITC has training facilities for bamboo including machines and equipment.

The National Bamboo Center will be composed of various groups corresponding to the strategic directions of the Plan, namely; (a) the Resource Management Group; (b) the Market Development Group; (c) the Technology Development, Promotion and Commercialization Group; (d) the Institutional Strengthening and Networking Group; and (e) the Studies, Publication and Policy Advocacy Group. Each group shall draw expertise and inputs from relevant agencies and institutions. For instance, the activities of the Market Development Group

shall be undertaken by agencies under DTI such as CITC, CITEM, BRTP, BDTP, BITR and PDDCP. The Resource Management Group shall be composed of people from ERDB, ERDS and FMB. The Technology Group will depend mainly on the inputs of FPRDI, TAPI, PCARRD and PCIERD. The Institutional Strengthening and Networking Group shall be composed of industry members including CDA and banking institutions which will provide organizing and banking support. The Studies, Publication and Policy Advocacy Group will undertake their activities through the SCUs and Industry Association. Although not listed, each group may seek the assistance of other agencies (DECS, LGUs, DFA, NSO, etc.) as their specific tasks so require. Moreover, it should be noted that there is interdependence among the different groups indicating the holistic and interdisciplinary nature of the Master Plan. As necessary, a Group may request members from other groups to participate in its planning and implementation activities as necessary.

Specific activities/ programs that will be implemented by each group will have to be approved by the Governing Body. Initially, this Body may be chaired by the CITC Executive Director. Subsequently, chairmanship may be determined on rotation basis.

7.8 Timetable of Master Plan Programs and Intervention

The duration of the Master Plan for bamboo is 10 years. Thereafter, it is assumed that the critical institutions would have already been in place and bamboo development activities can be undertaken with much less government intervention. The phasing of implementation of the proposed activities during the Master Plan period is shown in Table 7.8.1. Some activities need to be undertaken immediately and must be done before other activities can proceed. Some activities are continuing and should be done even beyond the planning period.

7.8.1 Resource Management

To fully attain the vision of sustainable bamboo resource base, all the proposed programs and interventions under bamboo resource management should be undertaken simultaneously in the first year of implementation of the Master Plan particularly plantation establishment, training and technology transfer aspects. Plantation development which should be carried out in the first three years of the program cannot be delayed if we have to ensure the raw material requirements of the proposed bamboo plant industries which are being envisioned to be operational on the 6th year of the program.

The other programs and interventions such as the national survey and inventory of bamboo, development of database and generation and verification of appropriate technologies are to be carried out even beyond the project duration. The output derived from these interventions would serve as a basis and inputs for decision making and planning for sustained and efficient management of bamboo resources in the country.

7.8.2 Technology Development, Promotion and Commercialization

Productivity assessment of the bamboo using industry

This program will bee implemented in year 1 and year 6 (every 5 years) covering the various bamboo producing regions of the country. It will involve about P1.0 million allocation to cover supplies and materials, travel, and personal services of research assistants.

Manpower training/skill upgrading

The activities under this program will be continuing to be conducted quarterly. This will require a yearly budget of about P870,000 or a total of P8.7 million for 10 years. The bulk of expenses will be in the preparation and printing of training materials plus the acquisition of essential training facilities and equipment.

R&D on product development, design and identified technology gaps

An amount of P 1.0 million per year is a conservative estimate for 10 projects (about P100,000 per project). Technology generation and development is a continuing activity requiring about P10 million for the duration of the Master Plan period of 10 years.

Massive information campaign/technotransfer of bamboo technologies

This continuing activity requires an appropriation of about P 250,000 per year to cover production/printing of information materials including MOE of identified OSICs plus incidental expenses in the conduct of fora.

Commercialization of new bamboo products

This program is also a continuing activity involving piloting and commercialization and linking with financial and banking institutions. A yearly budget of about P 250,000 is required in these activities.

7.8.3 Market Development

Aggressive information campaign

This should be a continuing activity in order to raise the level and awareness of the general public on the importance of bamboo. The various activities will require at least P200,000 per year or P2.0 million in 10 years.

Market identification and assessment

At least three major market surveys or rapid market appraisals should be conducted during the 10-year period, on the 1st, 4th and 7th year. Results of each market survey will be the basis of planning detailed marketing strategies and will provide inputs for building/updating the database. Since the DTI provincial offices are expected to provide assistance during surveys, the cost is estimated at P500,000 per year or P1.5 million for the three surveys.

Market linkage/encounters and trade fairs

This can be done every two years. About P600,000 is budgeted each year for a total of P3.0 million during the 10-year period. Feasible cost sharing schemes can be developed for participants of these activities.

Market testing of new products

This shall be conducted twice, on the 3rd and 6th year to support development of new products. About P400,000 will be required for this activitiy.

MIS and networking

This is a continuing activity and will consolidate outputs of similar activities under Resource Management and Technology Development, Promotion, and Commercialization. P250,000 is budgeted each year or P2.5 million in 10 years.

Trade missions

This will be conducted every three years beginning on the 1st year. P500,000 is allocated each year for this activity for a total of P1.5 million during the 10-year period.

Establishment of bamboo buying stations

Four buying stations to be located in major producing areas are proposed to be established within the first three years. Each buying station is estimated to cost P1.0 million for a total of P4.0 million.

7.8.4 Policy and Institutional Strengthening

Organization of a national bamboo industry association and a national bamboo society

This should be done on the 1st year since the bamboo association and the bamboo society are expected to be actively involved in the implementation of the Master Plan. This will entail a cost of about P200,000.

Creation of a National Bamboo Center

This is also to be done on the 1st year and is expected to operate with a budget of about P2.0 million per year of P20 million in 10 years.

Development of bamboo-based cooperatives

This is a continuing activity for developing new and strengthening existing cooperatives. P100,000 per year is budgeted or P1.0 million in 10 years. The cost of support services shall be integrated in the budget of relevant agencies.

Financing of integrated production, marketing and processing projects

The main cost budgeted here is for the preparation of feasibility studies at about P250,000 per study or a total of P2.0 million for 8 studies. Conduct of these studies should be done within the first four years of the Master Plan implementation.

Policy analysis, advocacy and implementation

Policy studies are estimated to cost P300,000 per study or a total of P1.5 million for five studies. These studies should be conducted within the first two years of implementation of the Plan.

7.9 Indicative Cost of the Master Plan Activities

Implementation of the Plan is estimated to cost about P799 million for a period of 10 years. This budget is allocated among the different component programs and as shown below, the bulk is to be incurred for the resource management program. Specifically, this is for the establishment of bamboo plantations costing P720 million.

Program	Cost (P million)	Percent
Resource Management	734.75	91.95
Technology Development, Promotion and Commercialization	24.70	3.09
Market Development	14.90	1.87
Policy and Institutional Strengthening	24.70	3.09
	799.05	**100.00**

235

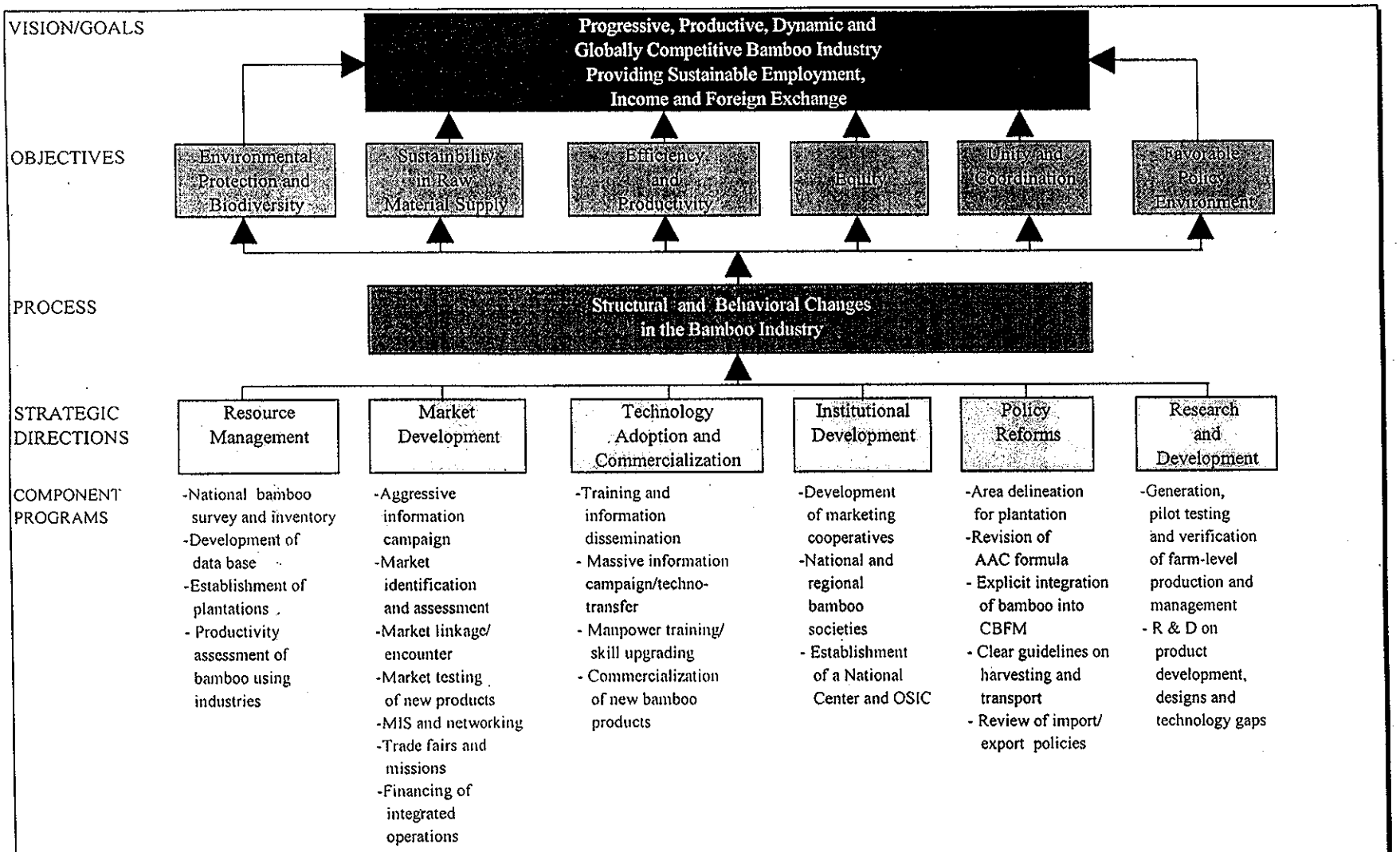

Figure 7.4.1. Development Framework for the Philippine Bamboo Industry

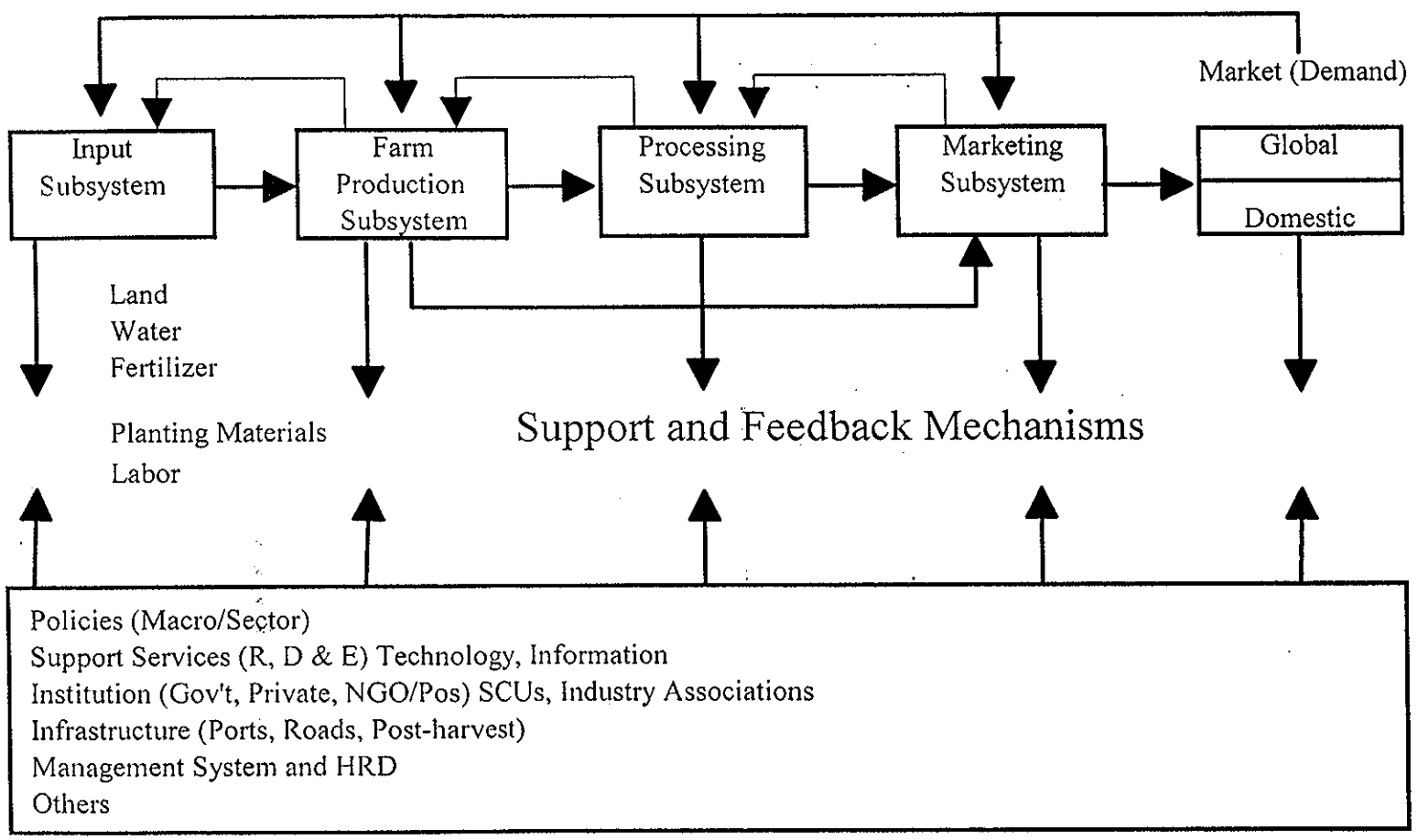

Figure 7.4.2. Bamboo agribusiness system within the context of socio-economic and physical environment

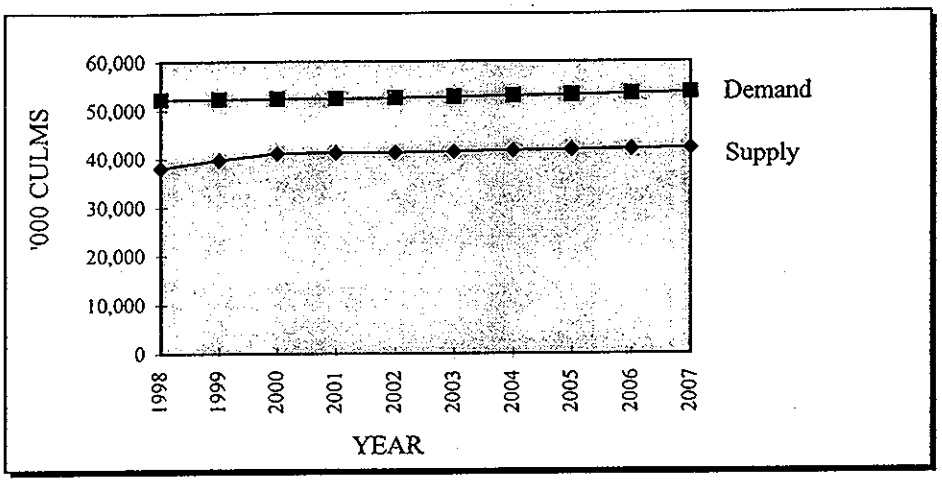

Figure 7.5.1a. Supply and- demand gap for Philippine bamboo, base case scenario

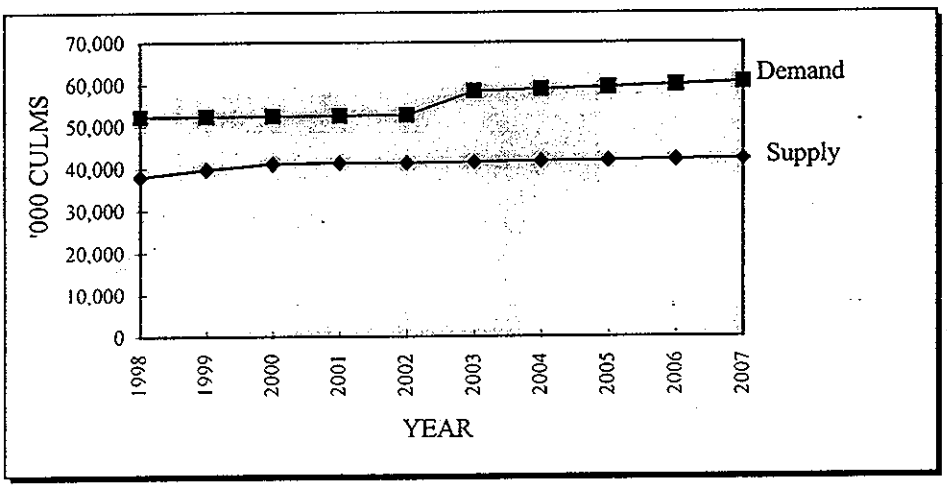

Figure 7.5.1b. Supply-demand gap for Philippine bamboo, Plan A scenario

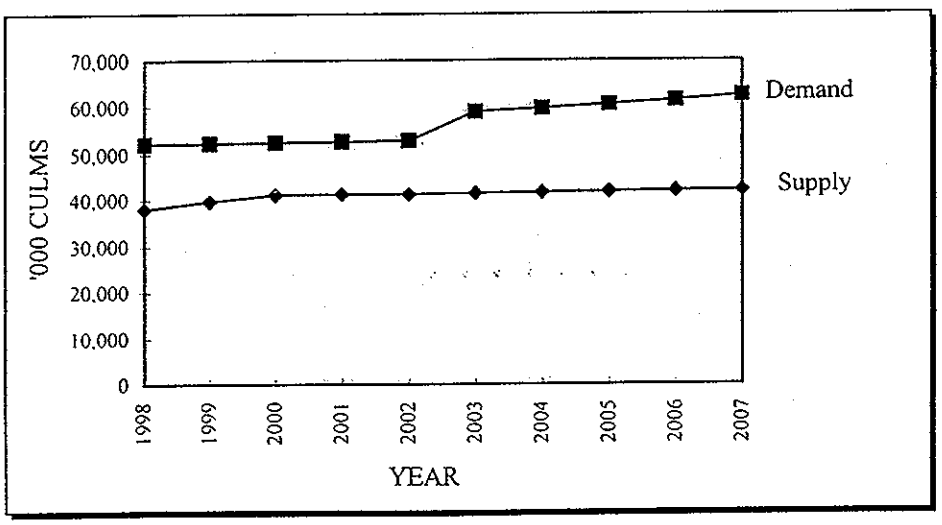

Figure 7.5.1c. Supply-demand gap for Philippine bamboo, Plan B scenario

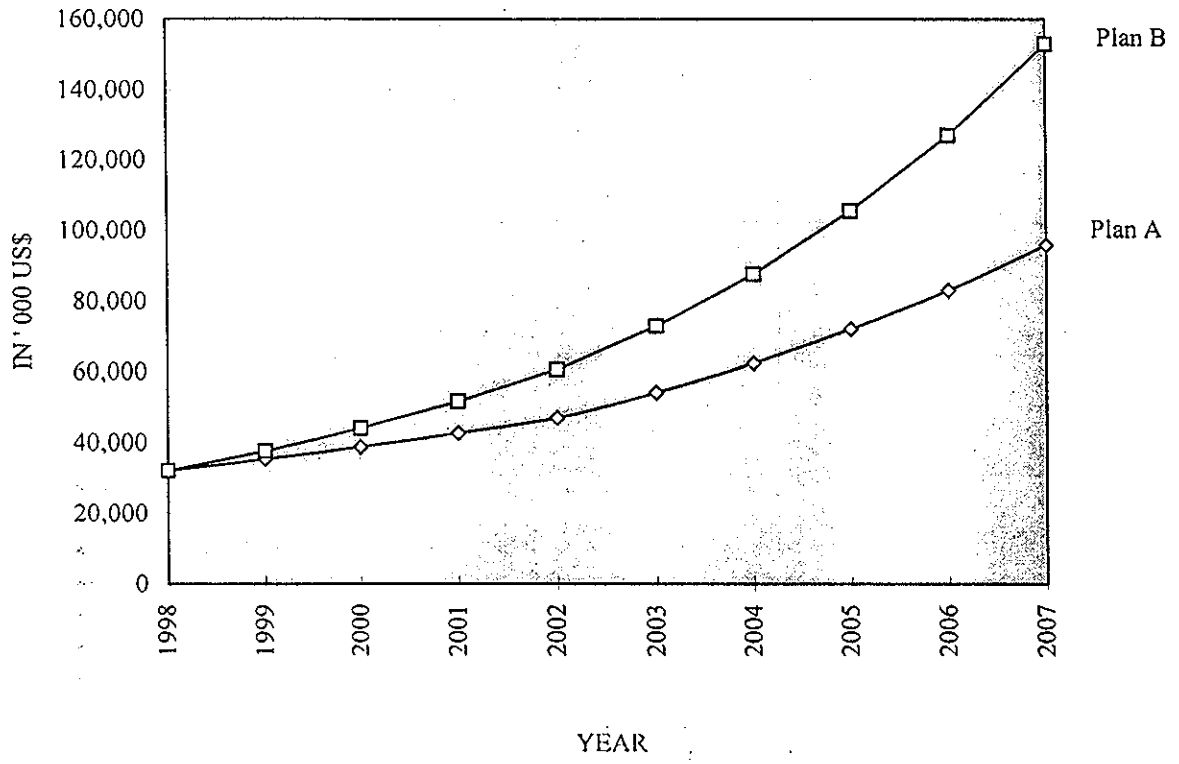

Figure 7.5.2. Export revenue targets under Plan A and Plan B Scenarios

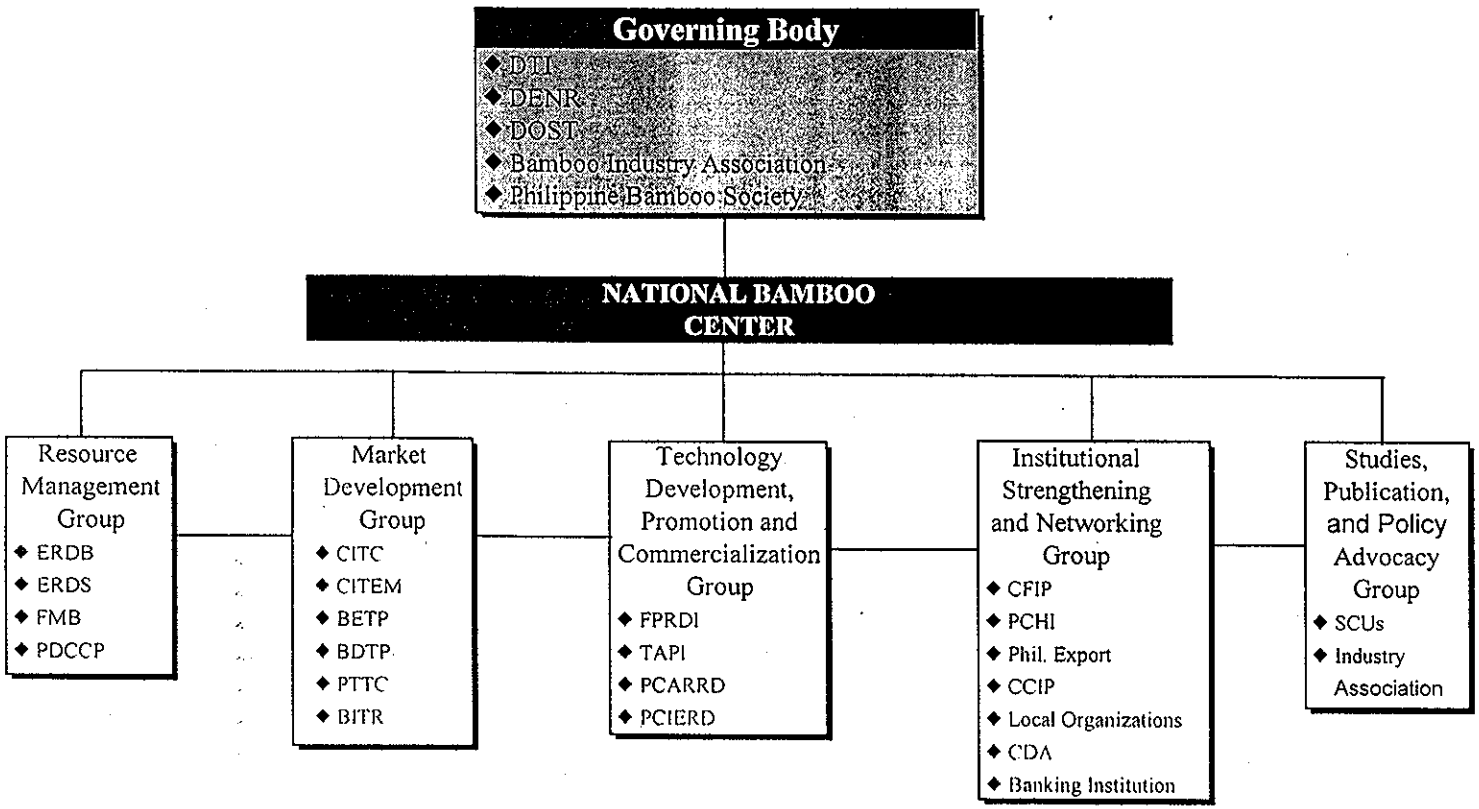

Figure 7.6. Implementation Structure for the Bamboo Master Plan

Table 7.5.1. Projected supply (domestic production and imports) of bamboo ('000 culms), Philippines, 1998-2007 (without intervention)

YEAR	DOMESTIC PRODUCTION a/	
	Average	High
1998	38,009	48,347
1999	39,686	50,583
2000	41,120	52,495
2001	41,279	52,708
2002	41,279	52,708
2003	41,477	52,972
2004	41,673	53,235
2005	41,871	53,499
2006	42,068	53,762
2007	42,265	54,026

a/ Consists of commercially utilizable bamboo species in the forestland, "natural forest" and government and private plantations

Note: Minimal imports of only 15.40 tons per year, on the average, during the 1981-1995 period, hence not included in estimation of total supply

Assumptions:

(1) 1998 production will come from forestland, natural stands and harvestable private plantations only

(2) 1999 production will come from forestland, natural stands and private and government plantations assuming that harvesting in government plantations will already be allowed

(3) 2000-2001 increase in production due to new harvest from harvestable areas of mature plantations earlier established

(4) 2003-2007 production based on 5% annual increase in bamboo plantation development both by government and private sectors starting 1998

Table 7.5.2a. Projected demand for bamboo by industry, Philippines, 1998-2007 (without intervention)

Year	Agriculture a/	Fishing a/	Furniture b/	Handicraft c/	Construction a/	TOTAL
1998	37,800	3,760	3,173	186	7,327	52,247
1999	37,800	3,760	3,225	214	7,327	52,326
2000	37,800	3,760	3,277	247	7,327	52,411
2001	37,800	3,760	3,332	284	7,327	52,502
2002	37,800	3,760	3,388	326	7,327	52,601
2003	37,800	3,760	3,503	391	7,327	52,781
2004	37,800	3,760	3,625	470	7,327	52,982
2005	37,800	3,760	3,755	563	7,327	53,205
2006	37,800	3,760	3,892	676	7,327	53,455
2007	37,800	3,760	4,038	811	7,327	53,736

a/ domestic demand
b/ domestic and export demand
c/ export demand

Assumptions:

(1) Agriculture - for banana plantations in Davao covering 24,000 ha, 5% breakage; declining demand for bamboo props due to use of preservative treatment and substitution to use of alternative propping materials is offset by increasing use in other agricultural crops and farm implements, hence constant

(2) Fishing - based on 1995 Philippine Fisheries Profile (BFAR, 1995), i.e., 6,000 ha fishpen, 610 ha mariculture, and 500,000 units of motorized and non-motorized boats; no expansion in fishpen area due to environmental consideration

(3) Furniture - total population growth rate is 2%/year, 50% of population is rural for 1998-2002 and 45% for 2003-2007, 8 members per household, 30% of rural households use bamboo furniture and other items made of bamboo, 5 culms/household, replacement is every 5 years, total use for 10 years considering replacement is over 10 years equally spread on an annual basis; for export, culm requirement is based on 1996 export volume for furniture and related items, growth of export is 3%/year for 1999-2002 and 6%/year for 2003-2007

(4) Handicraft - based on 1996 export volume of basket and basketwares and related items (25% of total export since others are made of rattan and other materials), growth is 15%/year for 1999-2002 and 20%/year for 2003-2007

(5) Construction - for rural housing only, 30% of rural households have housing units partially or wholly made of light materials, 25 culms/housing unit, see other assumptions in (3)

Table 7.5.2b. Projected demand for bamboo by industry including other bamboo products(in '000 culms), Plan A scenario, Philippines, 1998-2007

Year	Agriculture a/	Fishing a/	Furniture b/	Handicraft c/	Construction a/	Pulp a/	Other Products a/	TOTAL
1998	37,800	3,760	3,173	186	7,327			52,247
1999	37,800	3,760	3,225	214	7,327			52,326
2000	37,800	3,760	3,277	247	7,327			52,411
2001	37,800	3,760	3,332	284	7,327			52,502
2002	37,800	3,760	3,388	326	7,327			52,601
2003	37,800	3,760	3,503	391	7,327	3,000	2,600	58,381
2004	37,800	3,760	3,625	470	7,327	3,000	2,860	58,842
2005	37,800	3,760	3,755	563	7,327	3,000	3,146	59,351
2006	37,800	3,760	3,892	676	7,327	3,000	3,461	59,916
2007	37,800	3,760	4,038	811	7,327	3,000	3,807	60,543

a/ domestic demand

b/ domestic and export demand

c/ export demand

Assumptions:

(1) Other products include plyboo, plyboard, laminated floor board and sawali board - requirement for each of the four plants is 2,500 culms/day for 5 days/week and 52 weeks/year; 10% increase in raw material requirement starting 2004

(2) Pulp - for pulp mill of 5,000 tons annual capacity, 600 culms/ton pulp based on Chinte (1965)

(3) All other assumptions in Table 6.5.2a

Table 7.5.2c. Projected demand for bamboo by industry including other bamboo products and higher export growth (in '000 culms), Plan A scenario, Philippines, 1998-2007

Year	Agriculture	Fishing a/	Furniture a/	Handicraft b/	Construction b/	Pulp a/	Other Products c/	TOTAL
1998	37,800	3,760	3,173	186	7,327			52,246
1999	37,800	3,760	3,276	233	7,327			52,396
2000	37,800	3,760	3,385	291	7,327			52,563
2001	37,800	3,760	3,500	364	7,327			52,751
2002	37,800	3,760	3,622	473	7,327			52,982
2003	37,800	3,760	3,880	615	7,327	3,000	2,600	58,982
2004	37,800	3,760	4,170	800	7,327	3,000	2,860	59,717
2005	37,800	3,760	4,495	1,040	7,327	3,000	3,146	60,568
2006	37,800	3,760	4,858	1,352	7,327	3,000	3,461	61,558
2007	37,800	3,760	5,265	1,690	7,327	3,000	3,807	62,649

a/ domestic and export demand

b/ domestic demand

c/ Other products include plyboo, plyboard, laminated floor board and sawali board

Assumptions:

(1) Furniture - annual growth rate of export is 6% for 1999-2002 and 12% for 2003-2007

(2) Handicraft - annual growth rate of export is 25% for 1999-2002 and 30% for 2003-2007

(3) All other assumptions in Table 6.5.2a and 6.5.2b

Table 7.5.3a. Projected demand and supply deficit/surplus (in '000 culms), base case scenario (without intervention), Philippines, 1998-2007

Year	Supply a/	Demand b/	Surplus/Deficit
1998	38,009	52,247	-14,238
1999	39,686	52,326	-12,640
2000	41,120	52,411	-11,291
2001	41,279	52,502	-11,223
2002	41,279	52,601	-11,322
2003	41,477	52,781	-11,304
2004	41,673	52,982	-11,309
2005	41,871	53,205	-11,334
2006	42,068	53,455	-11,387
2007	42,265	53,736	-11,471

a/ Based on average projection (Table 7.5.1)

b/ Results from Table 7.5.2a

Table 7.5.3b. Projected demand and supply deficit/surplus (in '000 culms), Plan A scenario, Philippines, 1998-2007

Year	Supply a/	Demand b/	Surplus/Deficit
1998	38,009	52,247	-14,238
1999	39,686	52,326	-12,640
2000	41,120	52,411	-11,291
2001	41,279	52,502	-11,223
2002	41,279	52,601	-11,322
2003	41,477	58,381	-16,904
2004	41,673	58,842	-17,169
2005	41,871	59,351	-17,480
2006	42,068	59,916	-17,848
2007	42,265	60,543	-18,278

a/ Based on average projection (Table 7.5.1)

b/ Results from Table 7.5.2b

Table 7.5.3c. Projected demand and supply deficit/surplus (in '000 culms), Plan B scenario, Philippines, 1998-2007

Year	Supply a/	Demand b/	Surplus/Deficit
1998	38,009	52,246	-14,237
1999	39,686	52,396	-12,710
2000	41,120	52,563	-11,443
2001	41,279	52,751	-11,472
2002	41,279	52,982	-11,703
2003	41,477	58,982	-17,505
2004	41,673	59,717	-18,044
2005	41,871	60,568	-18,697
2006	42,068	61,558	-19,490
2007	42,265	62,649	-20,384

a/ Based on average projection (Table 7.5.1)

b/ Results from Table 7.5.2c

Table 7.5.4. Export revenue targets under Plan A and Plan B scenarios (in ' 000US$)

YEAR	PLAN A a/			PLAN B b/		
	Furniture	Handicraft c/	Total	Furniture	Handicraft c/	Total
1998	1,790	30,378	32,169	1,790	30,378	32,169
1999	1,969	33,416	35,386	2,148	35,543	37,691
2000	2,166	36,758	38,924	2,578	41,585	44,163
2001	2,383	40,434	42,817	3,094	48,654	51,748
2002	2,621	44,477	47,098	3,712	56,926	60,638
2003	3,145	51,149	54,294	4,640	68,311	72,951
2004	3,775	58,821	62,595	5,801	81,973	87,774
2005	4,529	67,644	72,173	7,251	98,368	105,618
2006	5,435	77,791	83,226	9,063	118,041	127,104
2007	6,522	89,459	95,981	11,329	141,649	152,979

a/ Based 10% per year for 1997-2002 and 15% per year for 2003-2007 for handicraft; and 5.84% per year for 1997-98, 10% per year for 1999-2002 and 20% per year for 2003-2007 for furniture.

b/ Based on 10.00% per year for 1997-98, 17% per year for 1999-2002 and 20% per year for 2003-2007 for handicraft; and 5.84 % per year for 1997-98, 20% per year for 1999-2002 and 25 % for 2003-2007 for furniture.

c/ Includes all products other than furniture and seats of bamboo, except bamboo poles and shoots

Table 7.6.1. Specific programs and interventions relating to proper resource management

PROGRAM INTERVENTION	OBJECTIVES	ACTIVITIES	EXPECTED OUTPUT	EXPECTED IMPACT	INDICATIVE COST	INSTITUTIONS INVOLVED
1. National bamboo survey and inventory	Come up with updated and comprehensive data and information on actual extent and distribution of different bamboo species in the country	Formulation of survey design Field survey and inventory Collation and analysis of data and manuscript preparation	Survey design and inventory procedures National data on extent and distribution of bamboo. Data for bamboo resource map. Information on bamboo extent and distribution by region , species and nature. Bamboo resource map	Reliable basis for sustainable bamboo resource production and management	P500,000	DA, FMB, DENR, ERDB, PEPR, LGUs
2. Development of computerized data base on bamboo production and management	Develop a computerized data information system for ready access, storage and retrieval of information on bamboo resources, production and management	Acquisition of computer hardware System analysis and design Development of data base structure Data base production(data encoding) Maintenance system	Operational bamboo resources data base	Facility and access for storage and retrieval of data on bamboo	P 3.0 M	ERDS-DENR, ERDB-DENR. LGUs
3. Training and information dissemination	Accelerate transfer and adoption of appropriate technologies on bamboo production and management	Conduct of farmers training. Development and production of information campaign materials for print, radio and TV Establishment of pilot plantation and demo farms	Trained farmers on appropriate bamboo production and management technologies Sets of packaged technologies on bamboo production disseminated to users Bamboo pilot plantation and model demo farm established in strategically located areas in the country	Accelerated transfer and adoption of appropriate technologies to farmers and clienteles to promote plantation establishment, hence greater contribution to national forestation effort	P1.25 M	ERDB-DENR, National Bamboo Office

Table 7.6.1 Continued . . .

PROGRAM INTERVENTION	OBJECTIVES	ACTIVITIES	EXPECTED OUTPUT	EXPECTED IMPACT	INDICATIVE COST	INSTITUTIONS INVOLVED
4. Establishment of bamboo plantations in various "demand centers"	Establish the bamboo plantation of appropriate species in different areas to augment and support raw material requirement of bamboo based industries	Site identification Nursery establishment Plantation establishment Maintenance, protection and management	Location maps, characterized sites Bamboo planting stocks of appropriate volume and quality Appropriate area planted to bamboo	Sustainable source of bamboo raw materials	P720 M	DENR, LGUs, Private individual
5. Generation, pilot testing and verification of farm-level technologies	Conduct R and D activities on bamboo production and management for the generation of more efficient and effective technologies	Research and experimentation Verification studies and pilot testing Technology commercialization	More efficient and effective bamboo production and management technologies	Greater productivity and efficiency of bamboo production	P10 M	ERDB, DENR, Research institution

Table 7.6.2. Specific programs and interventions relating to technology development, promotion and commercialization

PROGRAM/ INTERVENTION	OBJECTIVES	ACTIVITIES	EXPECTED OUTPUT	EXPECTED IMPACT	INDICATIVE COST (P)	INSTITUTIONS INVOLVED
1. Productivity assessment of the bamboo using industry	Come up with updated and comprehensive data/information on actual extent of utilization of bamboo using industries including species- end use matching	Interviews with entrepreneurs/managers Survey questionnaire with rank and file employees Collection and analysis of data and preparation of report	National data on extent/level of production technology, design, waste management, and marketing practices in the industry Human resource development needs of people involved in the industry. Problems and difficulties experienced by industry in receiving assistance from public and private institutions	Improved productivity of bamboo using industries	P 500,000 x 2 yrs = P 1.0 M	DTI, DOST, DENR, LGUs, Industry associations
2. Manpower training/ skill upgrading	Develop and upgrade manpower capability in the bamboo furniture, handicraft, panel boards, etc. Determine product lines suitable for bamboo species available in an area/community Determine appropriate tooling and equipment configuration and fabrication Come up with standardized training programs	Training needs analysis Identification and preparation of directory of experts Preparation of training modules and manuals Training and skills upgrading of industry manpower Training and skills upgrading of industry manpower and trainors Plant, facilities and equipment layout design Tools, equipment and accessories identification and selection	Directory of experts Standardized training modules and manuals Trained/upgraded manpower capability Manufacturing courses provide skills development phase under taken using suitable tools/ equipment	Acceptable and competitive product lines/better workmanship Establishment of cooperating entities and manpower requirements Continuous supervision of product lines to ensure its marketability Accreditation of training institutions, training programs, and trainors	P 870,000 x 10 yrs = P8.7 M	DTI, DOST, DECS, TESDA, LGUs, SCUs, Industry
3. R&D on product development, design and identified technology gaps	Develop new products, process, designs and/or improve existing ones. Develop linkage between government, NGOs and bamboo industries	R&D prioritization through coordination among agencies such as DTI, DOST, and others Conduct R&D on product development/improvement and design	New or improved products and designs Improved R&D and S&T mechanisms	Global competitiveness Better linkage between government, NGOs and industries Improved technology transfer	P 1.0 M x 10 yrs = P 10 M	DOST, DTI, LGUs, SCUs, Industry

248

Table 7.6.2 Continued

PROGRAM/ INTERVENTION	OBJECTIVES	ACTIVITIES	EXPECTED OUTPUT	EXPECTED IMPACT	INDICATIVE COST (P)	INSTITUTIONS INVOLVED
4. Massive information campaign/technotransfer on bamboo technologies a) Technology and investment fora	Develop appreciation and awareness among existing and would-be entrepreneurs on bamboo processing and utilization	Conduct national, regional, provincial and local fora	Knowledge on technological advances	Increase in number of investors, processors, traders, and consumers	P 250,000 x 10 yrs = P2.5 M	DOST, DTI, LGUs, NGOs, SCUs, Industry
b) One-stop information centers or (Establishment of national Bamboo Center)	Establish one-stop information centers in selected sites of the country Link with existing info center (PCARRD) and establish new ones	Identify OSIC sites at the regional, provincial or municipal levels Production of pamphlets, video tapes, how-to publications	Knowledge on technological advances Establish centers Database, internet, fax (package information)	Increase number of investors, processors, traders and consumers Easy access for information on bamboo technology at the municipal, provincial, and regional levels		
5. Commercialization of new bamboo products	Commercialized new bamboo products (plyboo, plyboard, flattened boards, as parquet, sawali board and laminated bamboo as floor board) Generate financing schemes and incentives, marketable and in demand	Piloting of the products Commercialization of the products Linkage with financial and banking institution	Establishment of commercial plants Financing schemes Well-informed financial and government institutions	Greater employment; higher per capita income of workers and higher revenues Increased diversity in product lines	P 250,000 x 10 yrs = P2.5 M	DOST, DTI, LGUs, Financing institutions, Industry

Table 7.6.3. Specific programs and interventions relating to market development

PROGRAM/ INTERVENTION	OBJECTIVE(S)	ACTIVITIES	EXPECTED OUTPUT	EXPECTED IMPACT	INDICATIVE COST (P)	INSTITUTIONS INVOLVED
1. Aggressive information campaign	Develop appreciation for bamboo and enhance its acceptability as a crop and product	Essay writing and poster development contest Development of materials on bamboo information and its importance Poster/calendars for distribution nationwide TV and print advertisement Celebration of "Bamboo Week" Display, use and gift-giving of bamboo products in gov't offices	Semi-annual contest Comics, posters, calendars distributed nationwide TV and print ads	Higher level of awareness among children, adults in both government and private sectors	P200,000/yr x 10 yrs = 2.0 M	DECS, PIA
2. Market identification and assessment	Assess existing and potential markets	Mobilization of commercial attaches abroad to provide market intelligence reports DTI provincial offices to provide market reports nationwide Distribute survey forms and collect the same regarding market requirements and intentions to buy including inquiries	Market intelligence reports for existing and new market Results of market surveys/ rapid market appraisals	More information on potential markets for possible market linkaging Inputs for data base development	P500,000/yr x 3 yrs =P 1.5 M	DTI, LGUs, SCUs
3. Market linkage/ Encounter	Provide opportunity for meeting of buyers and sellers Determine assistance needed in contract	Actual market encounter at the national, regional and provincial levels to coincide with trade fairs/conventions Assistance to negotiating	Better information on market requirements and supply potential resulting from actual market encounters	More marketing contracts negotiated More sales	P500,000/yr x 5 yrs = P 2.5 M	DTI-CITEM, LGUs

Table 7.6.3 Continued . . .

PROGRAM/ INTERVENTION	OBJECTIVE(S)	ACTIVITIES	EXPECTED OUTPUT	EXPECTED IMPACT	INDICATIVE COST (P)	INSTITUTIONS INVOLVED
	negotiations and consummating sales	parties				
4. Market testing of new products	Test market acceptance of new products (panel products, furniture, handicrafts, bamboo shoots in various forms, etc.)	Sales through selected distribution outlets Sending of brochures to prospective buyers Providing free samples Displays during trade fairs/ conventions Feedback mechanism regarding acceptability	Feedback from prospective buyers on acceptability and marketability of new products Possible purchase orders	More investments and production volume for highly acceptable products Improvement of new products based on feedback (comments, suggestions) Greater availability of new products	P200,000/yr x 2 yrs = P 0.4 M	DTI, SCUs, Private Sector
5. Market Information system (MIS) and Networking	Develop good database for bamboo and linkages with bamboo associations nationwide and abroad	Strengthening of collection and dissemination of bamboo information of DENR Accessing international databases on bamboo Membership to and linkages with international bamboo associations Updating directory of bamboo firms including product lines, supply potentials and other information DTI/CITC homepage in the Internet to be maintained by CITC in coordination with DENR Networking among firms,	More information on bamboo from international institutions/buyers/markets Greater linkages with international associations Available updated directory distributed to concerned and interested individuals/institutions Philippine homepage in the internet with information regularly updated Greater information sharing and access	More inquiries regarding Philippine bamboo products important for market linkaging activities Efficient communication system among buyers and sellers	P 250,000/yr x 10 yrs = P2.5 M	DTI, DENR, NSO, SCUs, Private Sector

Table 7.6.3 Continued ...

PROGRAM/ INTERVENTION	OBJECTIVE(S)	ACTIVITIES	EXPECTED OUTPUT	EXPECTED IMPACT	INDICATIVE COST (P)	INSTITUTIONS INVOLVED
		academe, research institutions, etc.				
6. Local and international trade fairs	Promote bamboo products and support market linkaging activities	Conduct of trade fairs at national, regional and provincial levels in key trading centers Display of products Dissemination of bamboo information	Trade fairs specific to bamboo, furniture or handicraft Participation of small, medium and large scale producers and manufacturers	Buyers-seller meetings and sales contracts negotiated Possible joint venture arrangements Cost-sharing among private and government sectors	P 100,000/yr x 5 yrs = P 0.5 M	DTI-CITEM, LGUs, DFA
7. Trade missions	Promotes bamboo product and search new markets abroad	Participation of key industry players in trade missions Expansion of sales to existing markets and negotiation of sales with new markets Exposure to new products and designs abroad	Completed trade missions in existing and new markets New ideas on new products, designs and market requirements	Sales contracts negotiated Investments on new products and designs	P 500,000/yr x 3 yrs = P 1.5 M	DTI, DFA, Private Sector
8. Establishment of bamboo buying stations	To put up buying stations in strategic areas	Identification of suitable areas Establishment of buying stations with primary processing facilities	Operational buying stations	Efficient marketing of bamboo	P1.0 M x 4 buying stations = P4.0 M	LGUs, Cooperatives

Table 7.6.4. Specific programs and interventions relating to policy and institutional strengthening

PROGRAM/ INTERVENTION	OBJECTIVES	ACTIVITIES	EXPECTED OUTPUT	EXPECTED IMPACT	INDICATIVE COST (P)	INSTITUTIONS INVOLVED
1. Organization of bamboo industry association and society	To organize an association and a society that will pursue a united front for bamboo development activities	Meetings and consultations among members of different associations Registration of association and societies	Registered bamboo association and society	Greater unity and cohesiveness among industry participants	P 200,000/yr. x 1 year = P 0.2 M	PCHI, CFIP, Phil Export, CCIP Local Associations, SCUs
2. Creation of a National Bamboo Center	To create an office which will be in charge of overall coordination of bamboo development activities	Meetings and consultations among industry leaders and concerned government agencies Formal creation of the Office through a legislative act or Executive Order	A National Bamboo Center with facilities and budget	More coordinated bamboo development efforts and enhanced delivery of government services	P 2.0 M/yr. x 10 years P20 M	DTI-CITC, DENR, DOST, Private Sector, others
3. Development of bamboo based cooperatives	To organize new and strengthen existing cooperatives for various bamboo-based business undertakings	Organization of farmers, producers and manufacturers Registration of new cooperatives Providing support services	Strong cooperatives organized and operational	Greater efficiency in production, trading and manufacturing of bamboo products More unity Higher income for SMEs	P 100,000/yr. x 10 years = P 1.0 M	CDA, Private sector, farmers and producers
4. Financing of integrated production, marketing and processing projects	Provide financing for feasible investments	Conduct investment analysis and feasibility studies Negotiations with DBP, LBP or other financing institutions for funding of feasibility projects Implementation of projects	Feasibility studies on bamboo projects Available financing for bamboo projects	More investments on bamboo projects More demand for raw materials and greater sales of bamboo products Greater efficiency of integrated operations	P250,000/ feasibility study x 8 studies =P2.0 M	DTI, DOST, DENR, BOI, Banking institutions, Private sector
5. Policy analysis, advocacy and implementation	Undertake policy studies and advocacy and improve implementation of policies/ guidelines	Review of existing guidelines Policy analysis and consultations with concerned sectors Policy recommendations	Policy/guideline documents on area delineation for bamboo plantation, explicit integration of bamboo into CBFM, etc., guidelines on harvesting, transport, export/import	Favorable policies for bamboo development and improved and consistent implementation of guidelines	P 300,000/ Study x 5 Studies = P 1.5 M	DENR, DTI, SCUs, Private sector